

TOYOTA

SERVICE MANUAL

Embroidery Machine

ESP9000

(15 needles)



AISIN
AISIN SEIKI CO., LTD.

How to Use this Service Manual

- 1 . This service manual applies to the ESP9000.

Model names are indicated only for sections equipped with each model.

- 2 . Refer to the section on TROUBLESHOOTING first.

Trouble often results from two or more causes. The TROUBLESHOOTING section indicates the correct order and method of troubleshooting. When need arises to repair the embroidery machine in reference to this Service Manual, refer to TROUBLESHOOTING first. Then, refer to ADJUSTMENT or REPLACEMENT as suggested.

- 3 . Only the critical instructions are given.

When a component must be removed for troubleshooting, adjustment or replacement, the Service manual explains how to remove other components before the component in question can be removed.

However, the manual does not explain how the other components are fitted, unless such information is necessary for technical reasons, when adjustment or replacement is completed.

I n s p e c t i o n & Repairs

- 1 . When parts need to be replaced, use only parts certified by Aishin Seiki Co., Ltd., to ensure machine performance.
- 2 . To prevent any accident from occurring, be sure to turn the power OFF before repair.

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4-9. Jump motor

[Removal]

- (1) Remove the needle case.
[Please refer to 『“ 4-5. Needle bar reciprocator” 』 on page 41]
- (2) Remove five set screws (a) and the arm front cover L. (Fig.1)
- (3) Remove each setting screws and the thread stand plate, bobbin winder base and rear cover. (Fig.2)
- (4) Cut the cable tie and remove the relay harness.
- (5) Remove two setting screws (b) and the jump motor set. (Fig.3)
- (6) Loosen the setting screws (c) and remove the jump lever holder. (Fig.4)
- (7) Remove four setting screws (d) and the jump motor. (Fig.4)

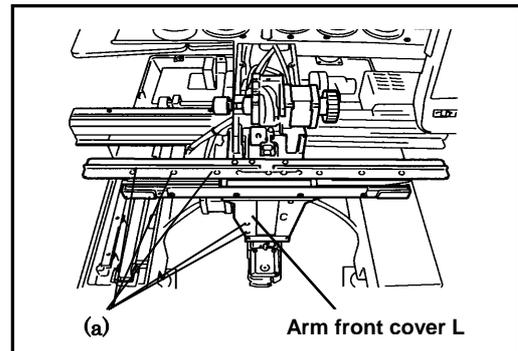


FIG.1

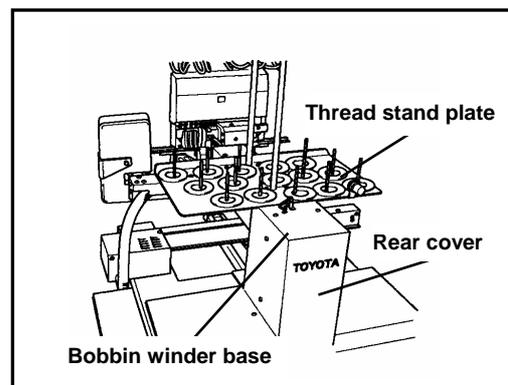


FIG.2

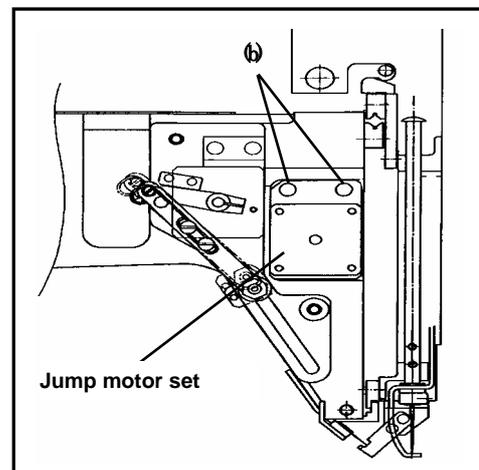
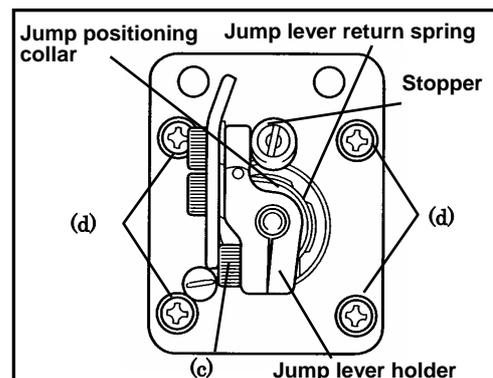


FIG.3

- (1) Install the jump motor with four setting screws (d). (Fig.4)
- (2) Hang the jump lever return spring on the jump lever holder and pull down the spring as low as possible so that the spring will not be located on the jump positioning collar. (Fig.4)
- (3) Tighten the setting screw (c) and check that the jump lever holder returns with the spring and stops with the stopper. (Fig.4)
- (4) Install the jump motor set with two setting screws (b). Adjust the clearance between the jump lever and the needle reciprocator at 0.5 mm by moving the jump motor right and left.
- (5) Connect the relay harness, bundle the cord with cable tie and install the thread stand plate, bobbin winder base and rear cover.
- (6) Install the needle case.



4-10. Main circuit board

[Removal]

- (1) Remove two setting screws (a) and the table set. (Fig.1)
- (2) Remove four set screws (b) and the base cover rear R. (Fig. 1)
- (3) Loosen two setting screws (c), remove other two set screws (d), move the case cover upper upwards, disconnect the connector CN2 and remove the case cover upper. (Fig.2)
- (4) Disconnect all the connectors. (Fig.3)
- (5) Remove two setting screws (e) and remove the main circuit board by holding the plastic spacer with pliers.

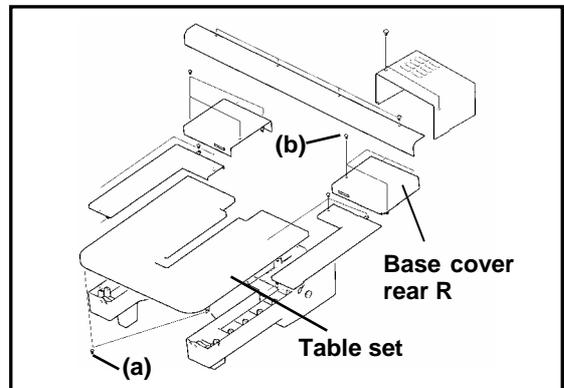


FIG.1

[Installation]

Attached in the reverse procedure of removal

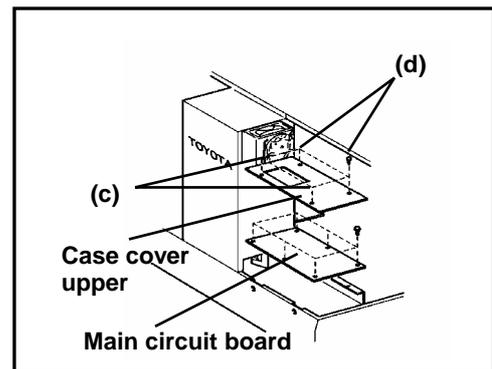


FIG.2

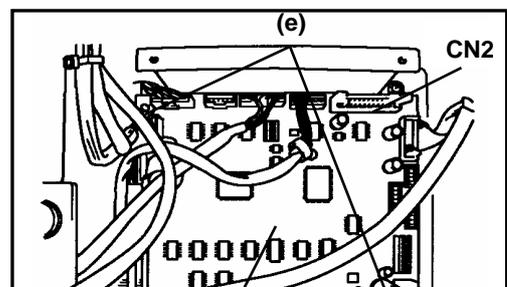


FIG.3

4-11. Operation box assembly

[Removal]

- (1) Loosen retaining screw (a) and rotate the operation box in the direction of the arrow to set the box in the upright position (Fig.1).
- (2) Remove retaining screw (b) and two retaining screws (c) and the operation box cover (Fig.1).
- (3) Remove four retaining screws (d). Unplug the cord and remove the operation box (Fig.2).

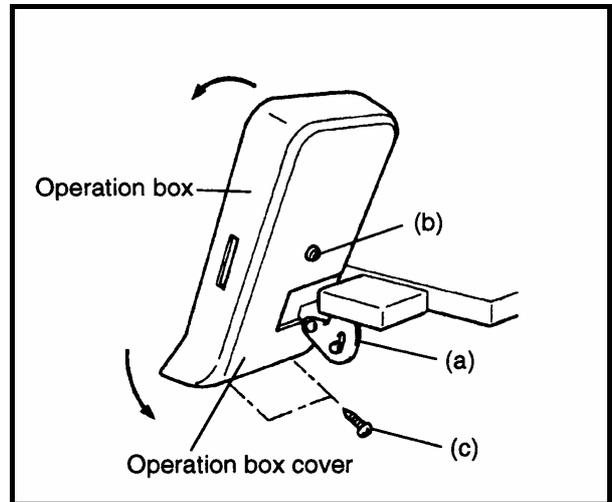


FIG.1

[Installation]

- (1) Plug in the cord.
- (2) Secure the operation box to the bracket with four retaining screws (d). One of these screws is for grounding (Fig.2).
- (3) Mount the operation box cover with retaining screw (b) and two retaining screws (c) (Fig.1).
- (4) Rotate the operation box to set it at the desired angle for easy operation and secure it with retaining screw (a) (Fig.1).

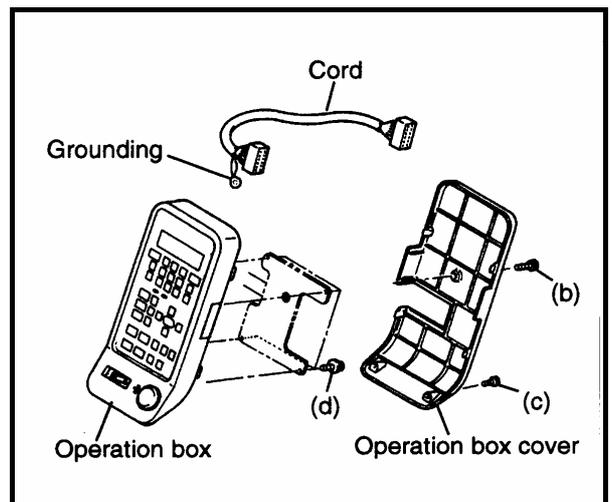


FIG.2

[Installation]

- (1) Install the upper shaft sensor on the sensor base with two setting screws (d). (Fig.3)
 - (2) Insert the connector of the upper shaft sensor in CN3 on the main circuit board. (Fig.5)
 - (3) Fix the upper shaft sensor set with two setting screws (c) in the position where the center of the sensor comes to the center of the rotation detecting plate. (Figs.2, 4)
 - (4) Bundle the cords with cable tie.
 - (5) Set the DS1-1 on and turn the power on. Rotate the hand wheel to move the needle bar to the bottom dead center. Check that the LCD display shows the needle position at 180°.
- Note: In case the LCD display does not show 180°, loosen the set screw, adjust the position of the detecting plate and fix it. (Fig.1)**
- (6) Install the case cover upper, base

4.REPLACEMENT OF MAIN COMPONENTS

cover rear L, rear cover and bobbin winder base set.

4-12. Upper shaft sensor

[Removal]

- (1) Remove two setting screws (a) and the bobbin winder base set. (Fig.1)
- (2) Loosen four setting screws (b) and remove the rear cover. (Fig.1)
- (3) Remove two setting screws (c) and the upper shaft sensor set. Then remove two setting screws (d) and the upper shaft sensor. (Figs.1, 2)
- (4) Remove four setting screws and the base cover rear L. (Fig.1)
- (5) Loosen two setting screws, remove other two setting screws, move the case cover upper upwards, disconnect the connector CN3 and cut the cable tie and then remove the upper shaft sensor. (Refer to Fig.2 on page 47)

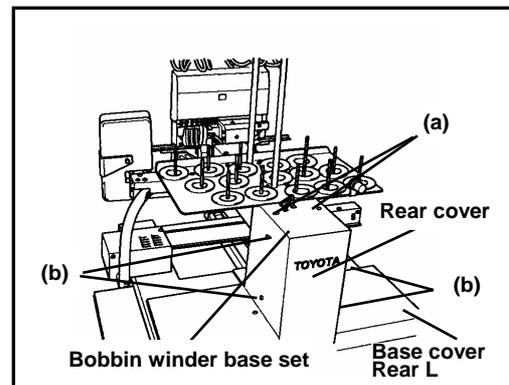


FIG.1

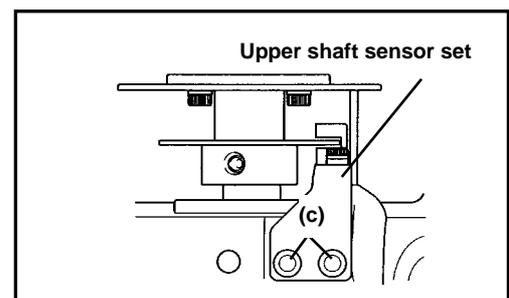
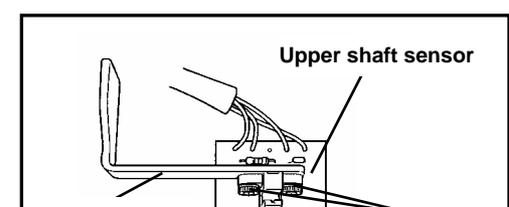


FIG.2



[Installation]

- (1) Two set surfaces of the sewing machine motor shaft and two setting screws (c) of the lower shaft joint are aligned and insert the sewing machine motor.
- (2) Fix the sewing machine motor with four setting screws (d). (Fig.4)
- (3) Insert two setting screws (c) of the lower shaft joint gradually, locate them vertically to the setting points and tighten them.
- (4) Insert two connectors and bundle the cords with the cable tie.
- (5) Install case cover upper with four setting screws (a) and (b). (Fig.1)
- (6) Install the base cover rear R.L. and the rear cover.

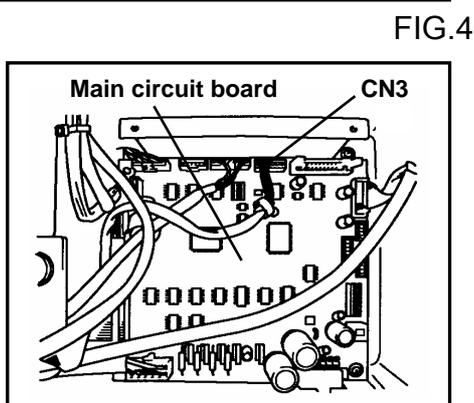
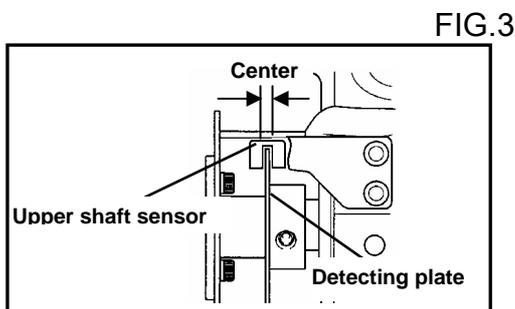


FIG.5

4.REPLACEMENT OF MAIN COMPONENTS

4-13. Sewing machine motor

[Removal]

- (1) Remove the rear cover and base cover rear R.L.
- (2) Loosen two set screws (a), remove other two set screws (b), move the case cover upper, disconnect CN5 of the main circuit board and CN3 of the power circuit board and cut the cable tie. (Figs.1, 2)
- (3) Loosen two setting screws (c), which are located on the motor side of the lower shaft joint. (Fig.1)
- (4) Remove four setting screws (d) and the sewing machine motor. (Fig.4)

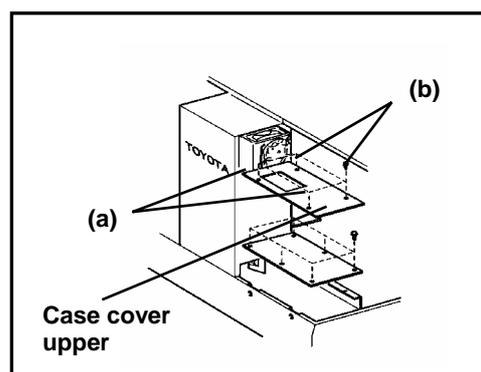
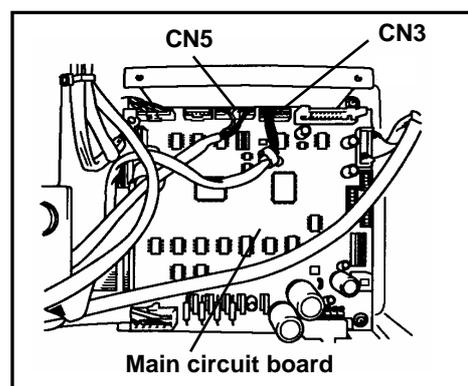


FIG.1



- (4) Remove four setting screws (d) and X motor from the bracket. (Fig.2)

FIG.2

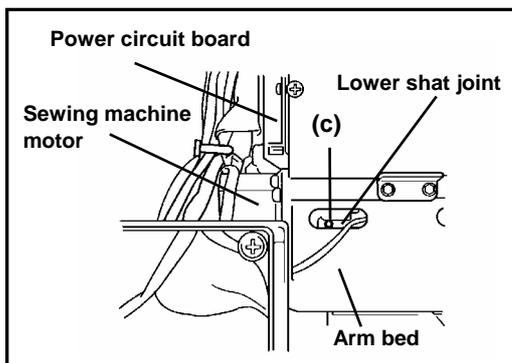


FIG.3

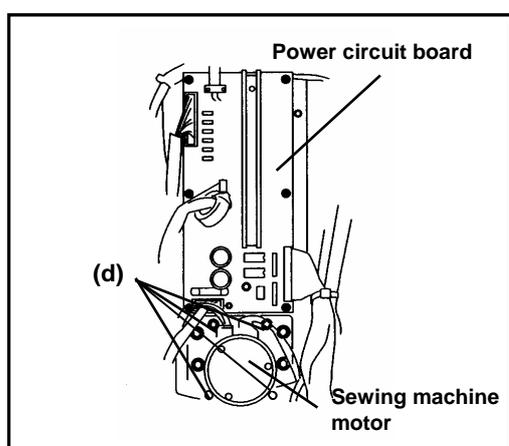


FIG.4

[Installation]

- (1) Mount the X motor to the motor base with four setting screws (d) (Fig.2).
- (2) Set the X motor gear to the belt and temporarily secure the motor base to the X base B with two setting screws (c) (Fig.2).
- (3) Adjust the belt tension by setting screw (b) and firmly tighten two setting screws (c), then tighten the nut. (Figs.2, 3)

Note: Check the tension, after tightening screws (c).

- (4) Insert the connector.

4.REPLACEMENT OF MAIN COMPONENTS

4-14. X motor

[Removal]

- (1) Remove two setting screws (a) and motor cover. (Fig.1).
- (2) Loosen the nut and remove the setting screw (b). (Fig.2)
- (3) Disconnect the connectors. Remove two setting screws (c) and the X motor. (Fig.2)

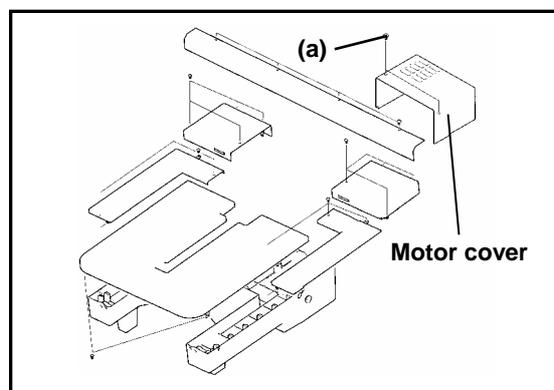
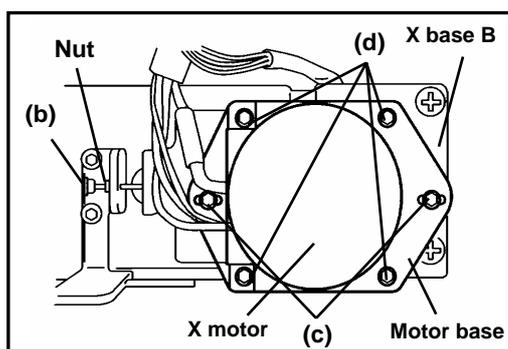


FIG.1



4.REPLACEMENT OF MAIN COMPONENTS

4-15. Y motor

[Removal]

FIG.2

- (1) Remove four set screws (a) and the base cover rear R. (Fig.1)
- (2) Remove two setting screws (b) and the fan set. (Fig.2)
- (3) Remove the Y pulley box adjusting screw (c) and nut (d) and loosen setting screw (e) and nut (f). (Fig.2)

- (4) Disconnect the connector, remove two set screws (g) and Y motor bracket set. (Fig.3)
- (5) Remove four setting screws (h) and the Y motor. (Fig.4)

[Installation]

- (1) Mount the Y motor to its bracket with four setting screws (h). (Fig.4)
- (2) Set the Y motor gear to the belt and temporarily secure them with two setting screws (g). (Fig.3)
- (3) Adjust the belt tension with setting screw (e), and then firmly tighten with two setting screws (g) and nut (f). (Fig.3)

Note: Check the tension, after tightening screws (g).

- (4) Insert the Y pulley box adjusting screw (c) into the backmost position and tighten the nut (d). (Fig.3)
- (5) Mount the fan set with two setting screws (b). (Fig. 2)
- (6) Insert the connector.

FIG.1

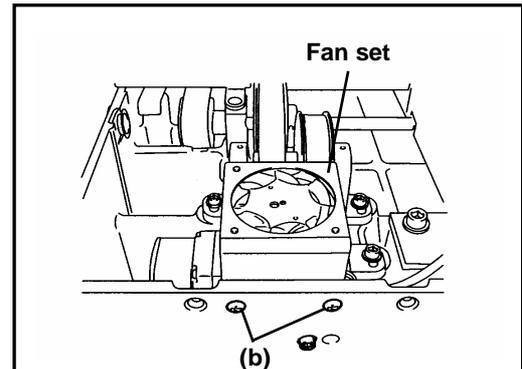


FIG.2

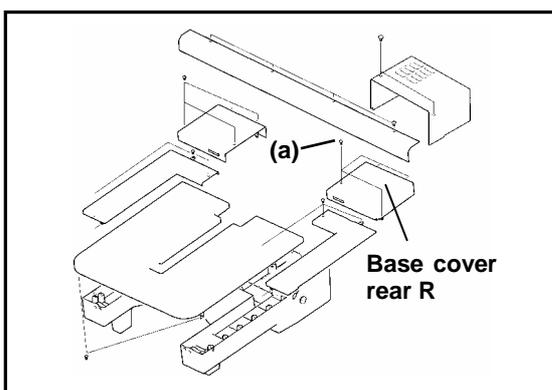
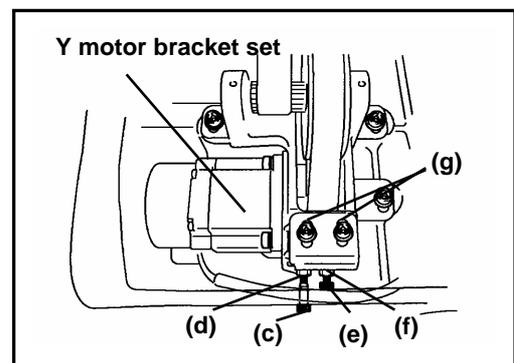
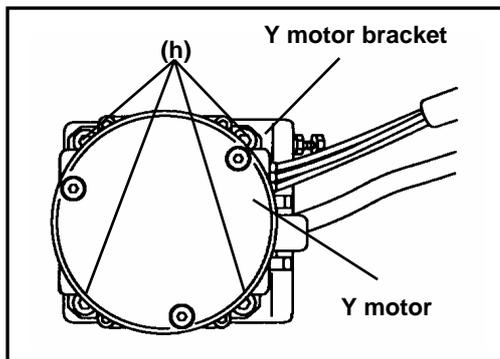


FIG.3



wiper motor. (Fig.1)

- (4) Remove the setting screw (d) and (e), and the upper thread hook lever. (Fig.3)
- (5) Remove the three setting screws (f) and the motor base.(Fig.3)

Note: Be sure to insert the small washer that is contained in each setting screws of (3) and (4) sections.

[Installation]

- (1) Attached in the reverse procedure of removal

Note: Set the vertical position of the upper thread hook lever slightly upward, and make sure that the connecting rod plate has a little play.

- (2) After attaching, check the distance A from the needle center to the thread wiper hook tip. [Please refer to 『“ 3-6 Position of the thread wiper hook.” 』 on page 28]
- (3) If the distance A differs from that specified, loosen two setting screw (c) and adjust by moving the thread wiper motor base up/down.

FIG.4

4.REPLACEMENT OF MAIN COMPONENTS

4-16. Thread wiper motor

[Removal]

- (1) Remove the each setting screws (a) and the change cover, the relay circuit board cover, the thread stand plate, the bobbin base and the rear cover. (Fig.1)
- (2) Cut a cable tie and remove the relay connector.
- (3) Remove the setting screw (b) and two setting screws (c), and the thread

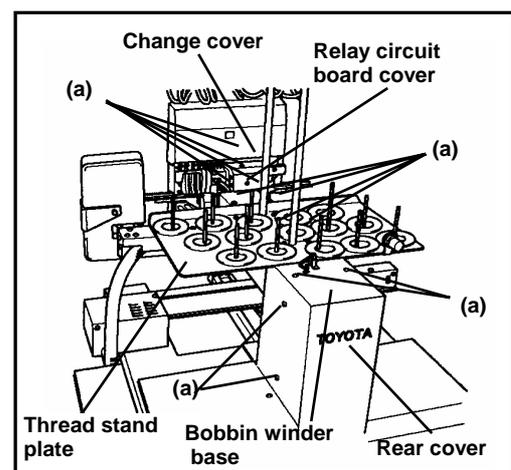


FIG.2

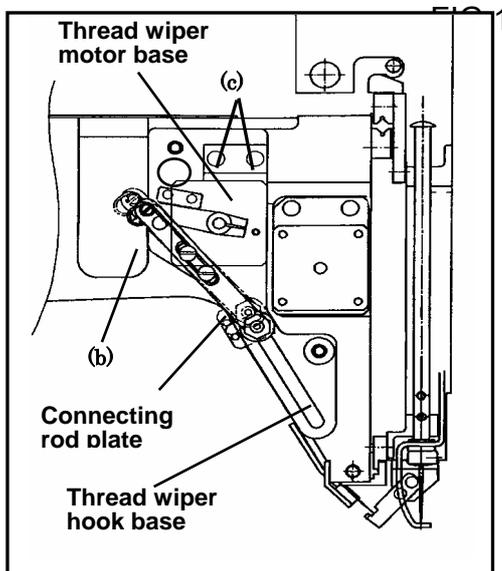
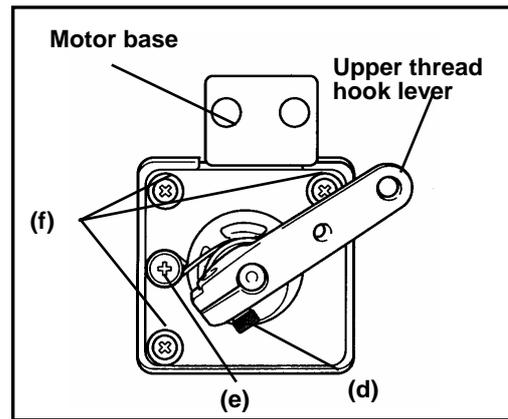


FIG.3

4-17. Thread sensor

[Removal]

- (1) Remove the two each setting screws (a), then remove the change cover and relay circuit board cover. (Fig.1)
- (2) Remove the connector CN2.
- (3) Remove the tension base cover. (Fig.1)
- (4) Raised the connector upwards and disconnect it.
- (5) Cut the cable tie, remove the two setting screws (b) then remove the sensor arm. (Fig.4)
- (6) Extract the thread sensor base from the thread sensor rail; remove the setting screw (c) and the thread sensor board. (Figs.3, 4)

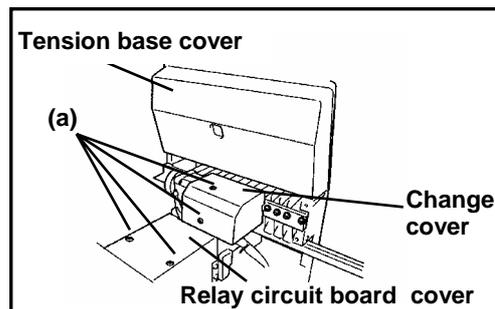


FIG.1

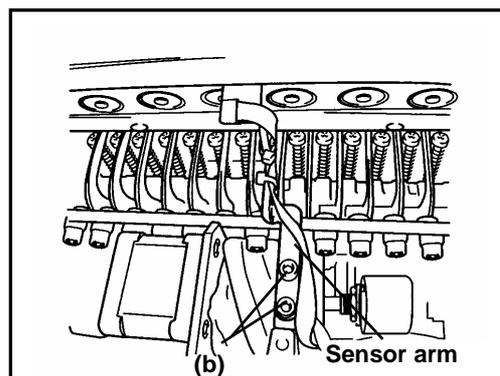


FIG.2

[Installation]

- (1) Attach the sensor board with the setting screw (c). (Fig. 4)
 - (2) Put the code of thread sensor base upwards into the thread sensor rail. (Fig. 3)
 - (3) Putting a sensor arm into the slot of the thread sensor base and secure it with two setting screws (b). (Fig.2)
- Note: At this time, check the sensor position.**

[Please refer to 『“ 3-11. Thread sensor” 』 on page 34]

- (4) Secure the cord with a cable tie and insert the connector.
Note: The blue field of a code is turned and inserted in a spool side. At this time, check the connector connection by pulling a code with hand.
- (5) Mount the relay circuit board cover, change cover and tension base cover.

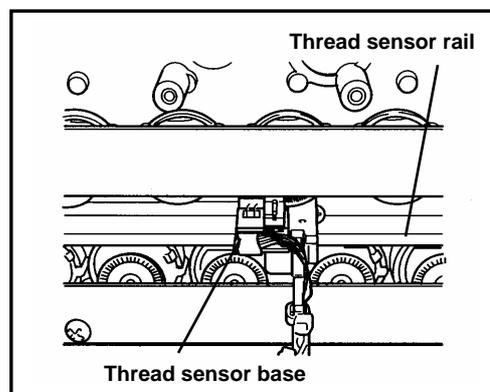


FIG.3

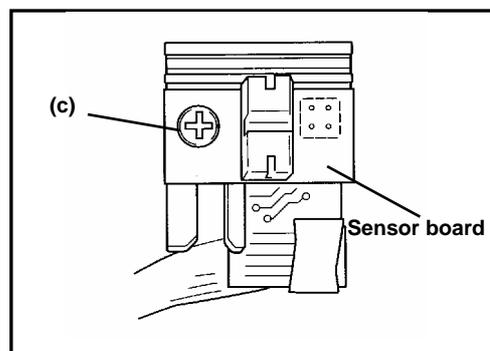


FIG.4

4-18. Operation control circuit board

[Removal]

- (1) Remove four setting screws (a) and the base cover rear R. (Fig.1)
- (2) Loosen the two setting screws (b), remove the two setting screws (c) and disconnect connectors CN12 and CN7, then remove the case cover upper. (Fig.2,3)
- (3) Remove the two setting screws (d) and the resin spacers, then remove the console board (Fig.4).

[Installation]

Attached in the reverse procedure of removal.

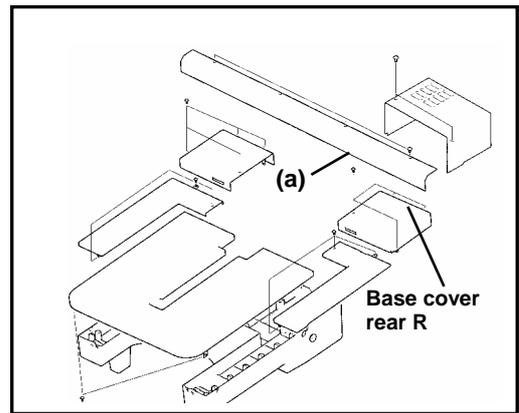


FIG.1

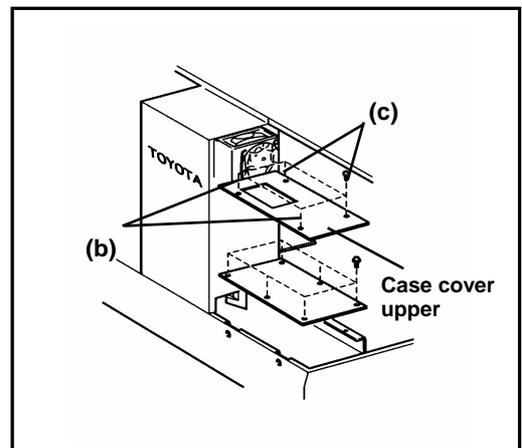


FIG.2

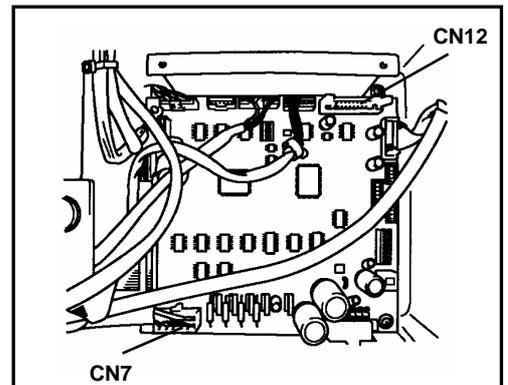


FIG.3

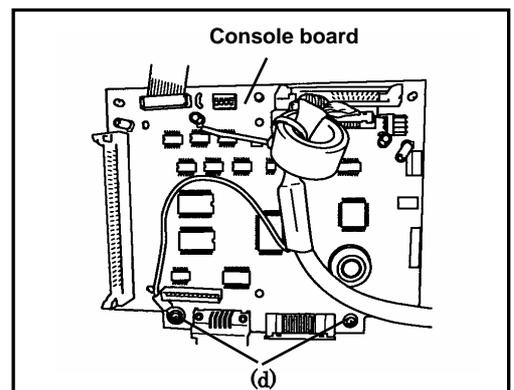


FIG.4

1 . S P E C I F I C A T I O N S

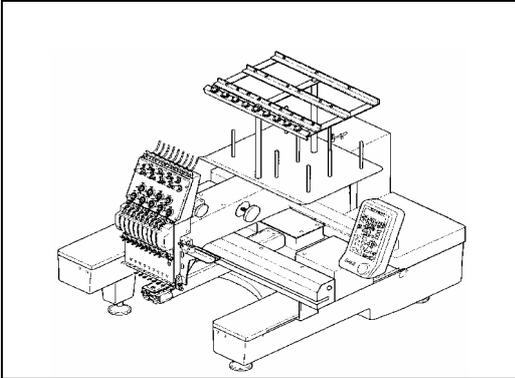
ESP9000

| No | Item | Specifications |
|----|-----------------------------------|---|
| 1 | Type of stitch | Lock stitch type sewing machine (for automatic embroidery only) |
| 2 | Rotary hook | Vertical 2 revolution type (eccentric) |
| 3 | Thread take-up lever | Cam take-up lever |
| 4 | Needle bar stroke | 50 ± 0.2 mm |
| 5 | Number of needles | 15 (auto changing) |
| 6 | Applicable needles | Organ DB×K5Z #11 |
| 7 | Presser foot | Needle bar linked driving system (with noise reduction mechanism) |
| 8 | Bobbin thread winding | Semi-auto winding (auto return, also stop) |
| 9 | Thread trimming method | Horizontal reciprocation (motor drive) |
| 10 | Thread wiper | Motor drive sliding type (with thread retaining mechanism) |
| 11 | Picker method | Picking at start, end of sewing and cutting thread |
| 12 | Stitch speed | 1,200spm maximum (800spm standard) |
| 13 | Embroidery area | 360 mm long × 500 mm wide |
| 14 | Embroidery control and indication | Touch switch control with LED/LED displays |
| 15 | Stitch memory | 280,000 stitches |
| 16 | Memory back-up | Memory saved during operation and after power off; kept for 4 weeks |
| 17 | Weight | 80 ± 1kg (without table) |
| 18 | Machine oil | High grease NX 2, molybdenum grease NO 2, SF oil (multi-grade) |
| 19 | Drive motor | AC servo motor (machine revolution) |
| 20 | Control motor | AC servo motor (X axis, Y axis) |
| 21 | Needle thread failure detection | Rotary detection system (photo sensor) |

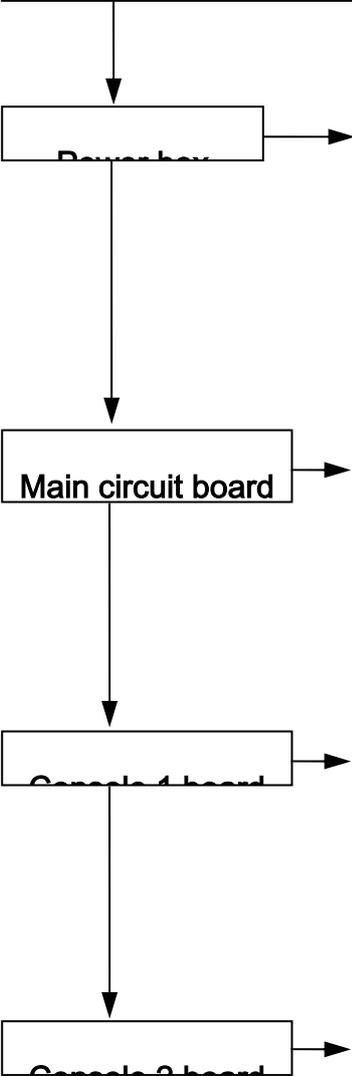
| | | |
|----|------------------------------|---------------------------------------|
| 22 | Power supply and consumption | 100 ~ 120/200 ~ 240VAC, 50/60Hz, 220W |
| 23 | Dimensions | 835(H) x 745(W) x 740(D) |

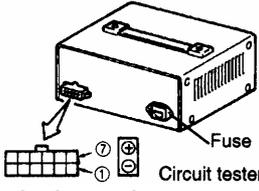
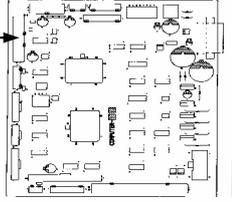
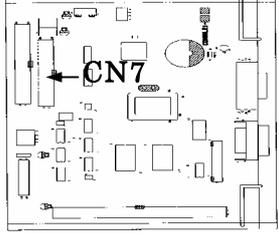
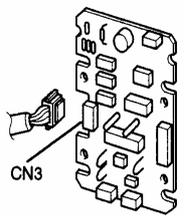
2 TROUBLESHOOTING
2-1 The power supply does not turn on

Preliminary inspection



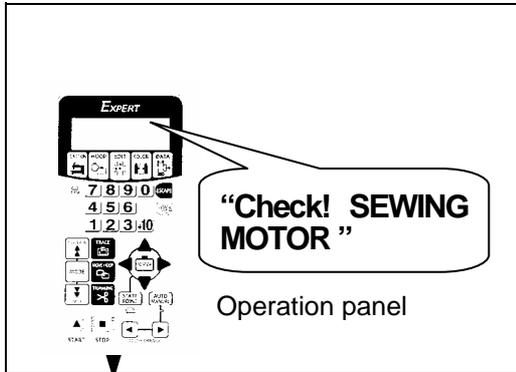
- Power cord may be unplugged (AC power cord).
- Cable from the power box to the embroidery machine may be disconnected (DC power cord).



| Item | Method | Standard | Action |
|-------------------------------|---|------------------------------|--|
| Fuse (outside) | Take out fuse and inspect it visually | 250V6.3 A,without fusion | Replace fuse. |
| 5V power supply |  <p data-bbox="710 443 1093 510">Check the voltage across ① and ⑦with a circuit tester.</p> | 5.0to5.2V when turned on | Adjust or replace the power box. See P.44. |
| Connection of connector CN 12 |  | Must be connecte d correctly | Connect the cable correctly or replace the main circuit board See P.47. |
| Connection of connector CN 7 |  | Must be connecte d correctly | Connect the cable correctly or replace the main circuit board. See P.55. |
| Connection of connector CN 3 | <p data-bbox="710 1176 853 1411">Remove the cover and inspect connection visually</p>  | Must be connecte d correctly | Connect correctly or replace defective connectors. See P48. |

2-2 An error message is displayed

Preliminary inspection



- Upper shaft torque may be too large
- Needle may be interfering with the embroidery hoop.
- Thread may be stuck.

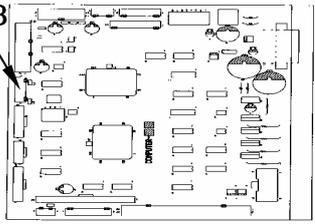
Power box

Sewing motor

Power circuit board

Main circuit board

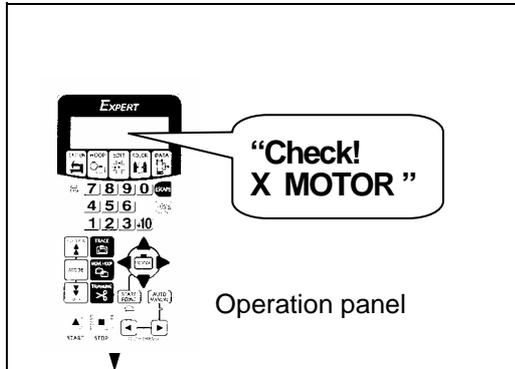
| Item | Method | Standard | Action |
|------------------------------|--|-----------------------------|---|
| 24V power supply | <p>Check the voltage across ⑤ and ⑪ with a circuit tester while shorting ⑧ to ⑨.</p> | 24.0 to 24.5V | Replace See P.44. |
| Connector connection | <p>Check connector visually.</p> | Must be connected correctly | Connect correctly |
| Resistance | <p>Disconnect the power connector, and check the resistance between ① and ②, ① and ③, ② and ③ with a circuit tester.</p> | 0.2 to 0.6 Ω | Replace. See P.50. |
| Connection of connector CN 3 | <p>Check the connector visually.</p> | Must be connected correctly | Connect correctly or replace See P.45. |

| | | | |
|-------------------------------------|---|------------------------------------|---|
| <p>Connection of connector CN 3</p> | <p>CN3</p>  A technical diagram of a circuit board. An arrow points from the label 'CN3' to a specific connector on the left side of the board. The board contains various electronic components, including integrated circuits, capacitors, and resistors. | <p>Must be connected correctly</p> | <p>Connect the cable correctly or replace the main circuit board. See P.47.</p> |
|-------------------------------------|---|------------------------------------|---|

2.TROUBLESHOOTING

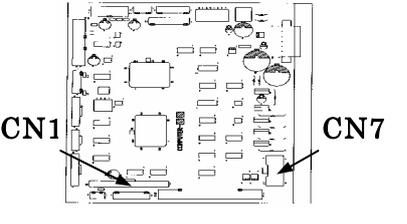
2-3 An error message is displayed

Determination inspection



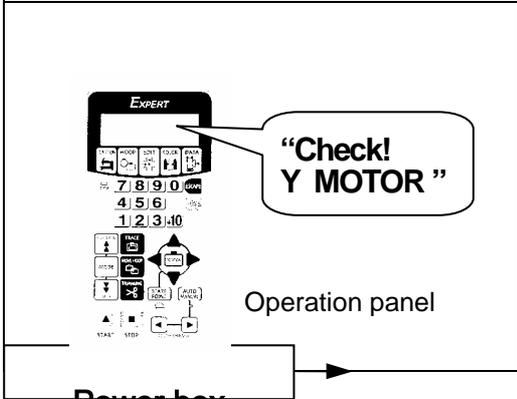
- The embroidery frame holder may be jammed.
- The cloth may be stuck at a table corner.
- The embroidery frame may be interfering.

| Item | Method | Standard | Action |
|---|---|-----------------------------|--|
| 24V power supply | <p>Check the voltage across ⑤ and ⑪ with a circuit tester, while shorting ⑧ to ⑨.</p> | 24.0 to 24.5V | Replace See P.44. |
| Connection of power and sensor connectors | <p>Power connector ① to ④ Sensor connector</p> | Must be connected correctly | Connect correctly |
| Resistance | Disconnect the power connector, and check the resistance between ① and ②, ① and ③, ② and ③ with a circuit tester. | 0.4 to 0.8 Ω | Replace. See P.51. |
| Connection of connectors CN 1, CN 4 | Check the connector visually | Must be connected correctly | Connect correctly or replace. See P.45. |

| | | | |
|------------------------------------|--|-------------------------------------|---|
| Fuse | Take out the fuse and check it visually. | 125V,20 A Must be in good condition | Replace the fuse. |
| Connection of connectors CN 1, CN7 |  | Must be connected correctly. | Connect correctly or replace. See P.47. |

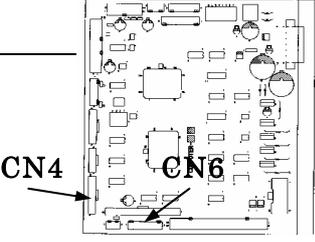
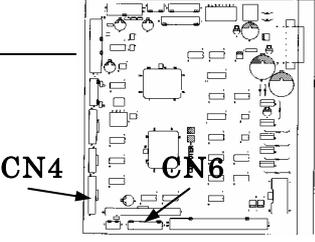
2-4 An error message is displayed

Determination inspection



- The embroidery frame holder may be jammed.
- The cloth may be stuck at a table corner.
- The embroidery frame may be interfering.

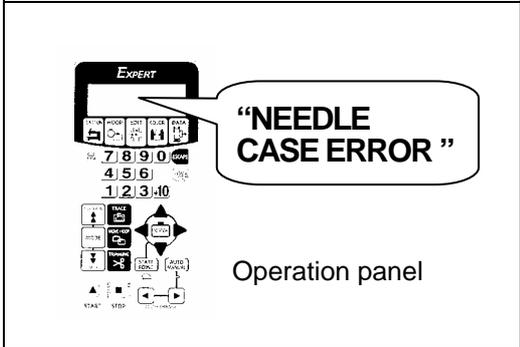
| Item | Method | Standard | Action |
|---|--|-----------------------------|--|
| 24V power supply | <p>Check the voltage across ⑤ and ⑪ with a circuit tester, while shorting ⑧ to ⑨.</p> | 24.0 to 24.5V | Replace See P.44. |
| Connection of power and sensor connectors | <p>Power connector ① to ③ Sensor connector</p> | Must be connected correctly | Connect correctly |
| Resistance | <p>Disconnect the power connector, and check the resistance between ① and ②, ① and ③, ② and ③ with a circuit tester.</p> | 0.2 to 0.5 Ω | Replace. See P.52. |
| Connection of connector CN 2 | <p>Check the connector visually.</p> | Must be connected correctly | Connect correctly or replace. See P.45. |

| | | | |
|--------------------------------------|--|-------------------------------------|---|
| Fuse | <p>Take out the fuse and check it visually.</p>  | 125V,20 A Must be in good condition | Replace the fuse. |
| Connection of connectors CN 4, CN 6. |  | Must be connected correctly. | Connect correctly or replace. See P.47. |

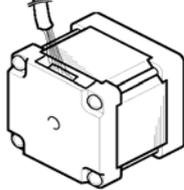
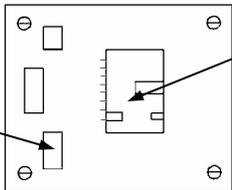
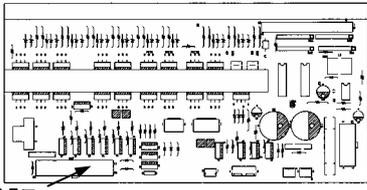
2.TROUBLESHOOTING

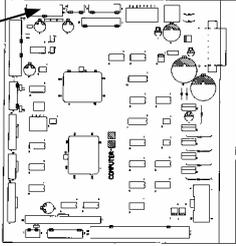
2-5 An error message is displayed

Preliminary inspection

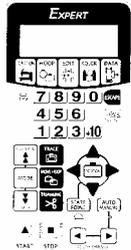


- Upper thread may be stuck, or thread trimming error.
- LCD display at right bottom corner is <-> instead of <8>.

| | Item | Method | Standard | Action |
|-----------------------------------|-------------------------------------|---|------------------------------|--|
| Thread change motor (pulse motor) | Connection of power connector | Connector ① - ⑥  | Must be connected correctly. | Connect correctly |
| | Resistance | Disconnect the power connector and check the resistance between ② and ⑥. | 4.8 to 6.0 Ω | Replace. See P.43. |
| Joint circuit board | Connection of connectors CN 3, CN 4 |  Remove the cover of the joint circuit board and check visually. | Must be connected correctly. | Connect correctly or replace. |
| Power circuit board | Connection of connector CN 7. |  | Must be connected correctly. | Connect correctly or replace. See P.45. |
| Main circuit board | | Check the connector visually. | | |

| | | | |
|---------------------------------------|--|-------------------------------------|---------------------------|
| <p>Connection of connector CN 10.</p> |  <p>CN10</p> | <p>Must be connected correctly.</p> | <p>Replace. See P.47.</p> |
|---------------------------------------|--|-------------------------------------|---------------------------|

2-6 Holder does not return to stroke center after home position return.

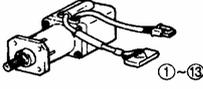
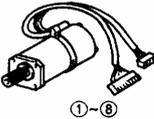


Operation panel

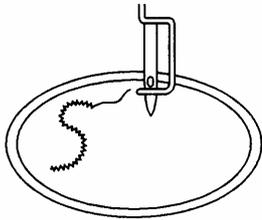
Preliminary inspection

- Initialize of LCD display may be OFF when turn the power on.

| Item | Method | Standard | Action |
|--------------------------------|--|--|---------------------|
| X.Y holder position check | <p>The distances X, set the joint plate at the original position (X0, Y0) and check the distances from the surface of the detecting plate to the center of the photo-sensor. The distances Y, set the X holder to its forefront position by pressing the emergency stop button, and check the distances from the surface of the detecting plate to the center of the photo-sensor.</p> | <p>X=65.7 ±1mm Y=213.5 ±1mm (Position of cap frame sensor is Y=133.5 ±1mm) C=1±0.5mm</p> | Adjust See P.32. |
| Connection of sensor connector | | Must be connected correctly. | Connect correctly. |
| Output voltage | <p>Turn the power on and check voltage across ⑤ (green) and ⑥ (blue) with a circuit tester.</p> | <p>When obstructed: 3.5 ~ 5V When not obstructed: 0 ~ 0.8V</p> | Replace. |

| | | | |
|--|--|---|--|
| <p>Phase U, phase V, phase W, phase A and phase B output</p> | <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>X motor</p>  </div> <div style="text-align: center;"> <p>Y motor</p>  </div> </div> <p>Press the emergency stop button. While turning the motor by hand, check the voltage of the sections below with a circuit tester.</p> <p>(X motor) Across ⑫ GND (red and black) and: ① +U (yellow) ② -U (yellow and black) ③ +V (white) ④ -V (white and black) ⑤ +W (brown) ⑥ -W (brown and black) ⑦ +A (orange) ⑧ -A (orange and black) ⑨ +B (pink) ⑩ -B (pink and black)</p> <p>(y motor) Across ⑦ GND (red and black) and: ① U (yellow) ② V (white) ③ W (brown) ④ A (orange) ⑤ B (pink)</p> | <p>X motor : in the range of 0 to 3.5V Y motor : in the range of 0 ~ 5V</p> | <p>Replace. See Pgs.51 and 52.</p> |
|--|--|---|--|

2-7 Thread comes off needle.

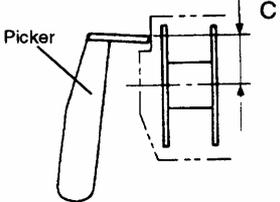


Thread wiper mechanism

Preliminary inspection

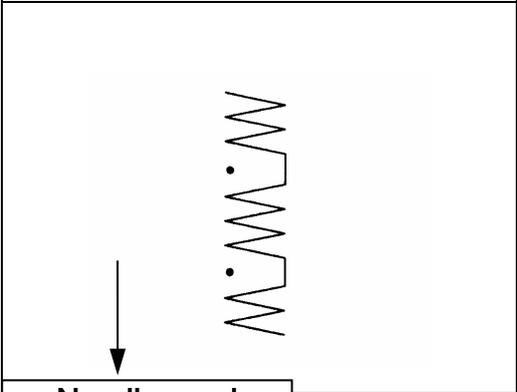
- The needle thread tension may be too high.
- The bobbin thread tension may be too high.
- The thread may be stuck on the thread take-up lever.
- The margin of the needle thread may be insufficient. (The setting value of (9) of a function key is enlarged)

| Item | Method | Standard | Action |
|---|--|--|-------------------|
| Thread wiper hook return | <p>Push the guide pin down as far as it will go in the direction of the arrow and check the returning movement of the pin.</p> | Must return smoothly | Adjust. See P.28. |
| Hook tip damage | | No damage is identified on the hook tip. | Repair. |
| Clearance between the picker and the bobbin | <p>Press the picker gently until it stops. Check the clearance between the picker tip and the bobbin.</p> | A=0.5 ~ 1.5mm | Adjust. See P.27. |
| Picker right/left position | <p>Rotary hook center Bobbin Picker tip center</p> <p>Clearance between the picker tip center and rotary hook center</p> | B=1mm or less | Adjust. See P.27. |

| | | | |
|---------------|--|---|----------------------|
| Picker height |  | C=7 ~ 9 mm (when piker solenoid is ON) | Adjust. See P.27. |
|---------------|--|---|----------------------|

2.8. Skive stitches

Determining inspection



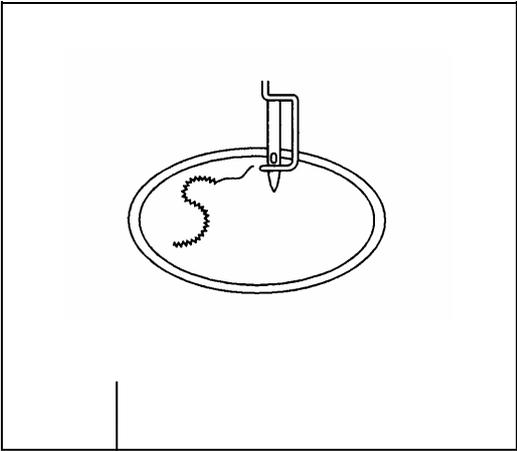
Needles and rotary hook

- A needle may be bent.
- A needle may be fitted incorrectly.
- Thread path may be incorrect.
- Cloth tension may be too weak.
- Needle size may be incorrect for the thread.

| Item | Method | Standard | Action |
|-------------------------------|--|-----------------------------------|-------------------|
| Needle and rotary hook timing | <p>The rotary hook tip must be aligned with the needle center.</p> <p>Needle at the bottom dead center</p> | A=201°±3° (Standard 1.8 to 3.1mm) | Adjust. See P.21. |
| Needle to hook clearance | <p>Align the needle to the hook tip, and check the clearance B visually.</p> | B=0.1 to 0.3mm | Adjust. See P.21. |

2-9 Needle thread breaks

Determining inspection



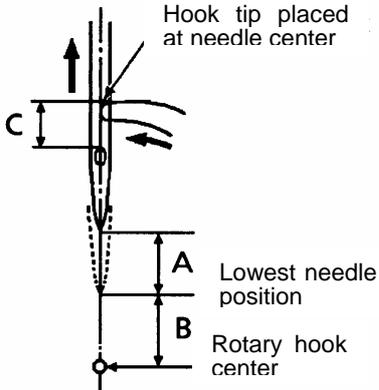
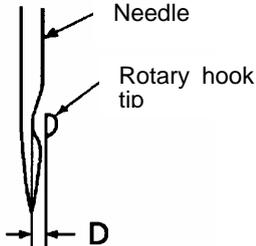
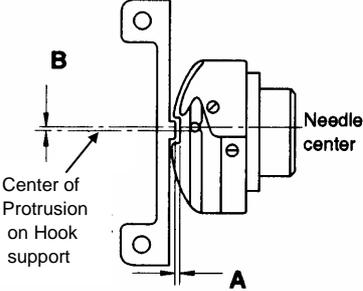
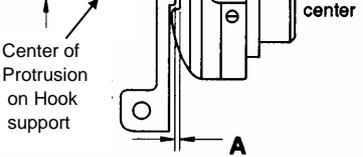
- Needle thread path may be incorrect.
- Thread tension may be too tight.
- A needle may be bent.
- A needle may be fitted incorrectly.
- Needle size may be incorrect for the thread.
- Thread density set to embroidery data may be too high.
- The thread may be stuck on the spool.

Needle thread path

Needle plate

Rotary hook

| Item | Method | Standard | Action |
|-------------------------------------|--------|------------------------------|--|
| Rouge edges or burrs on thread path | | Free of rough edges or burrs | Smooth edges with emery paper #800 or replace tough parts. |
| Rouge edges in needle plate hole | | Free of rouge edges | Repair or replace. |
| Rouge edges on rotary hook | | Free of rouge edges | Repair or replace. |

| Item | Method | Standard | Action |
|---|--|--|------------------------------|
| Needle lift |  <p>Hook tip placed at needle center</p> | $A=201^\circ \pm 3^\circ$ (Standard 1.8 to 3.1mm) | Adjust. See P.21. |
| Needle bar height | | $B=8.0 \pm 0.1\text{mm}$ | Adjust. See P.21. |
| Needle height (reference value) | | $C=1.0 \pm 0.5\text{mm}$ | Adjust. See P.21. |
| Needle to hook clearance |  <p>Needle Rotary hook tip</p> <p>Align the needle to the hook tip, and check the clearance B visually.</p> | $D=0.1 \text{ to } 0.3\text{mm}$ | Adjust. See P.21. |
| Rouge edges on hook support | Check the protrusion on hook support visually. | Free of rouge edges | Repair or replace. See P.23. |
| Clearance under the rotary hook support |  <p>Needle center</p> | $A=0.5 \text{ to } 0.8\text{mm}$ | Adjust. See P.23. |
| Relative positions of the center of the protrusion on the hook support and the center of the needle |  <p>Center of Protrusion on Hook support</p> | $B= \text{Center} \pm 0.2\text{mm}$ | Adjust. See P.23. |

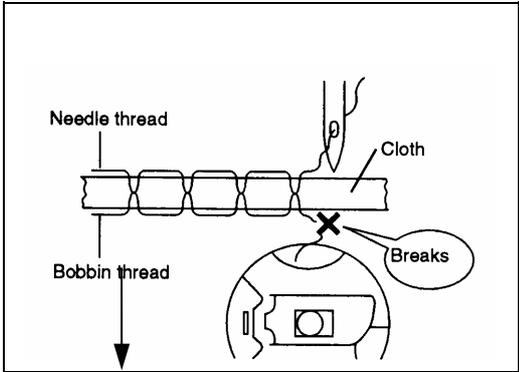
Needles and rotary hook

Hook support

2.TROUBLESHOOTING

2-10 Bobbin thread breaks

Determining inspection



- The bobbin thread tension may be too tight.
- The bobbin thread may be threaded incorrectly.
- The bobbin thread may be wound too loose.

Needle plate

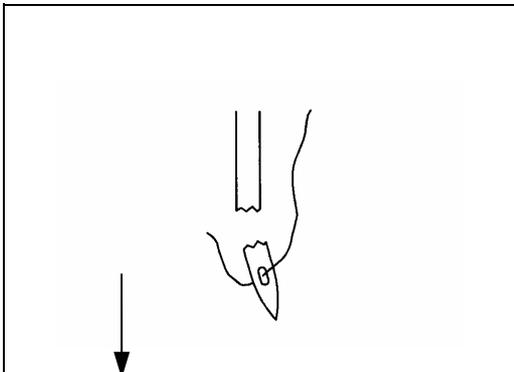
Rotary hook

Bobbin case

| Item | Method | Standard | Action |
|--|--------|---------------|--|
| Burred edges on hold in the needle plate | | Free of burrs | Repair or replace the needle plate. |
| Burred edges on the rotary hook | | Free of burrs | Repair or replace the rotary hook. See P.36. |
| Burred edges on the bobbin case | | Free of burrs | Repair or replace the bobbin case. |

2-11 Needle breaks

Determining inspection

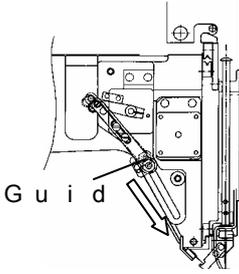


- The needle may be clamped incorrectly.
- The needle may be bent or blunt.
- The needle may be too thin for the cloth.
- The starting position may be incorrect.

Needle and rotary hook

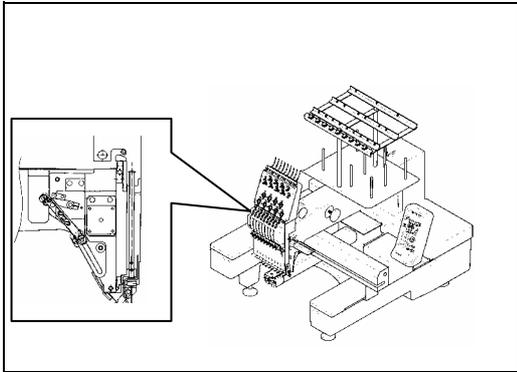
| Item | Method | Standard | Action |
|-----------------------------------|--|--|-------------------|
| Needle to rotary hook clearance | <p>Align the needle to the hook tip, and check the clearance A visually.</p> | A=0.1 to 0.3mm | Adjust. See P.21. |
| Needle bat height | <p>Hook tip must be at the needle center</p> <p>Needle bar at bottom dead center</p> <p>Rotary hook center</p> | B=201° ± 3° (Standard 1.8 to 3.1mm) | Adjust. See P.21. |
| Needle lift: D | | C=8.0 ± 0.1mm | Adjust. See P.21. |
| Needle lift: (Reference value: C) | | D=1.0 ± 0.5mm | |

Thread wiper mechanism

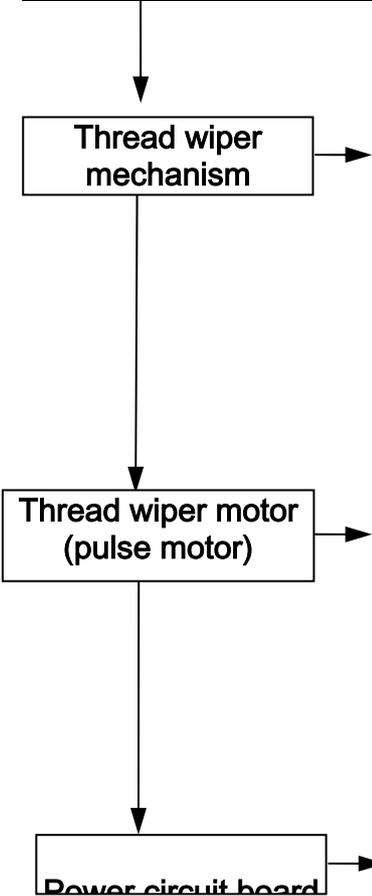
| | | | |
|---------------------------------|--|-------------------------------|--|
| <p>Thread wiper hook return</p> |  <p>Push the guide pin down as far as it will go in the direction of the arrow and check the returning movement of the pin.</p> | <p>Must return smoothly .</p> | <p>Adjustment is performed by loosening a guide pin screw.</p> |
|---------------------------------|--|-------------------------------|--|

2-12 Thread wiper hook does not operate

Determination inspection



- Thread wiper hook may need cleaning (lint, dust, etc.)
- Upper thread hook lever may be deformed

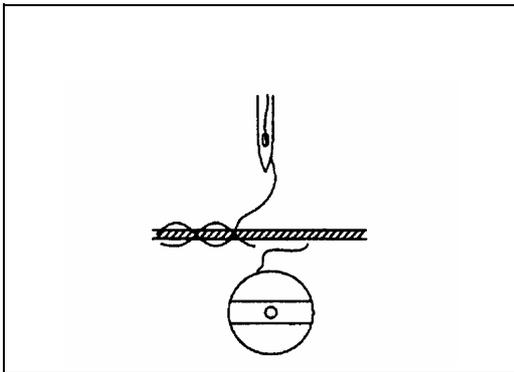


| Item | Method | Standard | Action |
|-------------------------------|--|------------------------------|--------------------|
| Thread wiper hook return | <p>Push the guide pin down as far as it will go in the direction of the arrow and check the returning movement of the pin.</p> | Must return smoothly | Adjust. See P.28. |
| Connection of power connector | <p>Connector ① - ⑥</p> | Must be connected correctly. | Connect correctly. |
| Resistance | <p>Disconnect the power connector and check the resistance between ① and ⑤, ② and ⑥, ③ and ⑤, ④ and ⑥ with a circuit tester.</p> | 4.8 ~ 6.0 Ω | Replace. See P.53. |
| Connection of connector CN 6 | <p>CN6</p> <p>Check the connection condition visually.</p> | Must be connected correctly. | Replace. See P.45. |

2-13 Thread trimming fails

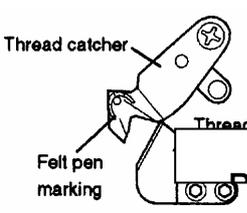
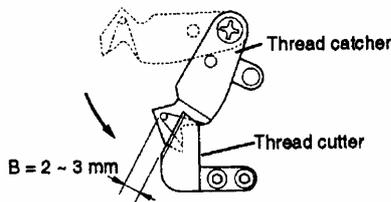
Determine inspection

2.TROUBLESHOOTING

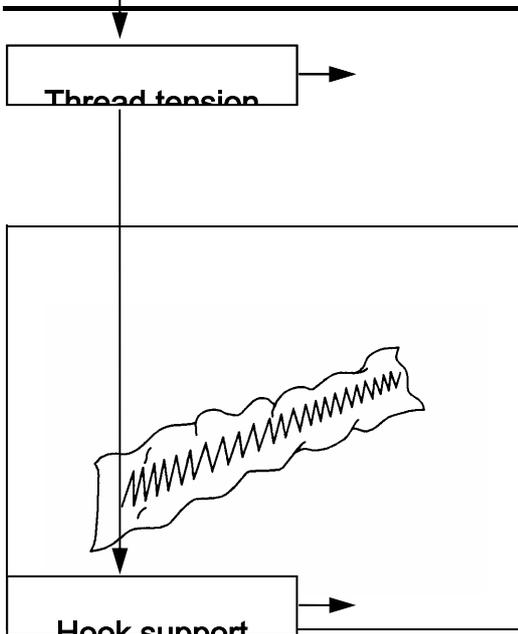


- Lint may be built up between the movable knife and fixed knife.
- Check thread trim timing.
(push function key and check thread trim timing)

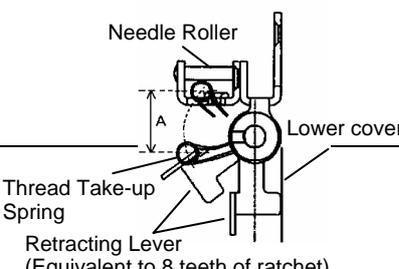
| Item | Method | Standard | Action |
|-----------------------------|--|---------------|--------------------|
| Thread trimming drive lever | <p>Check the clearance between the lever and stopper. At this point, LED must be turned on.</p> | A=0.5mm | Adjust. See P.24. |
| Thread catcher | | Free of flaws | Repair or replace. |
| Blade pressure | <p>Check the position of the thread cutter when the cutter return to the waiting position after cutting.</p> | A= 0 ± 0.5mm | Adjust. See P.24. |

| | | | | |
|------------------------|-------------------------------|---|-----------------------------------|--------------------------|
| <p>2-14. Puckering</p> | <p>Thread cutter evenness</p> |  <p>Smear the thread catcher with a felt pen, and check if contact evenly.</p> | <p>Must be contact evenly.</p> | <p>Adjust. See P.25.</p> |
| | <p>Blade pressure</p> |  | <p>B=2 ~ 3mm (0.6 ~ 1.5kg·cm)</p> | <p>Adjust. See P.25.</p> |

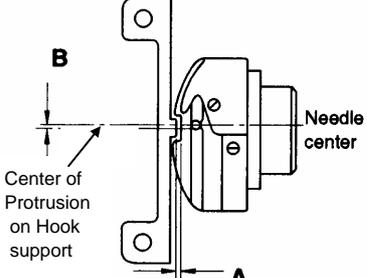
2.TROUBLESHOOTING



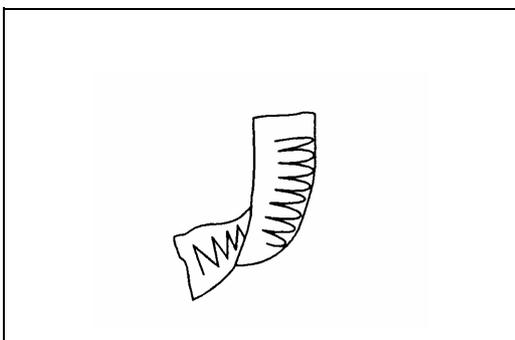
- The needle or bobbin thread tension may be too tight.
- The needle and thread may be too thick for the cloth.
- The cloth tension may be too loose.
- The needle tip may be blunt.
- The hole in the needle plate may be burred.
- The needle thread may be stuck around the threading tube holder and the thread take-up lever.

| Item | Method | Standard | Action |
|---|---|-----------------|--|
| <p>Thread take-up spring stroke (A)</p> | <p>Hold the thread before the needle roller. Pull the thread downward and the thread take-up spring starts moving. Check the length of thread pulled until the spring stops.</p>  | <p>A=20±1mm</p> | <p>Move the retracting lever position up and down to adjust.</p> |

2-15 Improper tension

| | | | |
|---|--|----------------|---|
| Initial thread take-up spring tension | | B=5±1g | The screw of the retracting lever aligned with the ratchet mark |
| Clearance under the rotary hook support | Check protrusion on hook support visually. | A=0.5 to 0.8mm | Adjust. See P.23. |
| Relative positions of the center of the protrusion on the hook support and the center of the needle |  | B=0 ± 0.2mm | |

2.TROUBLESHOOTING

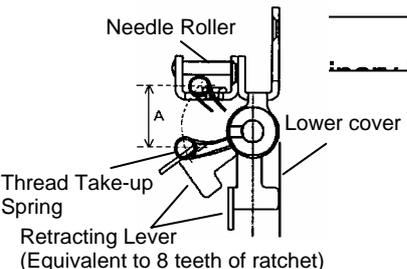
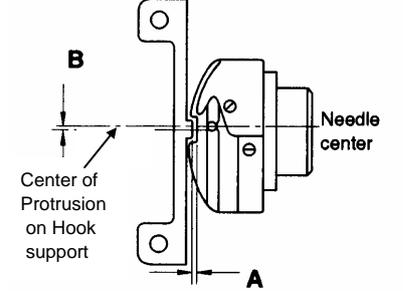
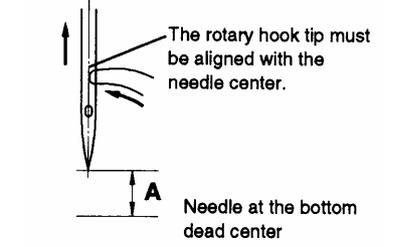


- The thread tension may be too loose.
- The bobbin thread tension may be too loose.
- Needle size may be incorrect for the thread.
- Upper threading may be incorrect.
- Bobbin thread may be loose.

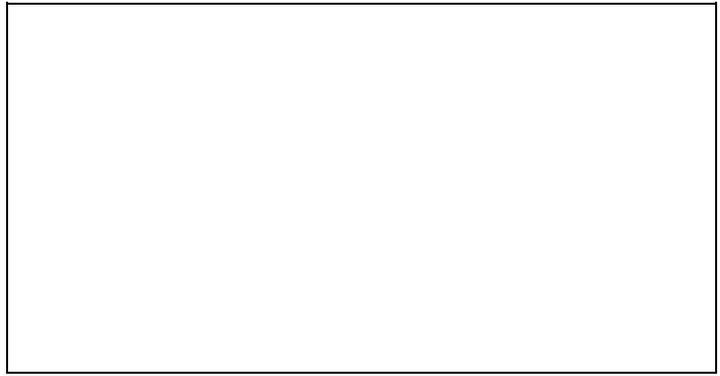
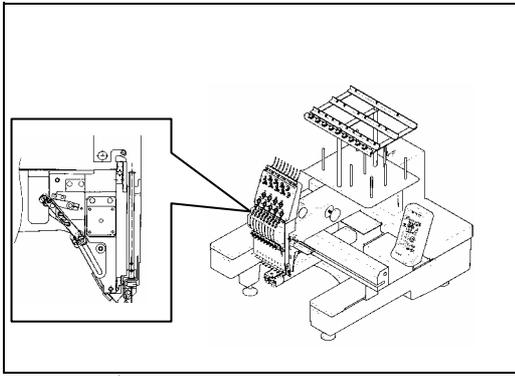
Thread tension

| Item | Method | Standard | Action |
|--------|-----------------------------------|----------|--------|
| Thread | Hold the thread before the needle | | |

2-16 Jump function does not work

| | | | |
|--|---|---|--|
| <p>take-up spring stroke (A)</p> | <p>roller. Pull the thread downward and the thread take-up spring starts moving. Check the length of thread pulled until the spring stops.</p>  | <p>$A=20\pm 1$ mm</p> | <p>Move the retracting lever position up and down to adjust.</p> |
| <p>Initial thread take-up spring tension (B)</p> | <p>Hold the thread before the needle roller and pull the thread downward. Check the tension when the thread take-up spring moves approximately 1mm.</p> | <p>$B=5\pm 1$g</p> | <p>The screw of the retracting lever aligned with the ratchet mark</p> |
| <p>Clearance under the rotary hook support</p> | <p>Check protrusion on hook support visually.</p> | <p>$A=0.5$ to 0.8mm</p> | <p>Adjust. See P.23.</p> |
| <p>Relative positions of the center of the protrusion on the hook support and the center of the needle</p> |  | <p>$B=0 \pm 0.2$mm</p> | |
| <p>Needle and rotary hook timing</p> |  <p>The rotary hook tip must be aligned with the needle center.</p> <p>Needle at the bottom dead center</p> | <p>$A=201^\circ \pm 3^\circ$ (Standard 1.8 to 3.1mm)</p> | <p>Adjust. See P.21.</p> |

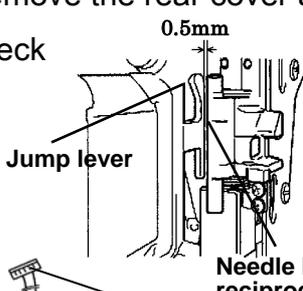
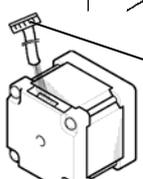
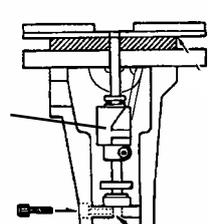
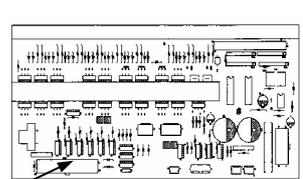
2.TROUBLESHOOTING



Jump motor
(pulse motor)

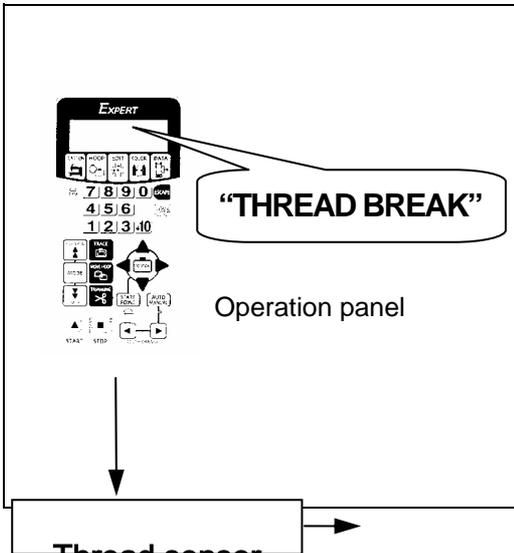
Needle bar
reciprocator

Power circuit board

| Item | Method | Standard | Action |
|---|---|------------------------------|--------------------|
| Installation position of jump motor | Remove the rear cover and check  0.5mm Jump lever Needle bar reciprocator | $A=0.5 \pm 0.1\text{mm}$ | Adjust. See P.29. |
| Connection of power connector |  Connector ① - ⑥ | Must be connected correctly. | Connect correctly. |
| Resistance | Disconnect the power connector and check the resistance between ① and ⑤, ② and ⑥, ③ and ⑤, ④ and ⑥ with a circuit tester. | 4.8 ~ 6.0 Ω | Replace. See P.47. |
| Wrong movement or damage of needle bar reciprocator |  Needle bar reciprocator | Free of burrs | Replace. See P.41. |
| Connection of connector CN 7 |  CN7 Check the connection condition visually. | Must be connected correctly. | Replace. See P.45. |

2-17 An error message is displayed

Determination inspection



When not displayed even if the needle thread breaks

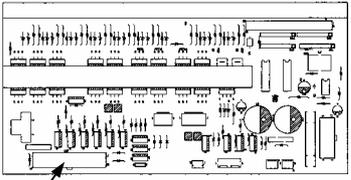
- The thread sensor may be OFF.

When displayed even if the needle thread is not break.

- The needle thread may not be set correctly.
- The bobbin thread may be broken.
- The bobbin thread may be run out.

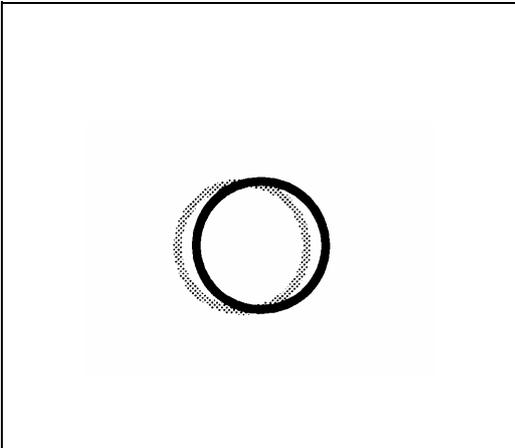
| Item | Method | Standard | Action |
|-------------------------------|--|------------------------------|-------------------------------|
| Torque of rotary tension disk | <p>Rotary tension disk</p> | Must turn smoothly | |
| Check position of sensor | <p>Slit disk</p> <p>Center of sensor</p> | A= less than 0.8mm | Adjust. See P.34. |
| Connection of connector CN 1 | <p>CN1</p> | Must be connected correctly. | Connect correctly or replace. |

Remove the cover of joint circuit board and check the connection.

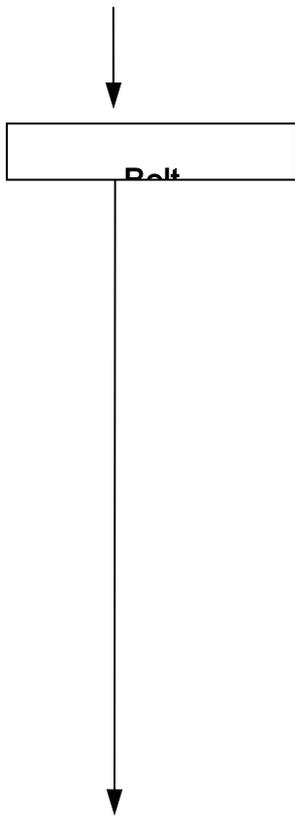
| | | | |
|-------------------------------------|--|-------------------------------------|---------------------------|
| <p>Connection of connector CN 7</p> |  <p>CN7</p> <p>Check the connector visually.</p> | <p>Must be connected correctly.</p> | <p>Replace. See P.45.</p> |
|-------------------------------------|--|-------------------------------------|---------------------------|

2-18 Stitch registration slips out

Determining inspection



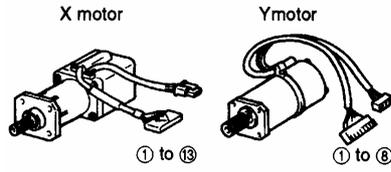
- The cloth may be set incorrectly in the embroidery frame.
- The embroidery frame holder may be interfering.
- The cloth may be stuck in the table.
- The embroidery frame may be interfering,
- The embroidery frame screws may be loose.



| Item | Method | Standard | Action |
|--------------|--|---------------------------------------|-------------------------------------|
| Belt tension | F: Force(kg)(at span center) G: Deflection (mm) | Belt A F=0.46 G=10.8± 2.16mm | Adjust. See Pgs.30 and 31. |
| | | Belt B F=0.46 G=0.9± 0.18mm | |
| | | Belt C F=0.95 G=7.4± 1.48mm | |
| | | Belt D F=0.64 G=1.1± 0.22mm | |
| | | Belt E F=0.51 G=1.2± 0.24mm | |

X, Y motor

Encoder output



Press the emergency stop button and check the voltage of the sections below with a circuit tester.
(X motor)
Across ① 5V (red) and ② GND (red and black)
(Y motor)
Across ⑥ 5V (red) and ⑦ GND (red and black)

+5V when turned on

Replace. See Pgs.51 and 52.

3. ADJUSTMENT

3-1 Timing of needle and rotary hook

1. Needle lift (rotary hook position) and clearance between needle and rotary hook

[Inspection]

- (1) Remove the table set.
- (2) Remove the needle plate.
- (3) Turn DS1-1 on and turn the power on.
- (4) Press SET key from test mode of LCD display, select No.2 and press SET key.
- (5) Rotate the hand wheel anti-clockwise to move the needle bar to the bottom dead center (180°). Rotate the hand wheel further, and when LCD display shows the needle position at $201^\circ \pm 3^\circ$ (Standard 1.8 to 3.1mm), the hook tip must be aligned with the needle center (Fig.1).
- (6) The clearance between the needle and the hook tip must be 0.1 to 0.3mm (Fig.3).

[Adjustment]

- (1) Slightly loosen the rotary hook set screw (a) closest to the hook tip and loosen the other two set screws (Fig.2).
- (2) Rotate the hand wheel anti-clockwise to move the needle bar to the bottom dead center (180°). Rotate the hand wheel further until LCD display shows the needle position at $201^\circ \pm 3^\circ$ (Fig.1).
- (3) Loosen set screw (a) further and rotate the rotary hook in either direction A or B. Align the hook tip with the needle center (Fig.1) and secure a clearance of 0.1 to 0.3mm between the needle and hook tip (Fig.3).
- (4) Slightly tighten the set screw (a) closest to the hook tip (Fig.2).
- (5) Rotate the hand wheel anti-clockwise again until LCD display shows the needle position at $201^\circ \pm 3^\circ$ and check

the position of the needle and hook tip.

- (6) Firmly tighten the three retaining screws (a) (Fig.2).
- (7) Mount the needle plate, the hook cover and the table set.

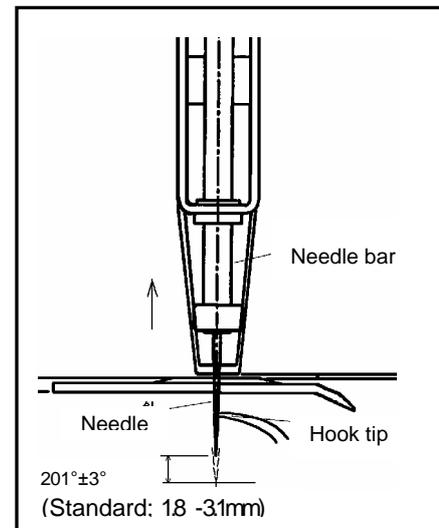
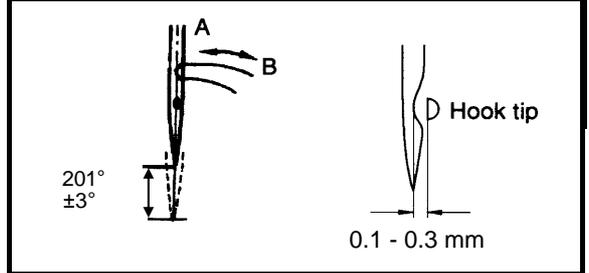


FIG.1

FIG.2



FIG.3



3.ADJUSTMENT

2.Needle bar height

[Inspection]

- (1) Remove the table set.
- (2) Remove the needle plate.
- (3) Rotate the hand wheel anti-clockwise.
When the needle bar comes to the bottom dead center, the distance from the rotary hook center to the needle tip must be $8.0 \pm 0.1\text{mm}$ (Fig.1).

[Adjustment]

- (1) Remove the lower cover (Fig.2).
- (2) Loosen the set screw of the needle bar connecting stud, set the needle bar height gauge, adjust the height and tighten the screw. (Figs.3, 4).

Note: Change the needle to check the needle can be easily changed.

Note: If the needle can not be easily changed, check the distance from the surface of needle bar connecting stud to the bottom of the upper dead point stopper must be $4.5 \pm 0.2\text{mm}$ (Fig.3).

- (3) Mount the needle plate and the table set.

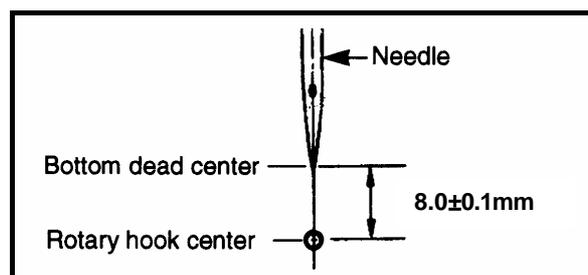


FIG.1

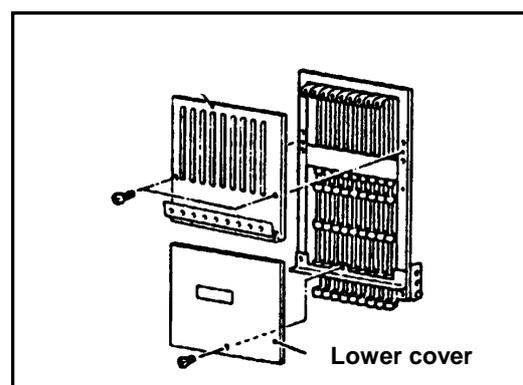


FIG.2

FIG.4

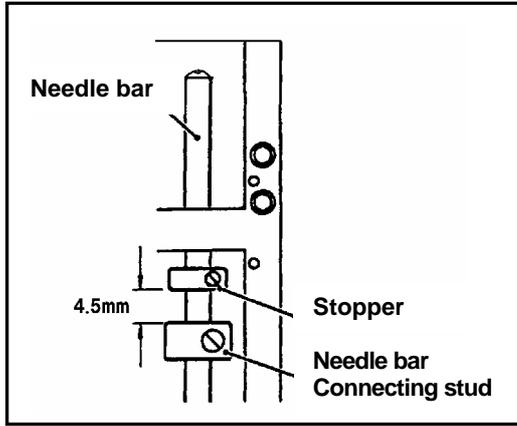
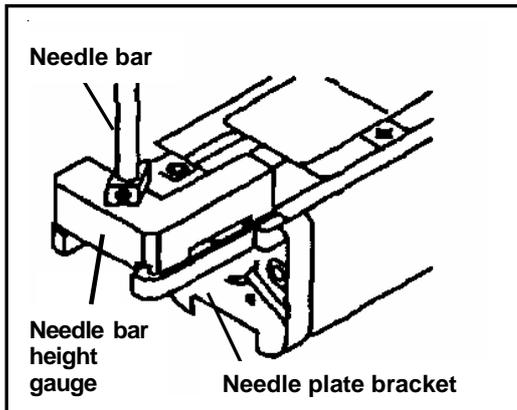


FIG.3



3-2 Position of the hook support

[Inspection]

- (1) Remove the table set.
- (2) Remove the needle plate.
- (3) There must be a clearance of 0.5 to 0.8mm between the hook support and the rotary hook (Fig.1).
- (4) Distance B (clearance between the needle center and the center of the protrusion on the hook support) must not exceed 0.2mm (Fig.1).

[Adjustment]

- (1) Loosen the two set screws (a).
- (2) Move the hook support in direction C or D to adjust the clearance between the hook support to the rotary hook (Fig.2).
- (3) Move the hook support fully in direction A or B to adjust the offset between the centers of the needle and the protrusion on the hook support (Fig.2).
- (4) Retighten the two set screws (a) (Fig.2).
- (5) Attach the needle plate and the table set.

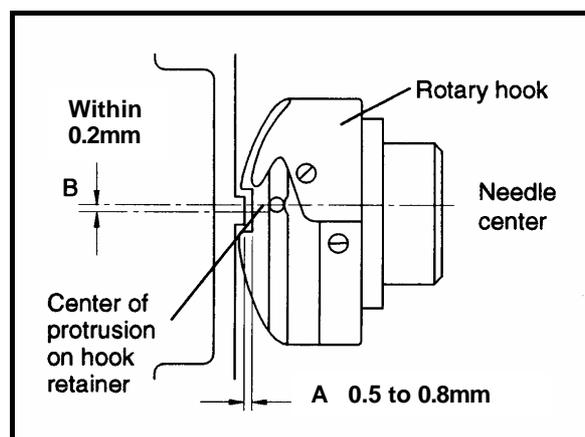


FIG.1

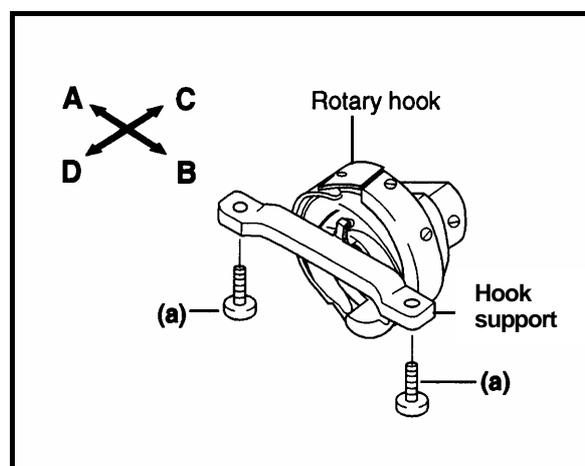


FIG.2

3-3 Standby position of thread catcher

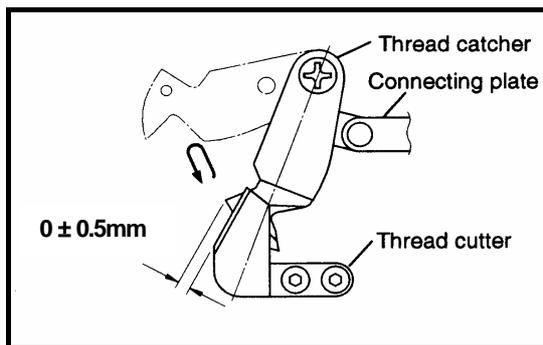
[Inspection]

- (1) Remove the needle plate.
- (2) Remove the table set.
- (3) Turn the power on and press the thread trim key to perform the thread trimming.
- (4) The relative positions of the thread catcher and the thread cutter must be a clearance of $0 \pm 0.5\text{mm}$. (Fig.1).
- (5) At that point, LED must be turned on (Fig.2).

[Adjustment]

- (1) Loosen four set screws (a) and remove bed cover A (Fig.3).
 - (2) Remove four set screws (b) and remove the base cover rear L. (Fig.4).
 - (3) Remove three set screws (c) and remove the base cover front L (Fig.4).
 - (4) If the LED is not turned on, loosen the set screw (d) of the thread trimming drive lever and adjust the clearance between the lever and stopper to 0.5mm (Fig.2). Then perform the thread trimming to check the standby position of the thread catcher.
- Note: At this time, vertical position of the thread trimming drive lever must be 0 ~ 0.1mm from the motor spacer.**
- (5) If the LED is not turned on and the clearance between the lever and stopper is 0.5mm, loosen the set screw of the drive arm, set the thread catcher at $0 \pm 0.5\text{mm}$ from the thread cutter and tighten the set screw of the drive arm. Then perform the thread trimming to

check the standby position of the thread



catcher.

FIG.1

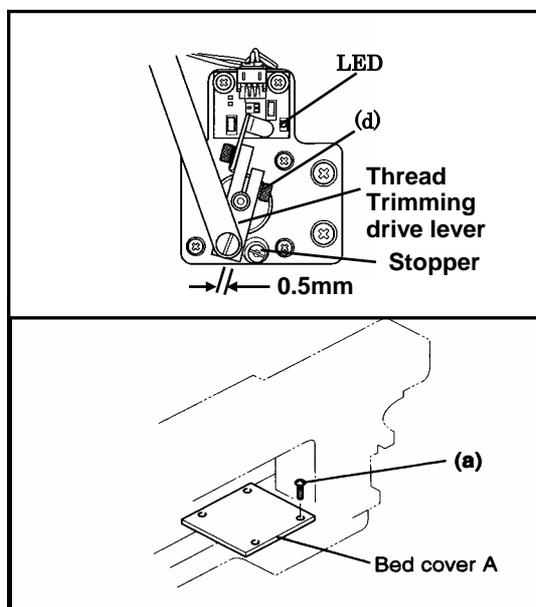


FIG.2

FIG.3

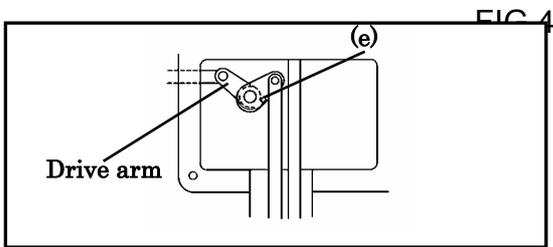


FIG.5

3-4 Blade pressure

[Inspection]

- (1) Remove the needle plate.
- (2) Remove the table set.
- (3) Remove four set screws (a) and remove the bed cover A (Fig.1).
- (4) Remove knife connecting plate from the pin of the thread trimming lever and smear the thread catcher with a felt pen (Fig.2).
- (5) Perform trimming manually and check that the felt pen marking on the thread catcher is scraped evenly (even contact).
- (6) Perform trimming again, and check that the thread catcher makes an initial contact with the thread cutter at a clearance of 2 to 3mm (blade pressure: 0.6 to 1.5kg·cm) (Fig.3).

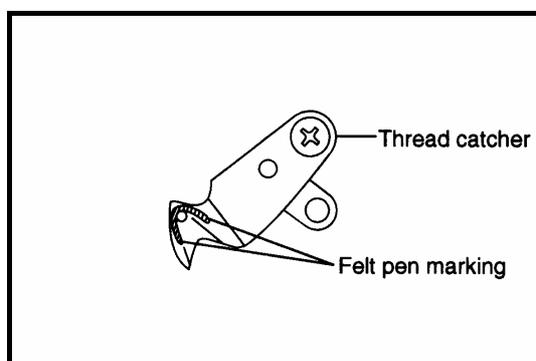
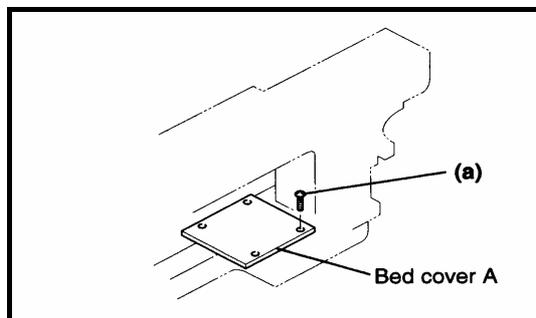


FIG.1

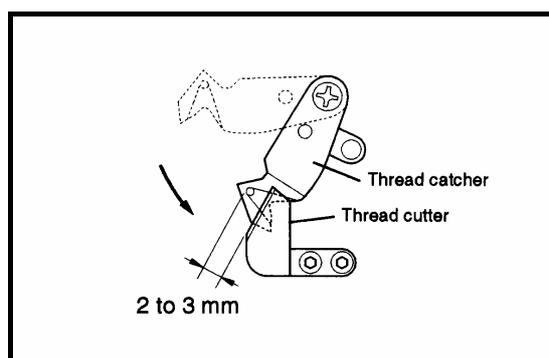


FIG.2

FIG.3

cutter in position with the left-side set screw (a) (Fig.5 and 6).

3..ADJUSTMENT

[Adjustment]

If the felt pen marking on the thread catcher looks like A or B, adjust the angle of the thread cutter as necessary then adjust the blade pressure (Fig.4).

1) If the felt pen marking looks like A (Fig.4).

(1) Turn adjusting screw (b) in direction B and, while steadying the thread cutter by hand, turn adjusting screw (b) in direction C just so the screw tip barely touches the thread cutter (Fig.5).

(2) While steadying the thread cutter by hand, tighten set screws (a) alternately and evenly until the cutter is fixed firmly (Fig.5).

2) If the felt pen marking looks like B (Fig.4),

(1) Slightly loosen two set screws (a) (Fig.5).

(2) While steadying the thread cutter by hand, turn adjusting screw (b) in direction C just so the screw tip barely touches the thread cutter (Fig.5).

(3) While steadying the thread cutter by hand, tighten set screws (a) alternately and evenly until the cutter is fixed firmly (Fig.5).

3) If the felt pen marking looks like C, adjust the blade pressure (Fig.4).

(1) If the clearance is less than 2mm, slightly loosen the right-side set screw (a), tighten the left-side set screw (a), then tighten the thread cutter in position with the right-side set screw (a)(Fig.5 and 6).

(2) If the clearance is larger than 3mm, slightly loosen the left-side set screw (a), tighten the right-side set screw (a), then tighten the thread

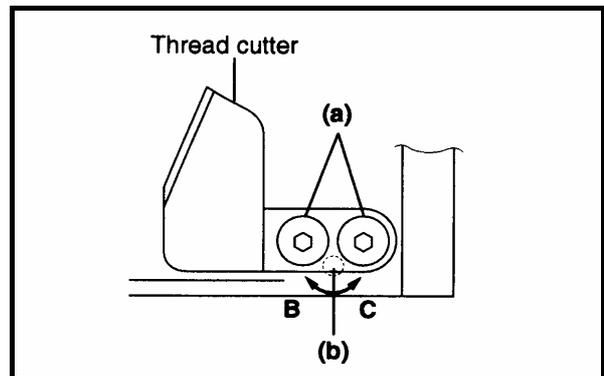
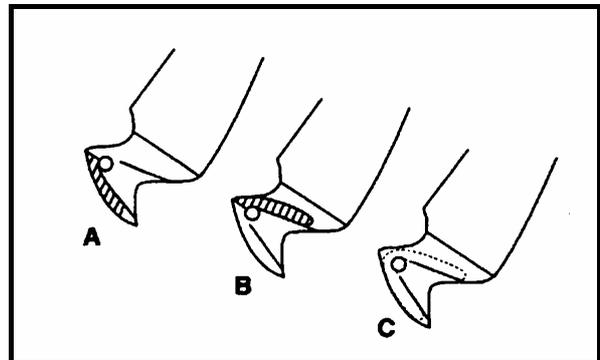


FIG.4

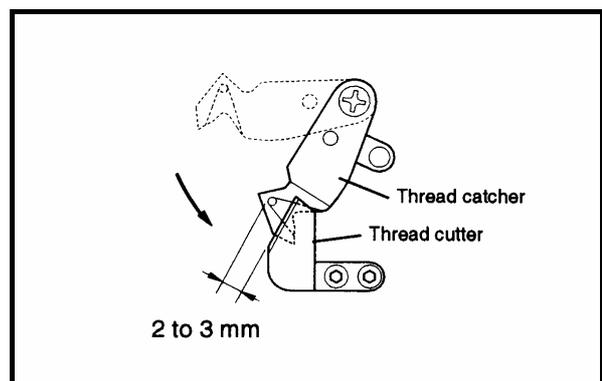


FIG.5

FIG.6

(Fig.2).

[Adjustment]

- (1) If clearance A between the picker tip and the bobbin differs from that specified, loosen two set screws (c) and the set screws (a), adjust the position of the picker by sliding the picker solenoid base back and forth. After adjusting, tighten the set screw (a), then move the picker base to the backmost position, set the picker stopper and tighten two set screws (c) (Fig.3).
- (2) If clearance B between the picker tip center and the rotary hook center differs from that specified, loosen two set screws (b) to shift the picker bracket. Tighten screws (b) after adjustment (Fig.4).
- (3) If the picker height differs from that

3..ADJUSTMENT

specified, loosen two set screws (b) to adjust the height. Tighten screws (b) after adjustment (Fig.3).

3-5 Picker position

[Inspection]

- (1) Remove the table set.
- (2) When the picker solenoid is on, clearance A between the picker tip and the bobbin must be 0.5 to 1.5mm (Fig.1).
- (3) Clearance B between the picker tip center and the rotary hook center must not exceed 1mm (Fig.2).
- (4) The picker height C must be 7 to 9mm from the center of the rotary hook

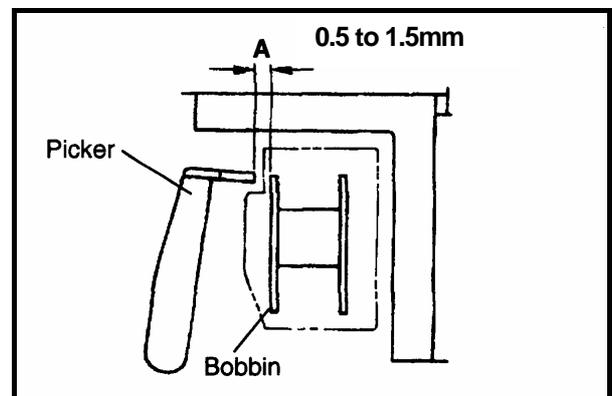


FIG.1

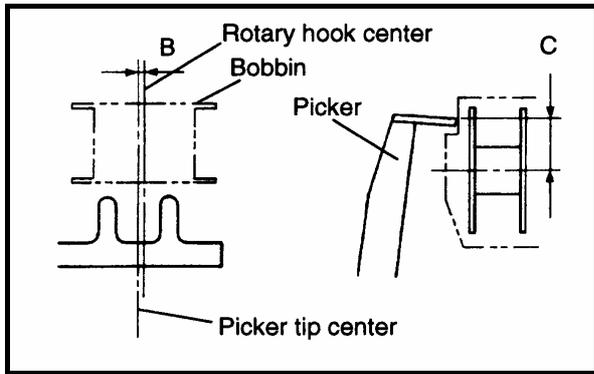


FIG.2

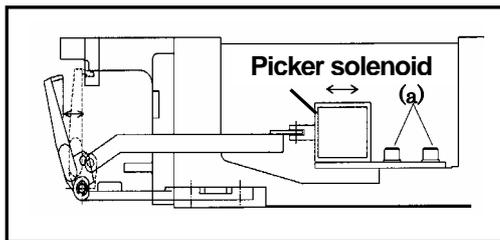


FIG.3

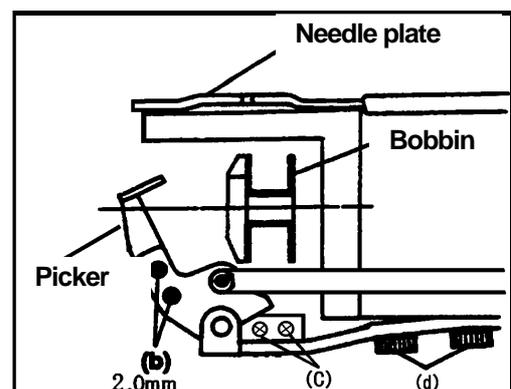
FIG.4

the thread wiper hook must catch the thread (Fig.1).

- (2) Distance A from the needle center to the thread wiper hook tip must be 11 to 12mm during operation (Fig.2).
- (3) Distance B from the right end of the thread wiper hook to the needle center must be 1 to 3mm (Fig.2).

[Adjustment]

- (1) If the thread wiper hook does not catch the thread, loosen four set screws (a) to move the thread presser base in the direction of the arrow. Position the base where the guide pin moves smoothly and tighten four set screws (a) (Fig.3).
- (2) If distance A from the needle center to the thread wiper hook tip differs from that specified, loosen two set screws (b), adjust by moving the thread wiper motor base right/left and tighten two set screws (b) (Fig.3).
- (3) If distance B from the needle center to the thread wiper hook tip differs from



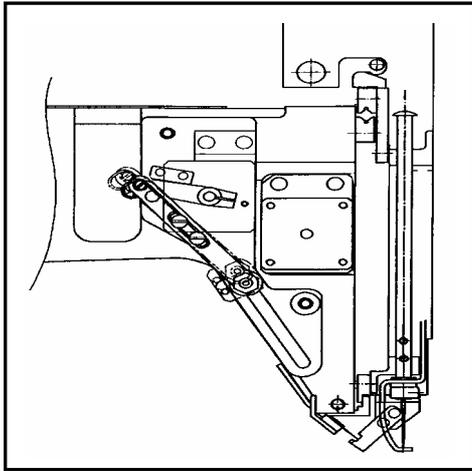
3.ADJUSTMENT

3-6 Position of the thread wiper hook

[Inspection]

- (1) When the guide pin is pushed down,

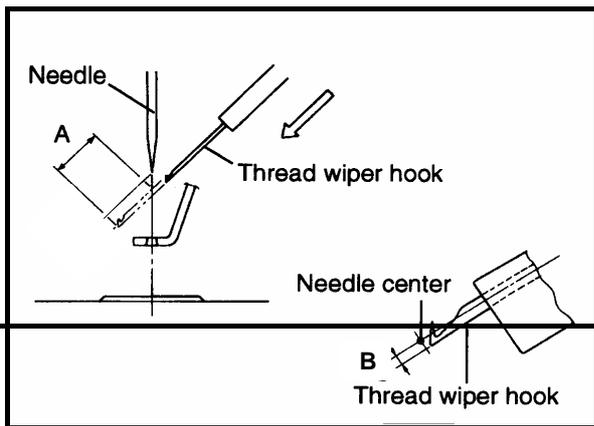
that specified, loosen two set screws (c) , and adjust by moving the thread wiper hook base right/left and tighten two screws (c) (Fig.3).



Guide pin

FIG.1

FIG.3



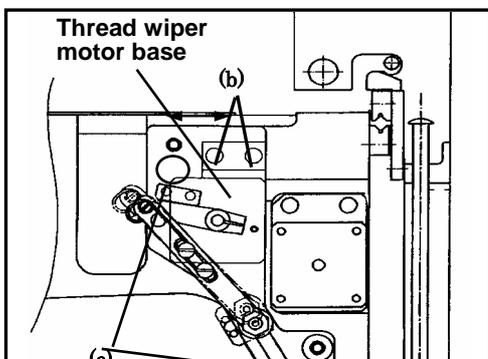
3.AJUSTMENT

FIG.2

3-7 Adjustment of the Jump motor position

[Inspection]

- (1) Remove the needle case.
 [『Refer to “ 4-5.Replacement of needle bar reciprocator” 』]



- (2) Remove three set screws (a), two set screws (b) and remove the arm front cover L (Fig.1).
- (3) In this state, the clearance between the jump lever and needle bar reciprocator must be 0.5mm (Fig.2).

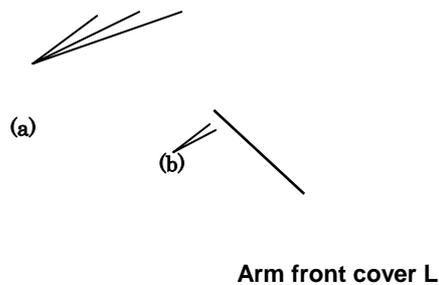


FIG.1

[Adjustment]

- (1) Loose the two set screws (c) and adjust the jump motor position by moving the jump motor right/left (Fig.3).
- [『refer to “ 4.Replacement of needle bar reciprocator” 』]
- (2) After adjusting, locate the jump motor at its highest position and tighten two set screws.
 - (3) Install the arm front cover L with five set screws (Fig.1).



FIG.2

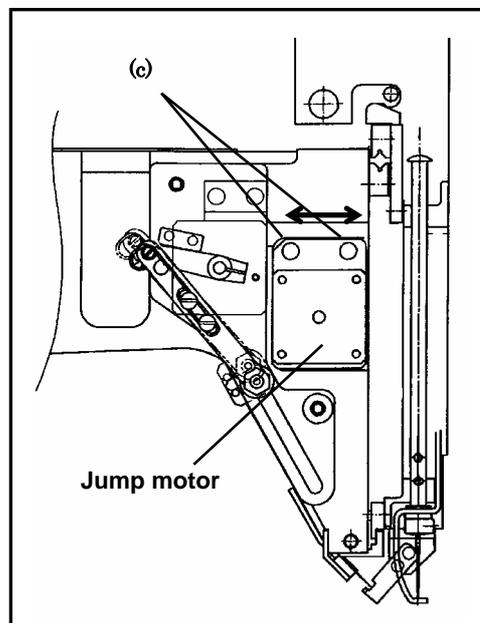
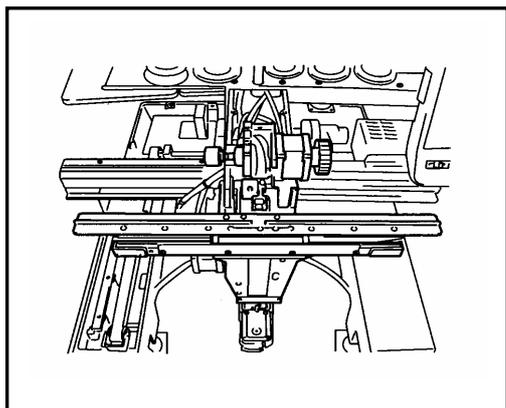


FIG.3

3. ADJUSTMENT

3-1 Timing of needle and rotary hook

1. Needle lift (rotary hook position) and clearance between needle and rotary hook

[Inspection]

- (1) Remove the table set.
- (2) Remove the needle plate.
- (3) Turn DS1-1 on and turn the power on.
- (4) Press SET key from test mode of LCD display, select No.2 and press SET key.
- (5) Rotate the hand wheel anti-clockwise to move the needle bar to the bottom dead center (180°). Rotate the hand wheel further, and when LCD display shows the needle position at $201^\circ \pm 3^\circ$ (Standard 1.8 to 3.1mm), the hook tip must be aligned with the needle center (Fig.1).
- (6) The clearance between the needle and the hook tip must be 0.1 to 0.3mm. (Fig.3)

[Adjustment]

- (1) Slightly loosen the rotary hook set screw (a) closest to the hook tip and loosen the other two set screws. (Fig.2)
- (2) Rotate the hand wheel anti-clockwise to move the needle bar to the bottom dead center (180°). Rotate the hand wheel further until LCD display shows the needle position at $201^\circ \pm 3^\circ$. (Fig.1)
- (3) Loosen set screw (a) further and rotate the rotary hook in either direction A or B. Align the hook tip with the needle center (Fig.1) and secure a clearance of 0.1 to 0.3mm between the needle and hook tip. (Fig.3)
- (4) Slightly tighten the set screw (a) closest to the hook tip. (Fig.2)
- (5) Rotate the hand wheel anti-clockwise again until LCD display shows the needle position at $201^\circ \pm 3^\circ$ and check

the position of the needle and hook tip.

- (6) Firmly tighten the three retaining screws (a). (Fig.2)
- (7) Mount the needle plate, the hook cover and the table set.

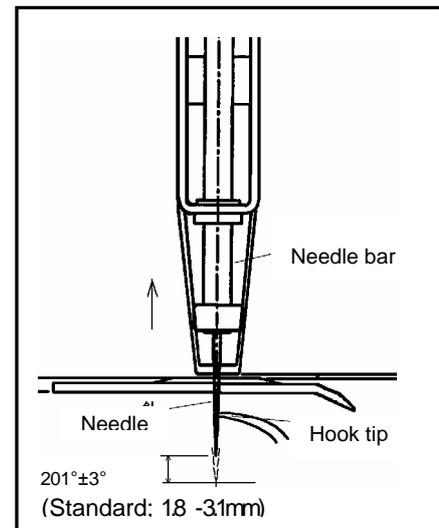
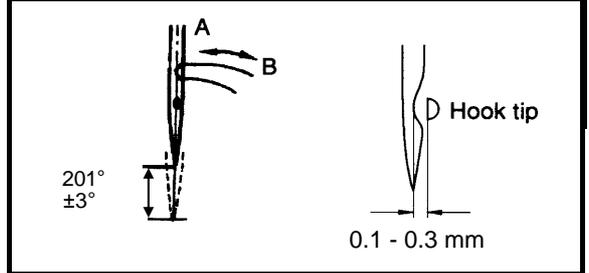


FIG.1

FIG.2



FIG.3



3.ADJUSTMENT

2.Needle bar height

[Inspection]

- (1) Remove the table set.
- (2) Remove the needle plate.
- (3) Rotate the hand wheel anti-clockwise.
When the needle bar comes to the bottom dead center, the distance from the rotary hook center to the needle tip must be $8.0 \pm 0.1\text{mm}$. (Fig.1)

[Adjustment]

- (1) Remove the lower cover .(Fig.2)
- (2) Bring the needle bar to the bottom dead center, loosen the set screw of the needle bar connecting stud and set the needle bar height, then tighten the screw.
(Figs.1, 3)

Note: Change the needle to check the needle can be easily changed.

Note: If the needle can not be easily changed, check the distance from the surface of needle bar connecting stud to the bottom of the upper dead point stopper must be $4.5 \pm 0.2\text{mm}$. (Fig.3)

- (3) Mount the needle plate and the table set.

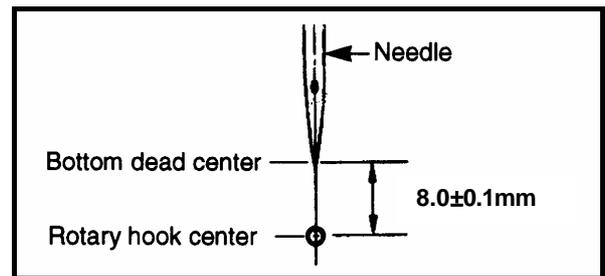


FIG.1

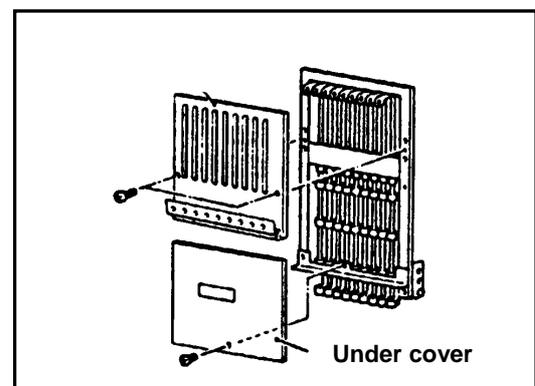


FIG.2

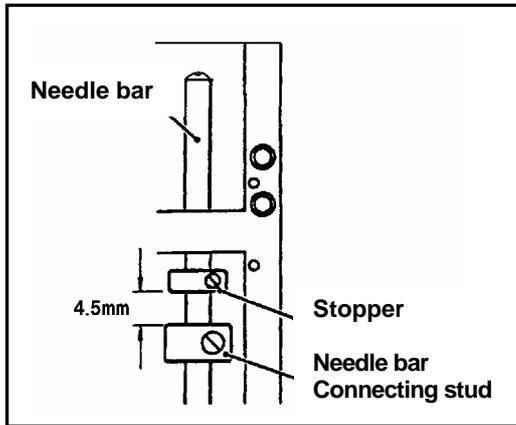


FIG.3

3-2 Position of the hook support

[Inspection]

- (1) Remove the table set.
- (2) Remove the needle plate.
- (3) There must be a clearance of 0.5 to 0.8mm between the hook support and the rotary hook. (Fig.1)
- (4) Distance B (clearance between the needle center and the center of the protrusion on the hook support) must not exceed 0.2mm. (Fig.1)

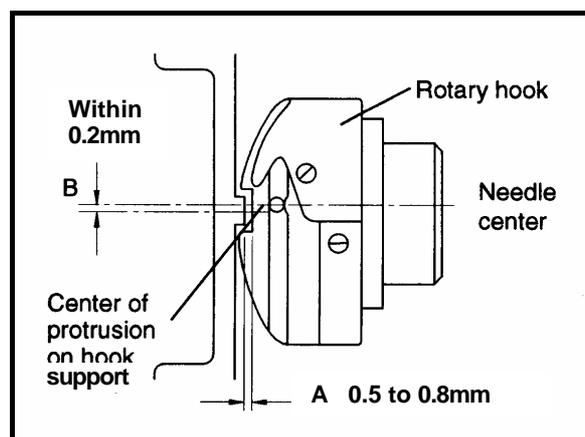


FIG.1

[Adjustment]

- (1) Loosen the two setting screws. (a)
- (2) Move the hook support in direction C or D to adjust the clearance between the hook support to the rotary hook. (Fig.2)
- (3) Move the hook support fully in direction A or B to adjust the offset between the centers of the needle and the protrusion on the hook support. (Fig.2)
- (4) Retighten the two set screws (a). (Fig.2)
- (5) Attach the needle plate and the table set.

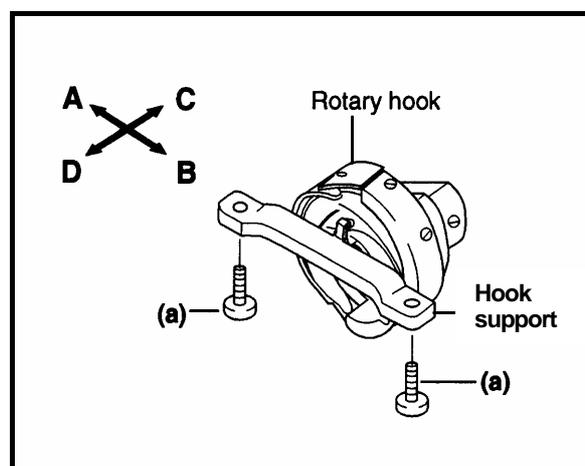


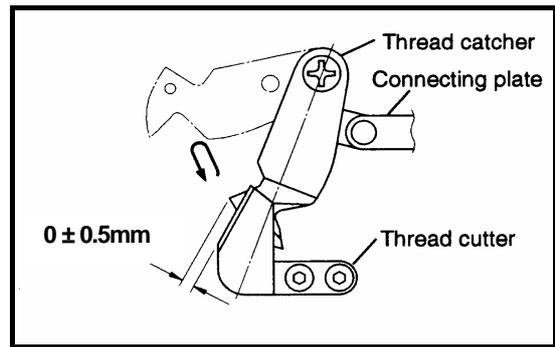
FIG.2

3-3 Standby position of thread catcher

[Inspection]

- (1) Remove the needle plate.
- (2) Remove the table set.
- (3) Turn the power on and press the thread trim key to perform the thread trimming.
- (4) The relative positions of the thread catcher and the thread cutter must be a clearance of $0 \pm 0.5\text{mm}$. (Fig.1)
- (5) At that point, LED must be turned on. (Fig.2)

Then perform the thread trimming to



check the standby position of the thread catcher. (Fig.5)

FIG.1

[Adjustment]

- (1) Loosen four set screws (a) and remove bed cover A. (Fig.3)
 - (2) Remove four set screws (b) and remove the base cover rear L.. (Fig.4)
 - (3) Remove three set screws (c) and remove the base cover front L. (Fig.4)
 - (4) If the LED is not turned on, loosen the set screw (d) of the thread trimming drive lever and adjust the clearance between the lever and stopper to 0.5mm. (Fig.2) Then perform the thread trimming to check the standby position of the thread catcher.
- Note: At this time, vertical position of the thread trimming drive lever must be 0 to 0.1mm from the motor spacer.**
- (5) If the LED is not turned on and the clearance between the lever and stopper is 0.5mm, loosen the set screw of the drive arm, set the thread catcher at $0 \pm 0.5\text{mm}$ from the thread cutter and tighten the set screw of the drive arm.

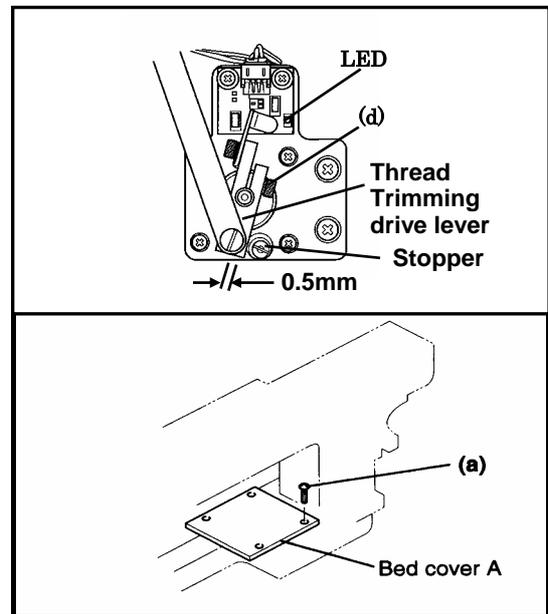


FIG.2

FIG.3

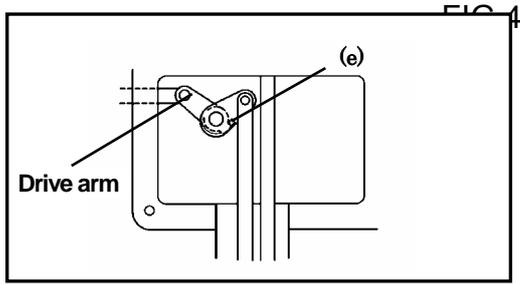


FIG.5

3-4 Blade pressure

[Inspection]

- (1) Remove the needle plate.
- (2) Remove the table set.
- (3) Remove four set screws (a) and remove the bed cover A. (Fig.1)
- (4) Remove knife connecting plate from the pin of the thread trimming lever and smear the thread catcher with a felt pen. (Fig.2)
- (5) Perform trimming manually and check that the felt pen marking on the thread catcher is scraped evenly. (even contact)
- (6) Perform trimming again, and check that the thread catcher makes an initial contact with the thread cutter at a clearance of 2 to 3mm (blade pressure: 0.6 to 1.5kg·cm). (Fig.3)

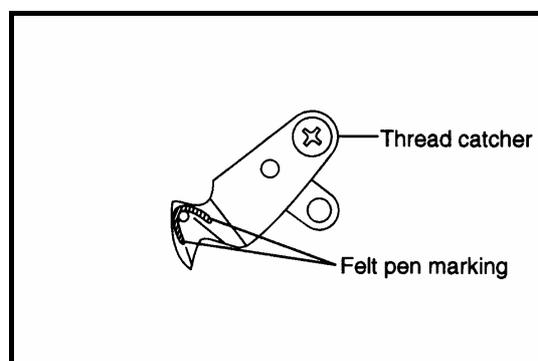
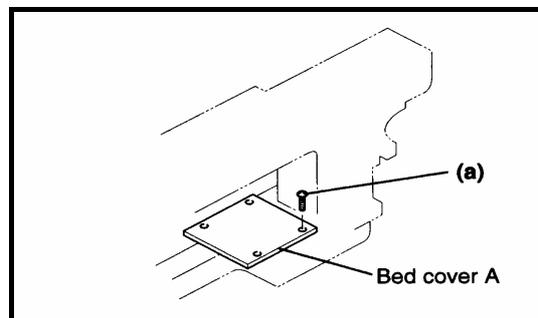


FIG.1

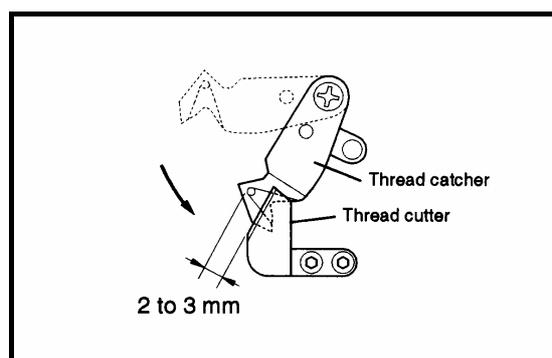


FIG.2

FIG.3

cutter in position with the left-side set screw (a). (Fig.5, 6)

3..ADJUSTMENT

[Adjustment]

If the felt pen marking on the thread catcher looks like A or B, adjust the angle of the thread cutter as necessary then adjust the blade pressure. (Fig.4)

1) If the felt pen marking looks like A. (Fig.4)

- (1) Turn adjusting screw (b) in direction B and, while steadying the thread cutter by hand, turn adjusting screw (b) in direction C just so the screw tip barely touches the thread cutter. (Fig.5)

- (2) While steadying the thread cutter by hand, tighten setting screws (a) alternately and evenly until the cutter is fixed firmly. (Fig.5)

2) If the felt pen marking looks like B (Fig.4),

- (1) Slightly loosen two setting screws (a). (Fig.5)
- (2) While steadying the thread cutter by hand, turn adjusting screw (b) in direction C just so the screw tip barely touches the thread cutter. (Fig.5)

- (3) While steadying the thread cutter by hand, tighten setting screws (a) alternately and evenly until the cutter is fixed firmly. (Fig.5)

3) If the felt pen marking looks like C, adjust the blade pressure. (Fig.4)

- (1) If the clearance is less than 2mm, slightly loosen the right-side set screw (a), tighten the left-side set screw (a), then tighten the thread cutter in position with the right-side set screw (a). (Fig.5, 6)

- (2) If the clearance is larger than 3mm, slightly loosen the left-side set screw (a), tighten the right-side set screw (a), then tighten the thread

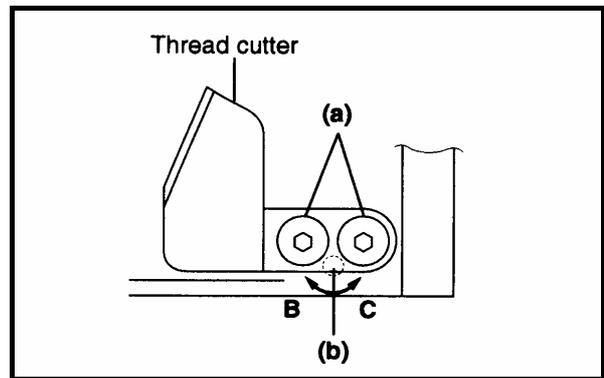
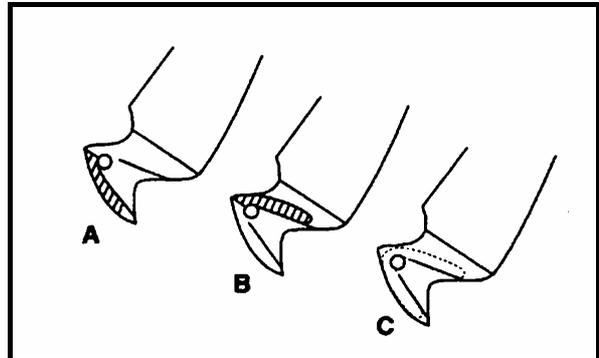


FIG.4

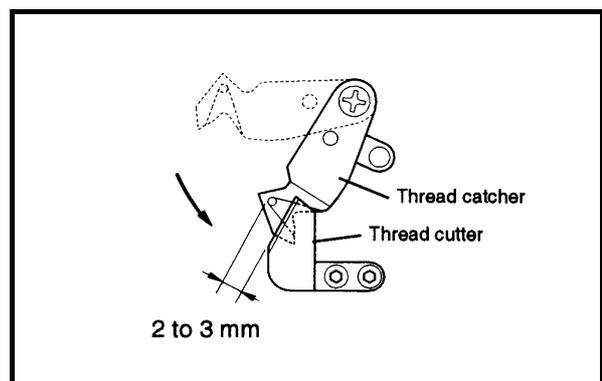


FIG.5

FIG.6

(Fig.2)

[Adjustment]

- (1) If clearance A between the picker tip and the bobbin differs from that specified, loosen two setting screws (b) to adjust the clearance A. (Fig.4)

Note: In case the picker solenoid is exchanged;

Loosen two set screws (c) and the set screws (a), adjust the position of the picker by sliding the picker solenoid base back and forth. After adjusting, tighten the setting screw (a), then move the picker base to the backmost position, set the picker stopper and tighten two setting screws (c). (Figs.3, 4)

- (2) If clearance B between the picker tip center and the rotary hook center differs from that specified, loosen two setting screws (d) to shift the picker

3..ADJUSTMENT

3-5 Picker position

[Inspection]

- (1) Remove the table set.
- (2) When the picker solenoid is on, clearance A between the picker tip and the bobbin must be 0.5 to 1.5mm. (Fig.1)

- (3) Clearance B between the picker tip center and the rotary hook center must not exceed 1mm. (Fig.2)
- (4) The picker height C must be 7 to 9mm from the center of the rotary hook.

bracket. Tighten screws (d) after adjustment. (Fig.3)

- (3) If the picker height differs from that specified, loosen two setting screws (b) to adjust the height. Tighten screws (b) after adjustment. (Fig.4)

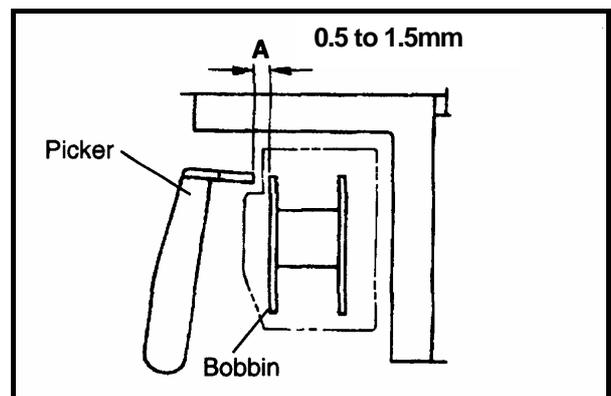


FIG.1

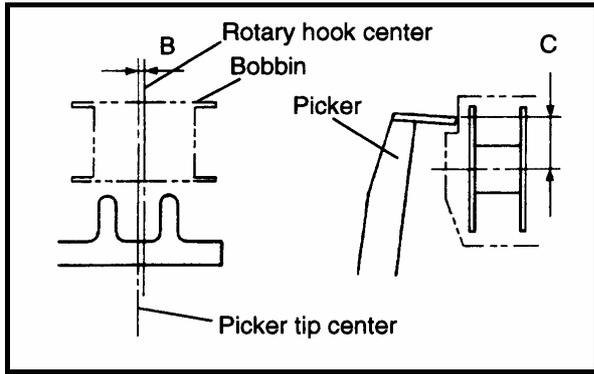


FIG.2

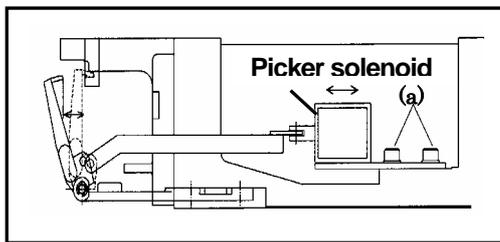


FIG.3

FIG.4

the thread wiper hook tip must be 11 mm or more during operation. (Fig.2)

- (3) Distance B from the right end of the thread wiper hook to the needle center must be 1 to 3mm. (Fig.2)

[Adjustment]

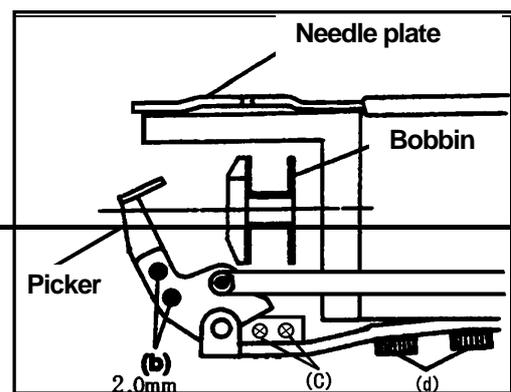
- (1) If the thread wiper hook does not catch the thread, loosen four setting screws (a) to move the thread presser base in the direction of the arrow. Position the base where the guide pin moves smoothly and tighten four setting screws (a). (Fig.3)
- (2) If distance A from the needle center to the thread wiper hook tip differs from that specified, loosen two set screws (b), adjust by moving the thread wiper motor base right/left and tighten two set screws (b). (Fig.3)
- (3) If distance B from the needle center to the thread wiper hook tip differs from that specified, loosen two set screws (c), and adjust by moving the thread wiper hook base right/left and tighten two screws (c). (Fig.3)

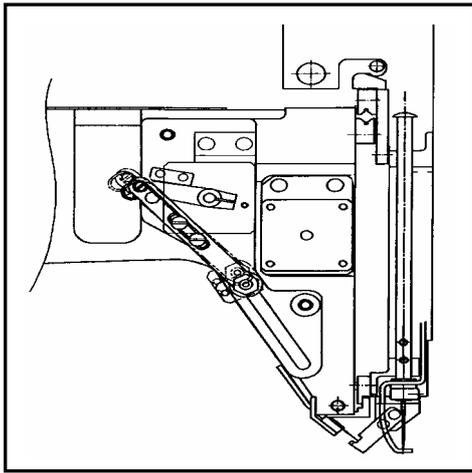
3.AJUSTMENT

3-6 Position of the thread wiper hook

[Inspection]

- (1) When the guide pin is pushed down, the thread wiper hook must catch the thread. (Fig.1)
- (2) Distance A from the needle center to





Guide pin

FIG.1

FIG.3

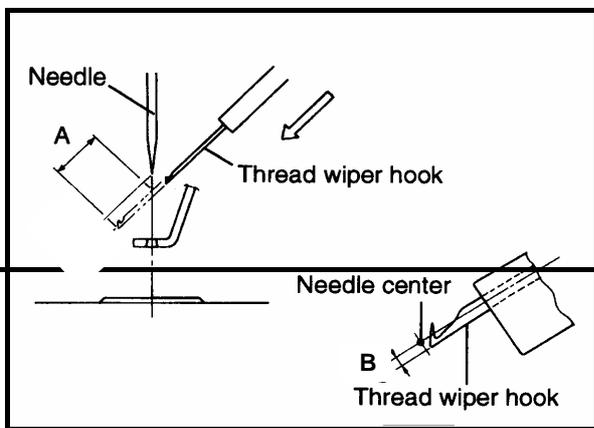


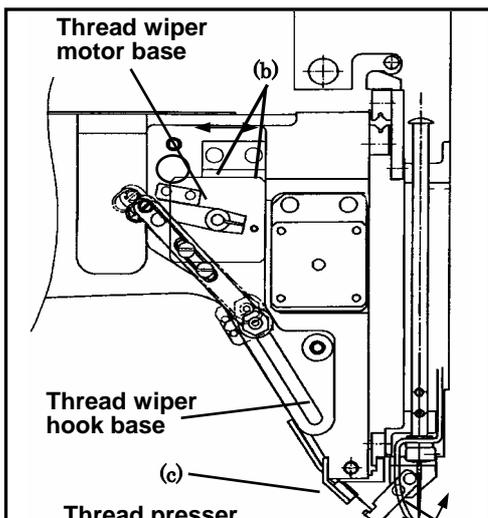
FIG.2

3.ADJUSTMENT

3-7 Adjustment of the Jump motor position

[Inspection]

- (1) Remove the needle case.
[『Refer to “ 4-5.Needle bar reciprocator” 』 on page 41]
- (2) Remove three setting screws (a), two set screws (b) and remove the arm front cover L. (Fig.1)
- (3) In this state, the clearance between the jump lever and needle bar



reciprocator must be 0.5mm. (Fig.2)

[Adjustment]

- (1) Loose the two setting screws (c) and adjust the jump motor position by moving the jump motor right/left. (Fig.3)

[『refer to “ 4-5.Needle bar reciprocator” 』 on page 41]

- (2) After adjusting, locate the jump motor at its highest position and tighten two setting screws.
- (3) Install the arm front cover L with five setting screws. (Fig.1)

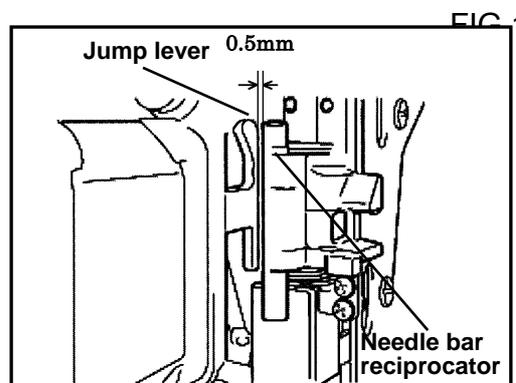
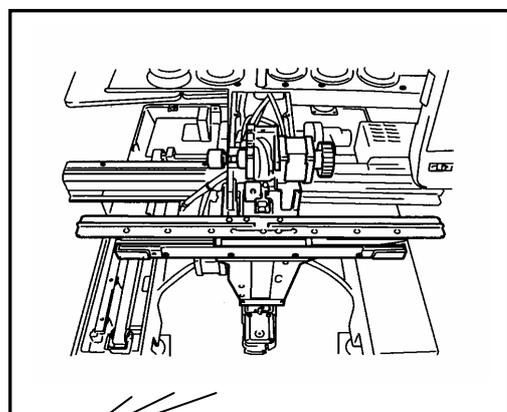


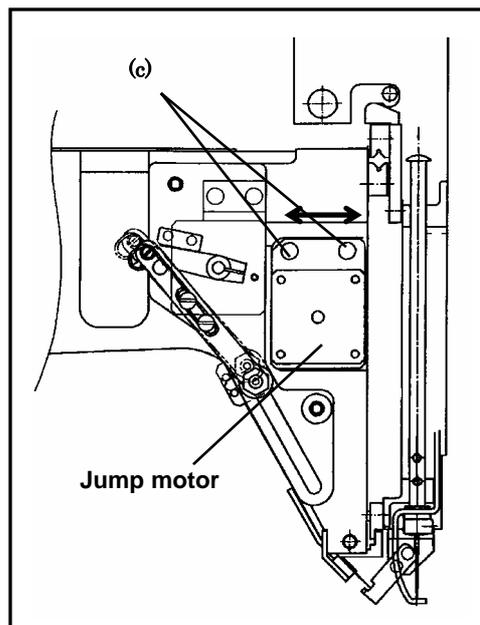
FIG.2



(a)

(b)

Arm front cover L



(c)

Jump motor

FIG.3

3-8. Tension of drive belts A & C

[Inspection]

- (1) Remove two setting screws (a) and then remove the table set. (Fig.1)
- (2) Remove four each set screws (b) and then remove base cover rear R and L. (Fig.1)
- (3) Remove three each set screws (c) and remove base cover front R and L. (Fig.1)
- (4) Remove four set screws (d) and remove X cover. (Fig.1)
- (5) When applying a force of 0.48 kg to drive belt A, amount of deflection G must be 10.8 ± 2.16 mm. (Fig.2)
- (6) When applying a force of 0.95kg to drive belt C, amount of deflection G must be 7.4 ± 1.48 mm. (Fig.2)

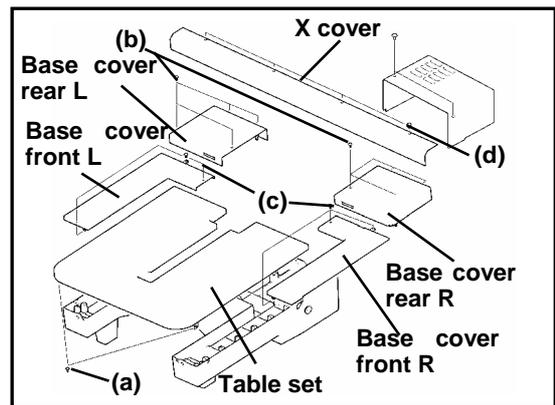


FIG.1

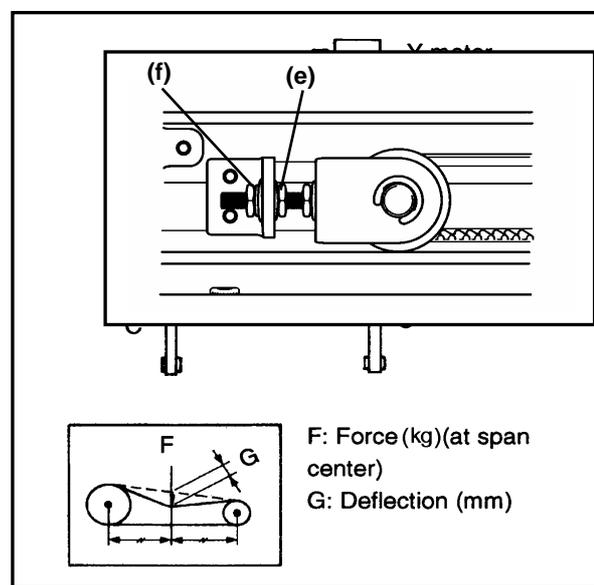


FIG.2

[Adjustment]

- (1) If amount of deflection G of drive belt A differs from that specified, loosen nut (e) and adjust the deflection using nut (f). (Fig.3)
- (2) If amount of deflection G of drive belt C differs from that specified, loosen two set screws (g) and nut, then adjust the deflection using hex socket screw (h). (Fig.4)

Note: Check the tension, after tightening nuts (e),(f) and a screw (g).

FIG.3

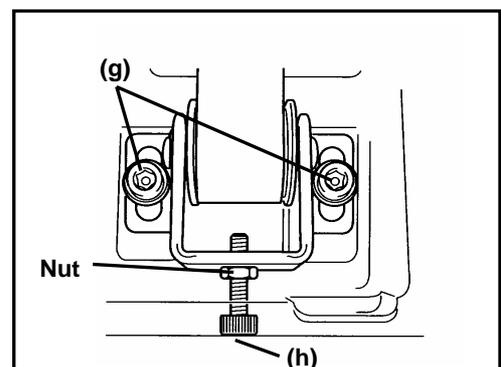


FIG.4

3-9. Tension of deceleration belts B, D, & E

[Inspection]

- (1) Loosen two set screws (a) and remove the table set. (Fig.1)
- (2) Loosen two setting screws (b) and remove the motor cover. (Fig.1)
- (3) Loosen four set screws (c) and remove the base cover rear R. (Fig.1)
- (4) When applying a force of 0.46 kg to the center of deceleration belt B, amount of deflection G must be $0.9 \pm 0.18\text{mm}$. (Fig.2)
- (5) When applying a force of 0.64 kg to the center of deceleration belt D, amount of deflection G must be $1.1 \pm 0.22\text{mm}$. (Fig.2)
- (6) When applying a force of 0.51 kg to the center of deceleration belt E, amount of deflection G must be $1.2 \pm 0.24\text{mm}$. (Fig.2)

(Fig.2)

[Adjustment]

- (1) If the amount of deflection of deceleration belt B differs from that specified, loosen the nut and two set screws (d), and turn setting screw (e) in the direction of the arrow. After adjustment, tighten two set screws (d) and the nut.. (Fig.3)
- (2) If the amount of deflection of deceleration belt D differs from that specified, loosen three set screws (f) and nut A, then turn setting screw (g) in the direction of the arrow. After adjustment, tighten three setting screws (f) and nut A. (Fig.4)
- (3) If the amount of deflection of deceleration belt E differs from that

specified, loosen two set screws (h) and nut B, then turn set screw (i) in the direction of the arrow. After adjustment, tighten two setting screws (h) and nut B. (Fig.4)

Note: Check the tension, after tightening screws (d),(f) and (h).

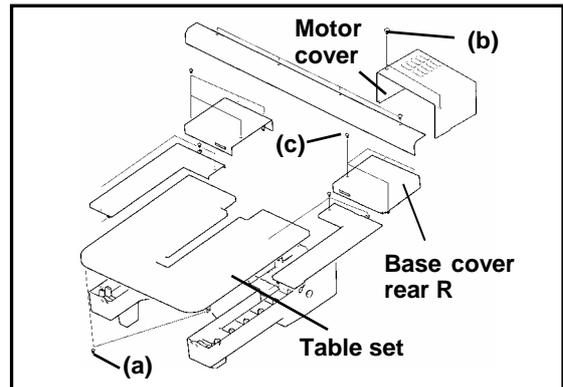


FIG.1

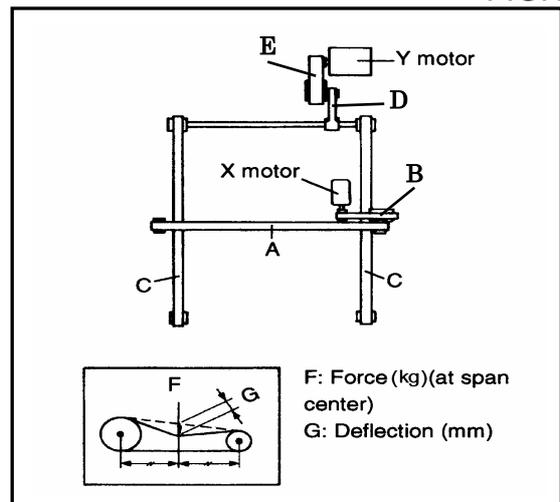


FIG.2

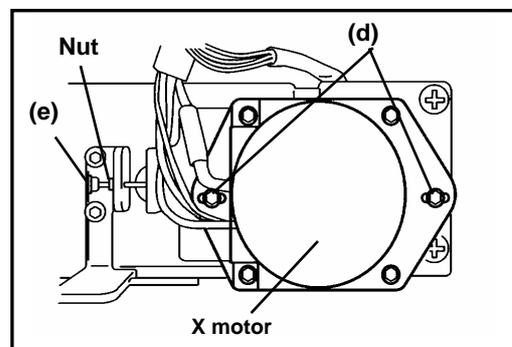


FIG.3

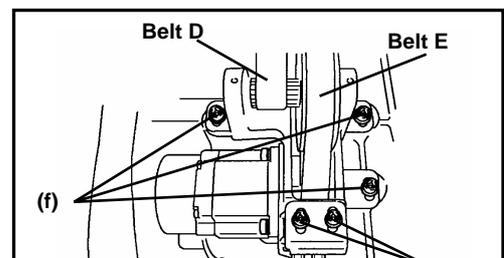


FIG.4

3-10. Limit sensor

[Inspection]

- (1) Loosen two setting screws (a) remove the table set. (Fig.1)
- (2) Remove four set screws (e) and then base cover rear L. (Fig 1)
- (3) Remove two setting screws (c) and the then base cover rearL. (Fig.1)
- (4) Remove three set screws (b) and then base cover front L. (Fig.1)
- (5) Remover four set screws (d) and then X cover. (Fig.1)
- (6) Turn power on and carry out home position return.

Note: Press the [SET] key.

- (7) Check the distance X from the right most surface of the detecting plate to the center of left side X limit sensor shown in Fig.2.
- (8) Move the X-axis drive system to its forefront position and check the distance Y from the back most surface of the detecting plate to the center of middle side Y limit sensor. (Fig.2)

Reference: X=65.7±1mm

Y =213.5 ± 1mm (Flat frame)

Y'=133.5 ± 1mm (Cap

frame)

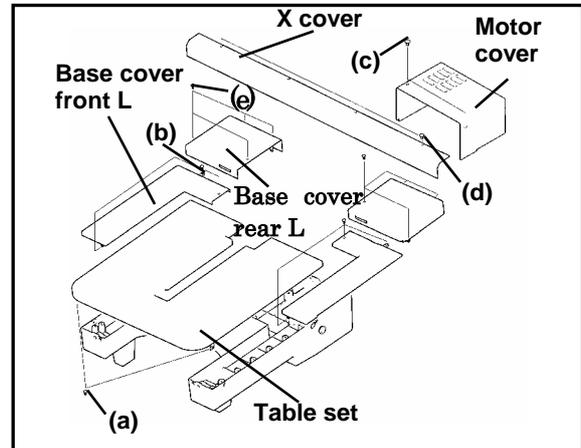


FIG.1

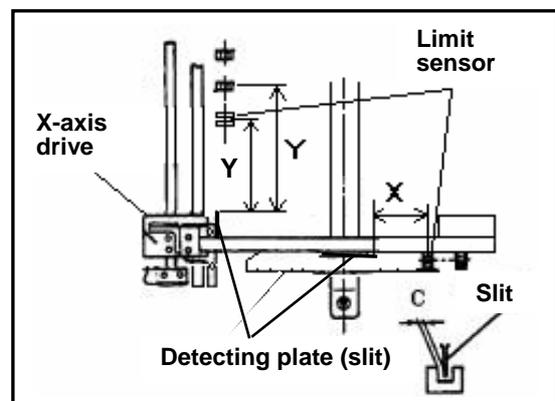


FIG.2

[Adjustment]

- (1) If the X distance differs from that specified, loosen two set screws (a) provided under the belt. Move the sensor bracket to the specified position and tighten set screw (a). (Fig.1)
- (2) If the adjustment is not successful after step (1), loosen two setting screws (b) and move the slit. (Fig.2)

Note: The slit is placed in the center of the sensor slot. (Fig.2)

- (3) If the Y distance differs from that specified, loosen two setting screws (c) and move the limit sensor to the specified position, then tighten setting screw (c). (Fig.3)
- (3) If the adjustment is not successful after step (3), loosen two setting screws (d) and move the slit. (Fig.4)

Note: The slit is placed in the center of the sensor slot. (Fig.4)

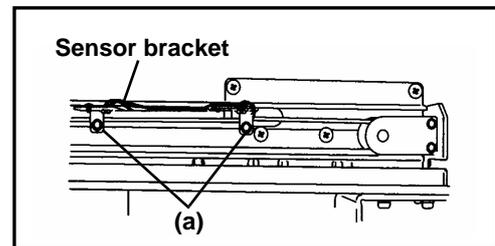


FIG. 1

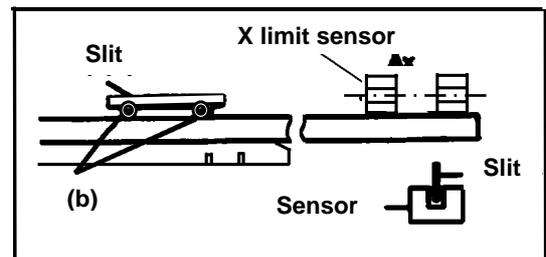


FIG.2

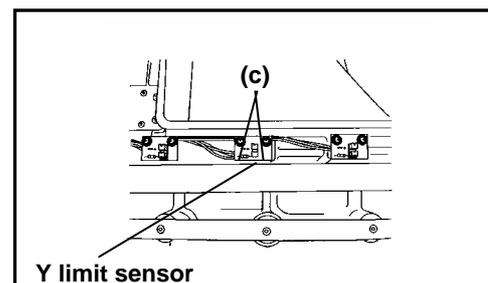


FIG.3

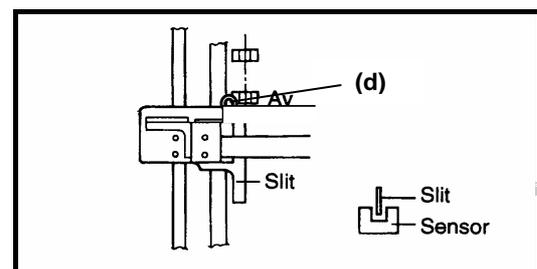
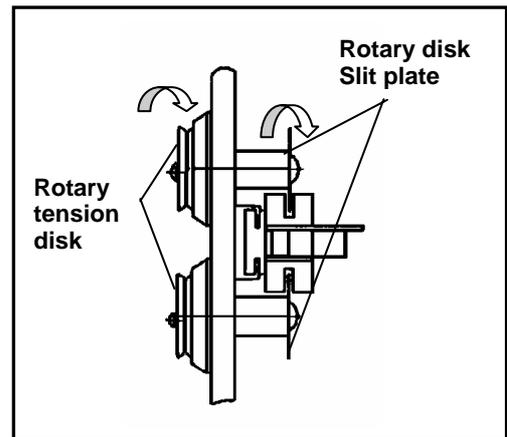


FIG.4

3-11. Thread sensor

[Inspection]

- (1) Remove the tension base cover.
- (2) When pulling the upper thread by hand, the rotary tension disk and rotary disk slit plate should turn smoothly. (Fig.1)
- (3) The rotary disk slit plate should be located at the position where the distance A between the center of the disk and the center of the sensor is less than 0.8mm. (Fig.2)



[Adjustment]

- (1) If the distance differs from that specified, loosen two set screws (a) and adjust the position by moving sensor arm right and left. (Fig.3)

[Refer to 『“4-17 Thread sensor”』 on page 54].

F I G.1

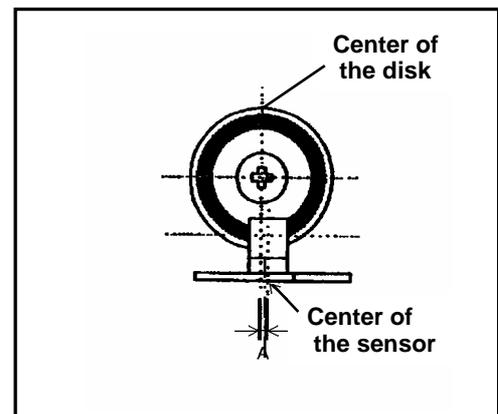


FIG.2

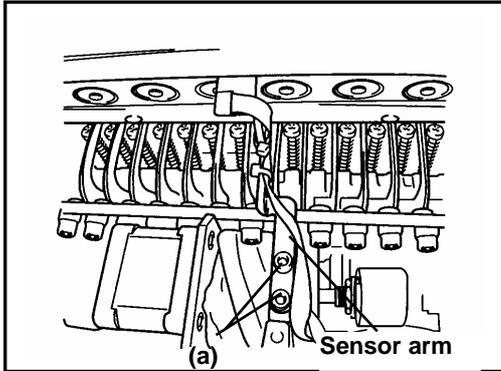


FIG.3

3-12. Power box

[Inspection]

- (1) Turn power on and connect the circuit tester as shown in Fig.1. Check that the voltage across ① and ⑦ is 5.0 ~ 5.2V.
(Fig.1)
- (2) Short ⑧ to ⑨ and turn power on. Connect the circuit tester as shown in Fig.2 and check that the voltage across ⑤ and ⑪ is 24.0 ~ 24.5V.
(Fig.2)

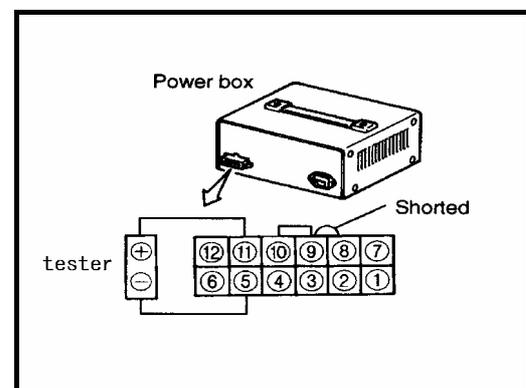
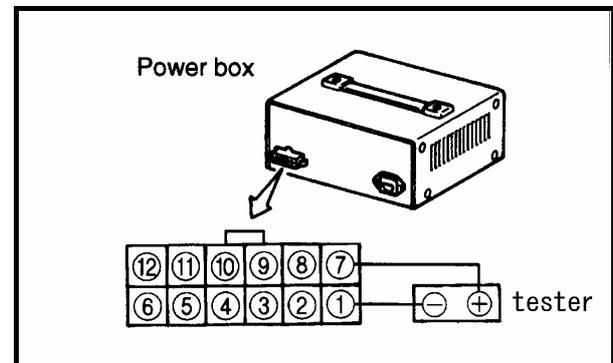


FIG.1

FIG.2

[Adjustment]

- (1) Remove eight setting screws (a) and then the case cover. (Fig.3)
- (2) Turn power on.
- (3) If the 24V power supply differs from that specified, replace the power circuit board. [Refer to 『“4-7 Power supply board”』 on page 44].
- (4) If the 5V power supply (① ~ ⑦) differs from that specified, adjust power using VR6. (Fig.4)
- (5) Turn power off and mount the case cover.

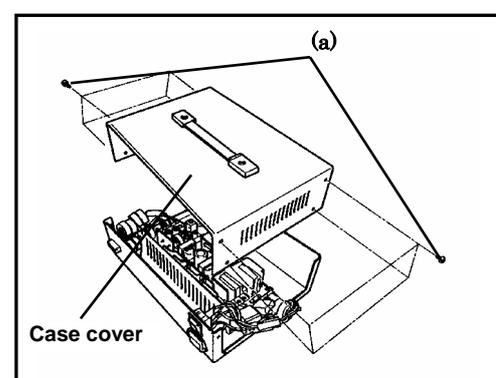


FIG.3

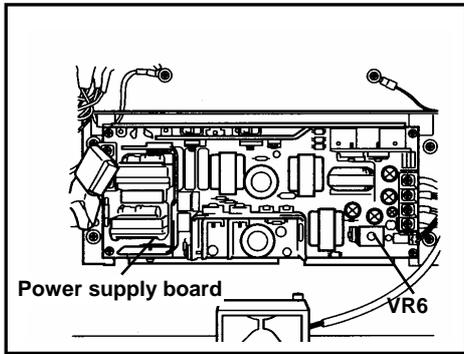


FIG.4

4. REPLACEMENT OF MAIN COMPONENTS

4. REPLACEMENT OF MAIN

4-1. Rotary hook

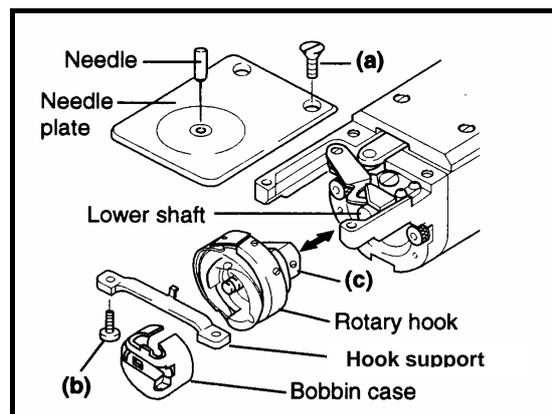
[Removal]

- (1) Remove the table set.
- (2) Bring the needle bar to the top dead center, and remove the needle.
- (3) Remove two set screws (a), and remove the needle plate. (Fig.1)
- (4) Take out the bobbin case. (Fig.1)
- (5) Remove two set screws (b), and remove the hook support. (Fig.1)
- (6) Loosen three set screws (c), and remove the rotary hook. (Fig.1)

[Installation]

- (1) Turn DS1-1 on and turn the power on.
- (2) Put the rotary hook along the lower shaft. (Fig.1)
- (3) Align the protrusion of the hook support with the dent in the rotary hook, and temporarily fit the hook support with setting screw (b). (Fig.1)
- (4) Rotate the hand wheel to move the needle bar to the bottom dead center. Rotate the hand wheel further until LCD display shows the needle position at $201 \pm 3^\circ$. (Fig.2)
- (5) Rotate the rotary hook manually to align the hook tip with the needle center. Secure a clearance of 0.1 to 0.3mm between the needle and the hook tip and temporarily tighten setting screw (c) closest to the hook tip. (Figs.1, 2)
- (6) Rotate the hand wheel again, and check the position of the needle and hook when LCD display shows the needle position at $201 \pm 3^\circ$. Then tighten three setting screws firmly. (Figs.1, 2)
- (7) Adjust the hook support position, and retighten set screw (b). (Figs.1, 3) [『Please refer to “ 3-2. Position of the hook support” 』 on page 23]
- (8) Insert the bobbin case, and attach the needle plate with two setting screws

(a). (Fig.1)



(9) Attach the table set.

FIG.1

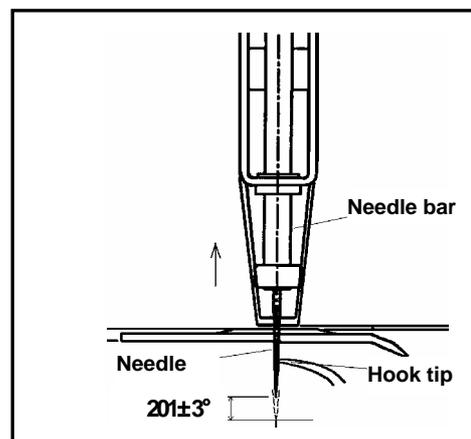


FIG.2

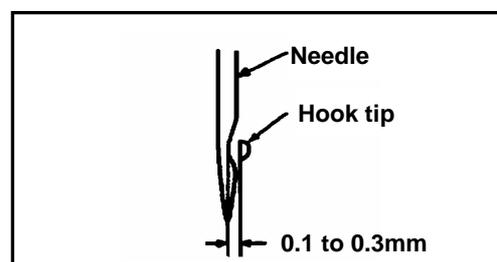
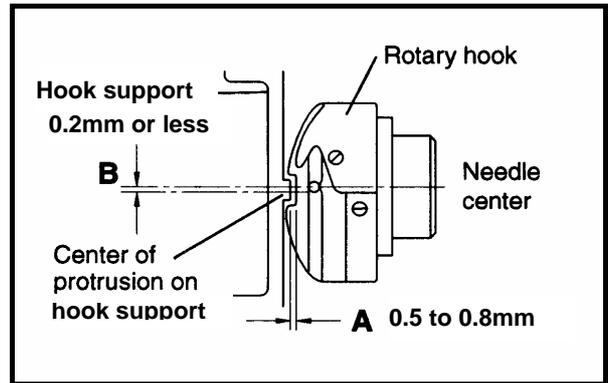


FIG.3

FIG.4



4-2. Thread cutter

[Removal]

- (1) Remove the table set.
- (2) Remove two setting screws (a) detach the needle plate. (Fig.1)
- (3) Remove two set screws (b) and detach the thread cutter. (Fig.1)

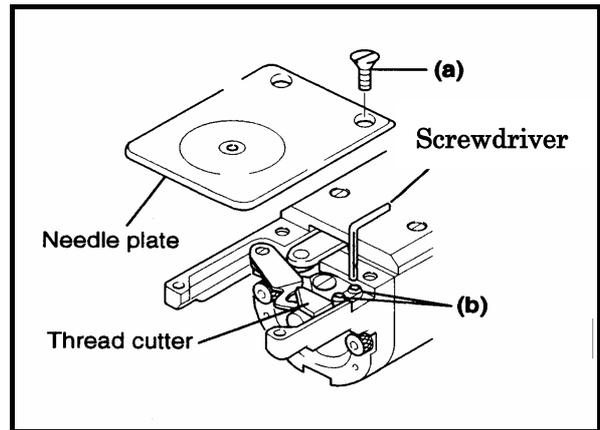


FIG.1

[Installation]

Slightly pressing the thread cutter, set it in parallel with the needle plate bracket (A=B), and fix it in that position with two setting screws (b). (Fig.2)

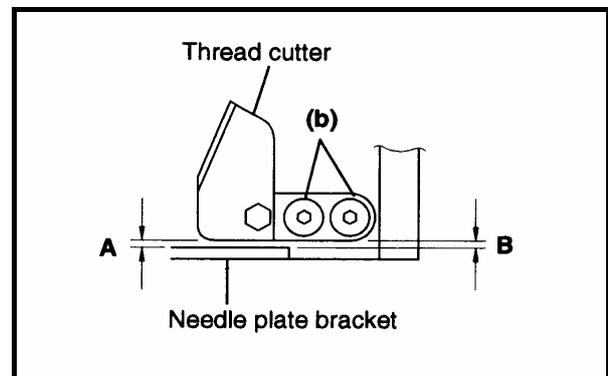


FIG.2

[Inspection]

After setting the thread cutter, check again that the thread catcher makes an initial contact with the thread cutter at a clearance of 2 to 3mm. Also check the sharpness of the thread catcher by hanging thread on the thread catcher and pushing it to the knife by hand.

[『 Please refer to “ 3-4. Blade pressure” 』 on page 25]

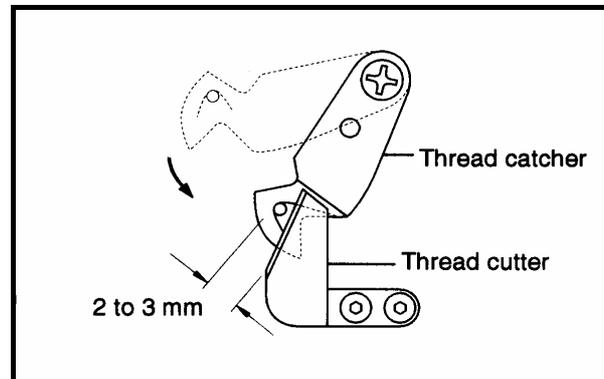


FIG.3

4-3. Thread catcher

[Removal]

- (1) Remove the table set.
- (2) Remove two setting screws (a) and detach the needle plate. (Fig.1)
- (3) Remove set screw (b) and detach the thread catcher. (Fig.1)

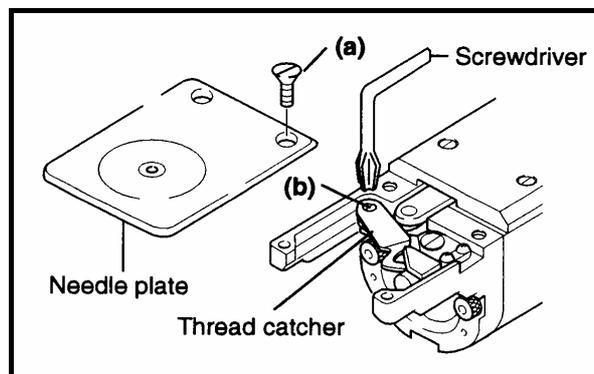


FIG.1

[Installation]

- (1) Put hole B of the thread catcher through pin A of the thread catcher drive arm.
- (2) Tighten setting screw (b). (Fig.2)

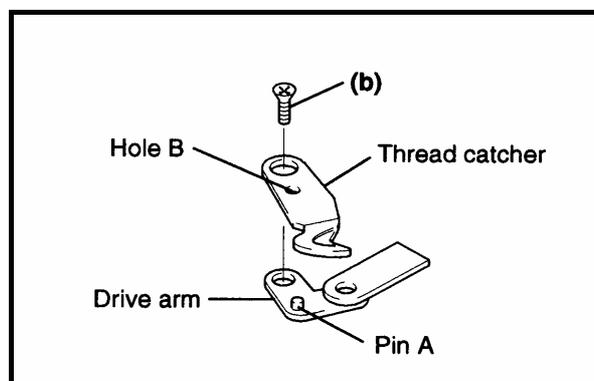


FIG.2

[Inspection]

- (1) When the thread catcher is in the standby position, the dimension between the shoulder and the thread cutter must be $0 \pm 0.5\text{mm}$. (Fig.3) [Please refer to 『 “ 3-3 standby position of thread catcher” 』 on page 24]
- (2) Remove the bed cover A and remove the connecting plate from the pin of the thread trimming lever.
- (3) Move the thread catcher by hand and check the blade pressure of the thread catcher and the thread cutter. (Fig.4) [Please refer to 『 “ 3-4 Blade pressure” 』 on page 25]

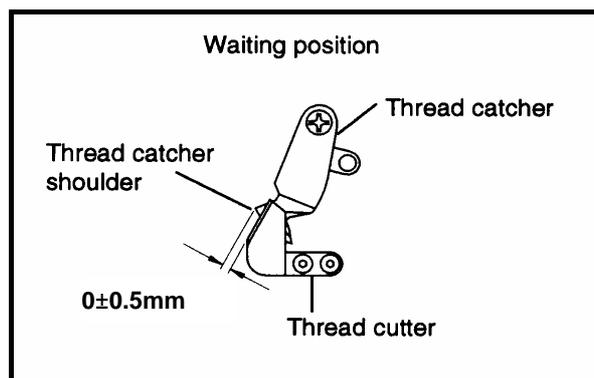


FIG.3

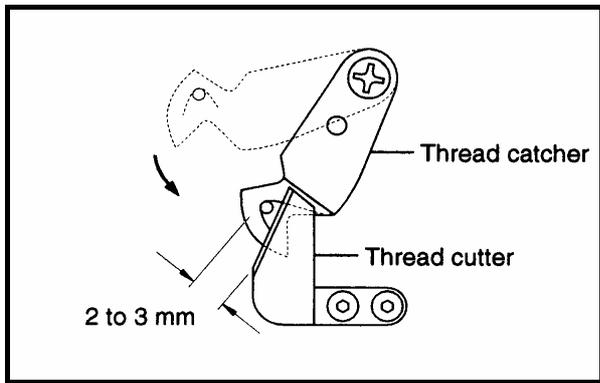


FIG.4

4-4. Needle bar

[Remove]

- (1) Remove two setting screws (a) and the upper cover. (Fig.1)
- (2) Remove set screw (b) and the under cover. (Fig.1)
- (3) Remove two each setting screws (c), then remove the change cover and the relay circuit board cover. (Fig.2)
- (4) Disconnect the card from the connector of CN2 and remove the tension base cover.(Fig.2)
- (5) Remove the tension base cover. (Fig. 2)
- (6) Disconnect the cord from the connector of CN1 and remove two setting screws (d) and the sensor arm. (Fig.3)
- (7) Remove two setting screws (e) and the tension base set. (Fig. 3)
- (8) Loosen the set screw (f) and remove the needle, needle clamp and cushion ring A. (Fig. 4)
- (9) Remove the setting screw (g) and the needle bar holder spring.
- (10) Loosen the setting screw (h) for the top dead center stopper and the setting screw (i) for the needle bar connecting stud. Remove the needle bar upwards and take out the washer, cushion ring E, top dead center stopper and needle bar holder. (Fig.4)

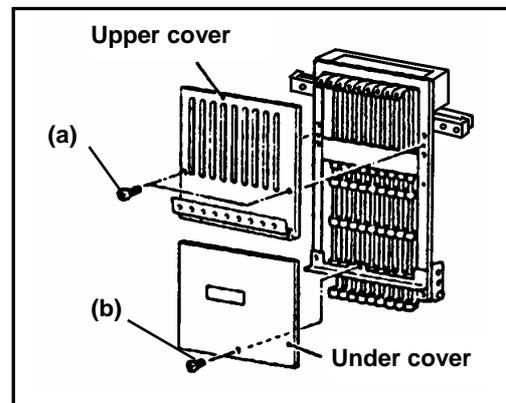


FIG.1

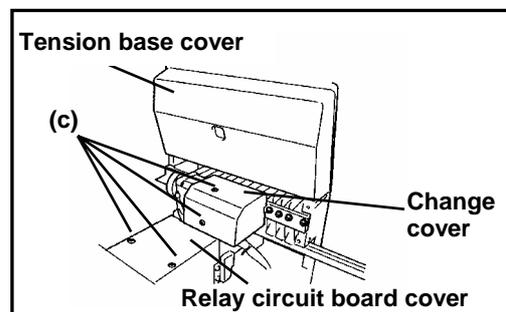


FIG.2

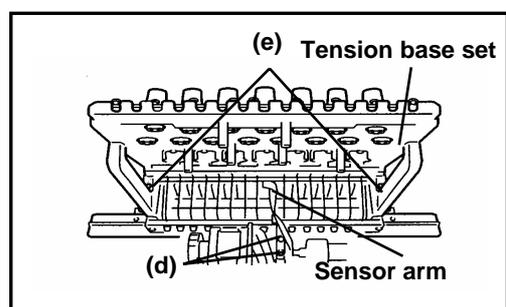


FIG.3

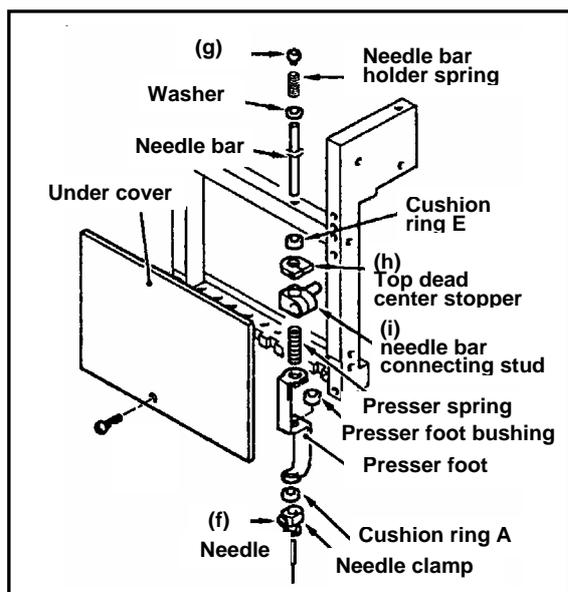


FIG.4

the needle bar height from the surface of the needle bar bracket to the lower end of the needle bar at 15.4 ± 0.03 mm, then tighten the setting screw (d) in the right direction. (Figs.1, 2)

- (7) Adjust the distance from the lower end of the top dead center stopper to the upper end of the needle bar connecting stud to 4.5 mm, and tighten the setting screw (c). (Fig.3) Rotate the hand wheel and check the needle bar reciprocator is properly set with the needle bar connecting stud.

Note: Check that the needle bar returns smoothly with the spring when pushing down the needle bar. If the needle bar does not return smoothly, adjust the direction of the top dead center stopper.

- (8) Check the needle and hook timing.

4. REPLACEMENT OF MAIN COMPONENTS

[Installation]

- (1) Insert the needle bar from the top of the needle bar case, install the cushion ring E, top dead center stopper, needle bar connecting stud, spring, presser foot and presser foot bushing in that order. Then, insert the needle bar all the way down to the needle bar case. (Fig.1)
- (2) Install the cushion ring A and needle clamp to the needle bar in that order and fix the needle with the setting screw (a). (Fig.1)
- (3) Install the washer, needle bar holder spring to the needle bar and tighten the setting screw (b). (Fig.1)
- (4) Set the upper end of the needle bar to the same height as the next ones and tighten the setting screw (c) temporarily and also the needle bar connecting stud with the setting screw (d). (Fig.1)
- (5) Remove the needle plate.
- (6) Rotate the hand wheel to bring the needle bar to the bottom dead center. Loosen the set screw (d) and adjust

[Please refer to 『“ 3-1.Timing of the needle and the rotary hook ” 』 on page 21]

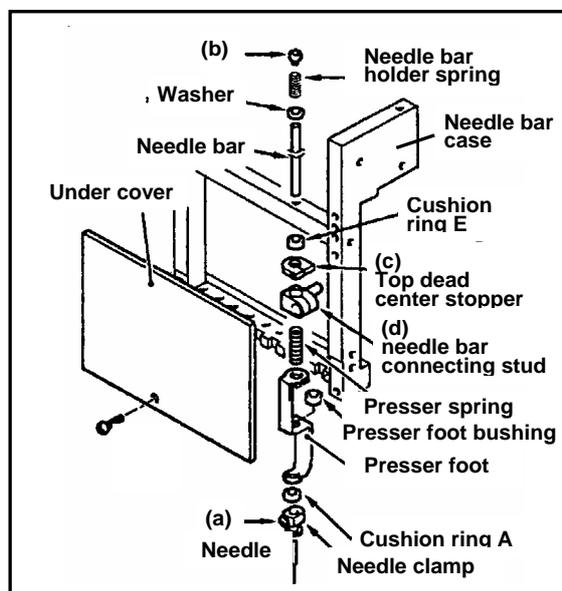


FIG.1

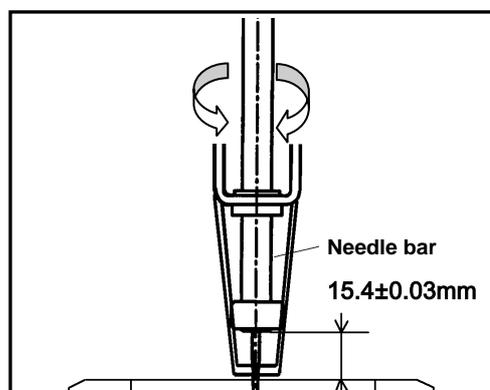


FIG.2

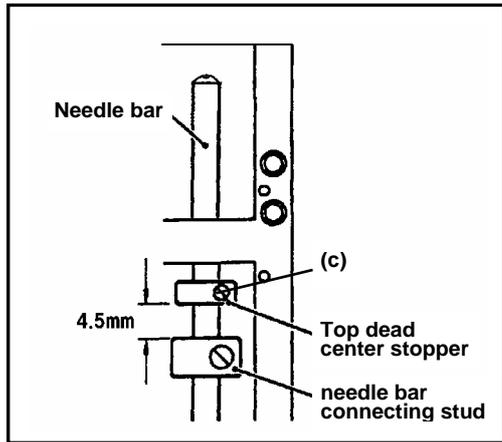


FIG.3

4-5. Needle bar reciprocator

[Remove]

- (1) Remove two setting screws (a) and the upper cover. (Fig.1)
- (2) Remove set screw (b) and the under cover. (Fig.1)
- (3) Remove two setting screws and the face plate.
- (4) Remove two each setting screws (c) and the change cover, the relay circuit board cover, and then disconnect the connector CN2. (Fig. 2)
- (5) Remove the tension base cover. (Fig.2)
- (6) Disconnect the cord from the connector CN1 and remove the two setting screws (d) and the sensor arm. (Fig. 3)
- (7) Remove the setting screws (e) and the tension base set. (Fig.3)
- (8) Turn DS1-1 on and turn the power on.
- (9) Press SET key in the test mode of LCD, locate the cursor at No.2 and press SET key.
- (10) Select the No.15 of a needle number by color change key.
- (11) Turn the hand wheel until the angle of LCD displays 107.5°.
- (12) Remove two setting screws (f) and pull out the needle case by holding it upwards. (Fig.1)
- (13) Remove five set screws (g) and the arm front cover L. (Fig.4)
- (14) Loosen the setting screw (h), bring the connecting rod to the bottom dead center and pull out upward the needle bar drive shaft. (Fig.5)
- (15) Move the connecting rod to the left and pull out the needle bar reciprocator. (Fig.5)

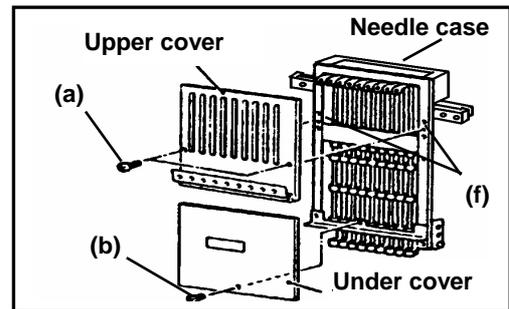


FIG.1

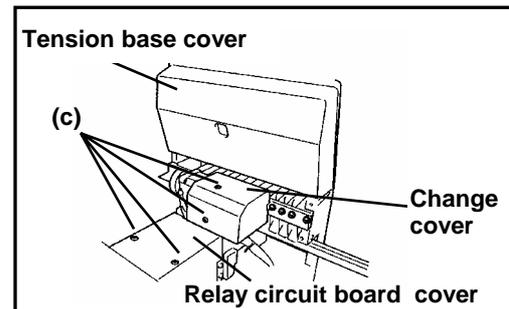


FIG.2

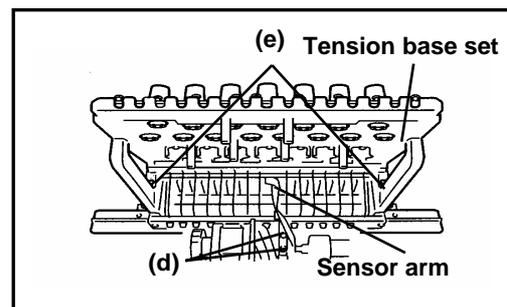


FIG.3

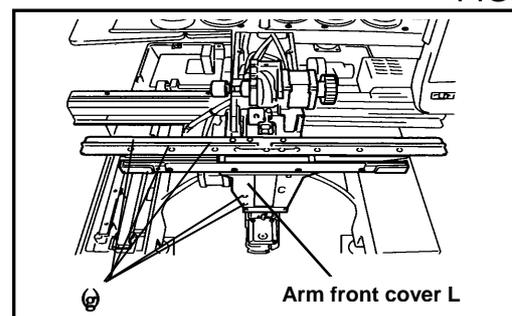


FIG.4

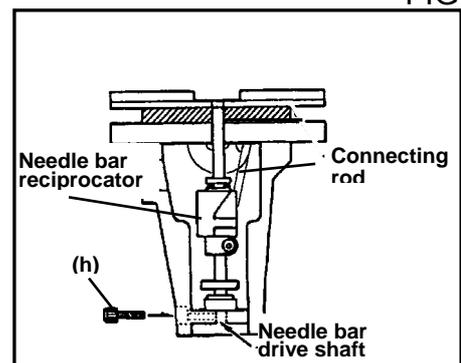


FIG.5

4. REPLACEMENT OF MAIN COMPONENTS

under cover. (Fig.4)

[Installation]

- (1) Insert A of needle bar reciprocator into the connecting rod and also the needle bar drive shaft from the top of the arm. Install the felt, needle bar reciprocator, felt B and bearing case collar in that order. (Fig.1)
- (2) The set hole of the needle bar drive shaft is turned in the direction of set screw (a) and it binds tight firmly in the place where the set hole suited. (Fig.2)
- (3) Install the arm front cover L with five setting screws (b). (Fig.3)
- (4) Bring the case linear to the left end, and cam roller pin is put into the slot of the change cam, imposing the needle case on the positioning board from the top, and putting the slot on the take-up lever into the take-up lever guide rail.

Note: When installing the needle case, check that the thread wiper hook is inside the Velcro.
- (5) After checking that all the slits of the take-up lever are in the take-up lever guide rail, set the needle case to the right most stopper of the case linear and fix by pushing from the top. (Fig.4)
- (6) Check the needle position at the needle No.15.

Note: No play with the needle case.

Note: If the needle position is wrong, loosen the setting screw for the change base and adjust the needle position by moving the needle case right and left. The change base must be located in the position where the cam roller pin does not touch also in the front and back.
- (7) Install the tension base set with two setting screws (a). (Refer to Fig.3 of removal)
- (8) Install the sensor arm with two setting screws (b). (Refer to Fig.3 of removal)

Note: Check the position of the sensor.

[Please refer to 『 “ 3-11. Thread sensor” 』 on page 34]
- (9) Install the change cover and the relay card cover with two setting screws. (Refer to Fig.2 of removal)
- (10) Install the tension base set, upper cover,

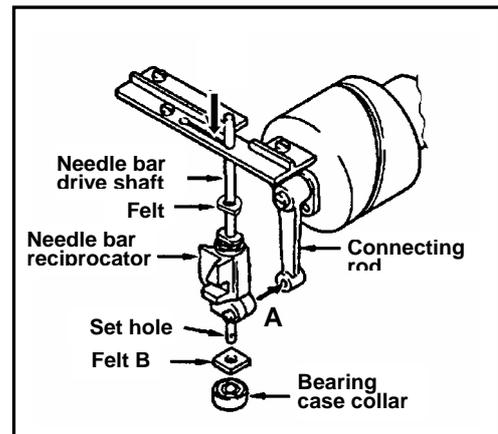


FIG.1

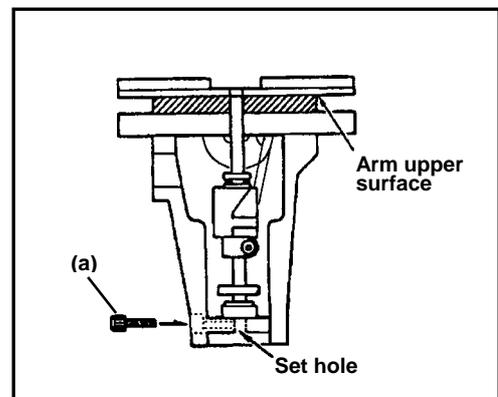


FIG.2

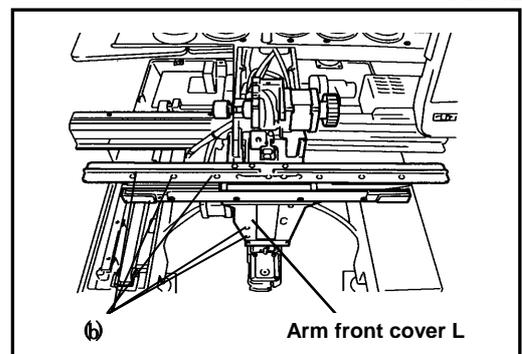


FIG.3

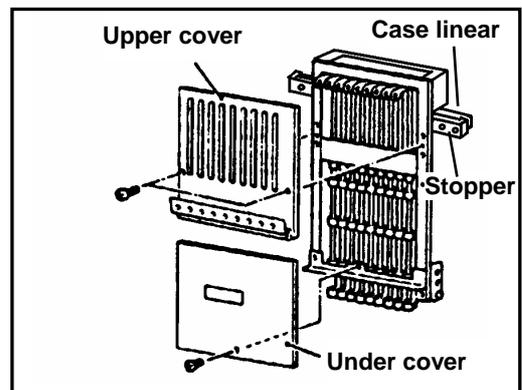


FIG.4

4-6. Thread change motor

[Removal]

- (1) Remove two each setting screws (a) and remove the change cover and relay circuit board cover. (Fig.1)
- (2) Remove each set screw (b) and remove the thread stand plate, bobbin winder base and rear cover. (Fig.1)
- (3) Remove the tension base cover and disconnect the cord by holding the connector CN1 upwards.
- (4) Remove two setting screws (c) and the sensor arm. Remove two setting screws (d) and the tension base set. (Fig.2)
- (5) Cut the cable tie and disconnect the connector.
- (6) Remove two each set screws (e) and the thread change motor base. (Fig.3)
- (7) Loosen the set screw (f) and remove the hand wheel B. (Fig.3)
- (8) Remove four setting screws (g) and the thread change motor. (Fig.4)

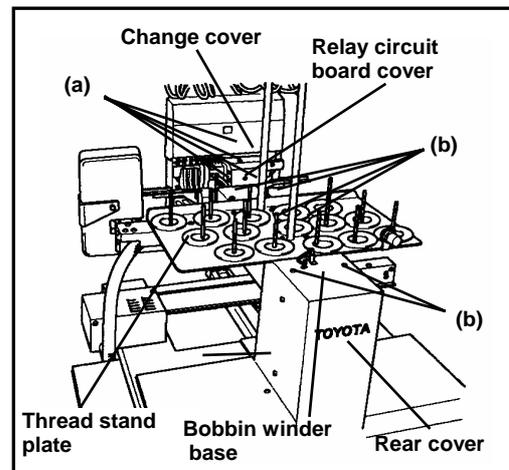


FIG.1

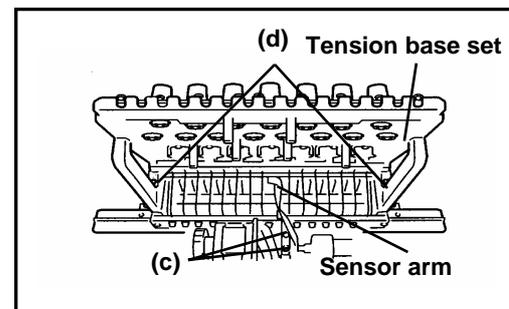


FIG.2

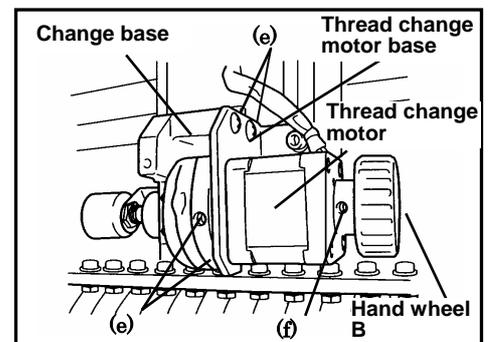


FIG.3

[Installation]

- (1) Install the thread change motor and the hand wheel B with setting screws.
- (2) Install the thread change motor base with two each set screws (e). (Fig.3)
Note: After checking that the thread change motor base touches the change base, fix it with two setting screws.
- (3) Connects the connector and bundle the cords with cable tie.
- (4) Install the sensor arm and the tension base set with the setting screws and connects the cord to the connector.
Note: After connecting the cord to the connector, check that the cord does not come off.
- (5) Install covers with setting screws.

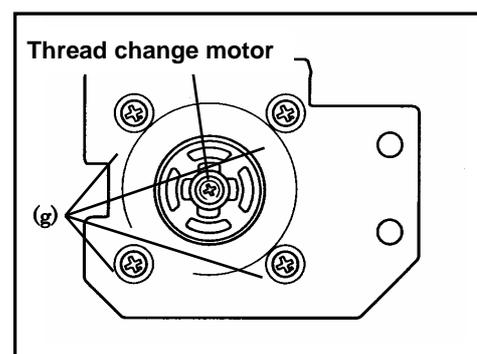


FIG.4

4. REPLACEMENT OF MAIN COMPONENTS

4-7. Power supply board

[Removal]

- (1) Remove eight setting screws (a) and then the case cover (Fig.1).
- (2) Remove the connector CN3 and the cords connected to the circuit board. (Fig.2)
- (3) Remove four setting screws (b) and remove the power supply board. (Fig.2)

[Installation]

- (1) Install the power supply board with four setting screws (b). (Fig.2)
- (2) Connects the connector and connect all the cords. (Fig.2)
- (3) Mount the case cover with eight setting screws (a). (Fig.1)

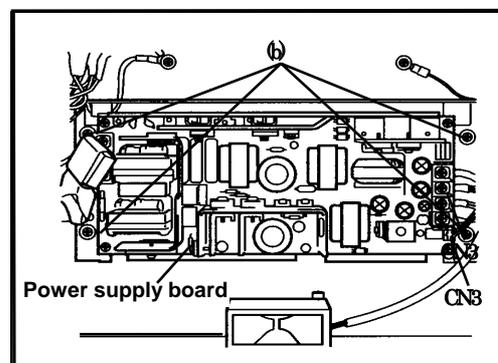
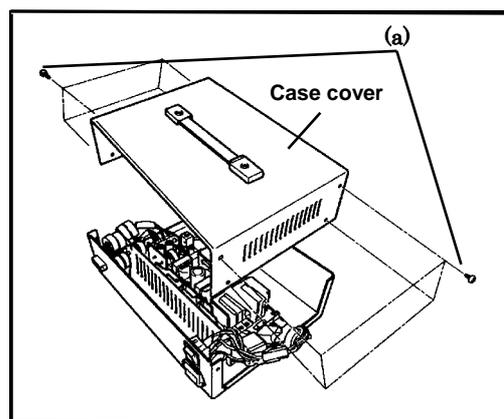


FIG.1

4-8. Power circuit board

FIG.2

[Removal]

- (1) Remove two setting screws (a) and the table set. (Fig.1)
- (2) Loosen four setting screws (b) and the rear cover. (Fig.2)
- (3) Remove each four set screws (c) and the base cover rear R. (Fig.1)
- (4) Loosen two setting screws (d), remove other two setting screws (e) and move the case cover upper. (Fig. 3)
- (5) Remove the connector CN9 of the computer board and all the connectors of the power circuit board. (Fig.4)
- (6) Remove six set screws (f) and remove the power circuit board (Fig.4)

[Installation]

Attached in the reverse procedure of removal.

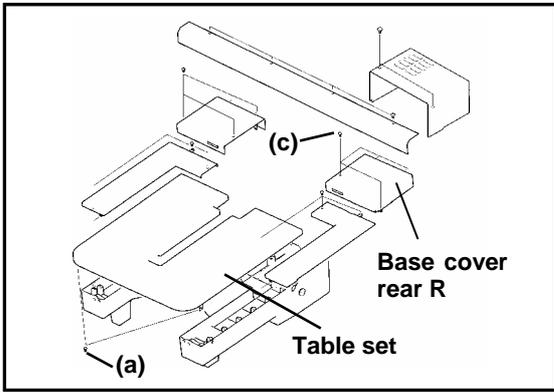


FIG.1

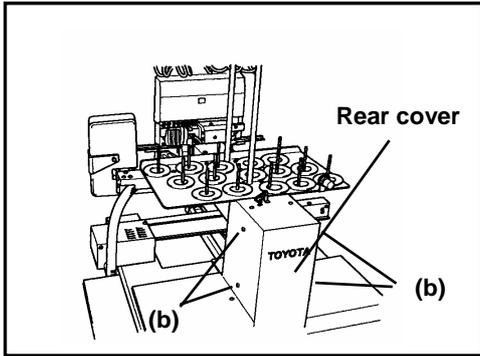


FIG.2

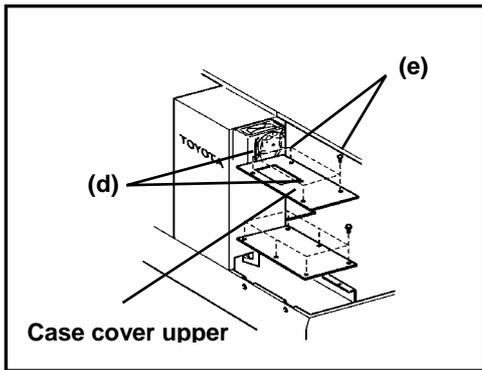


FIG.3

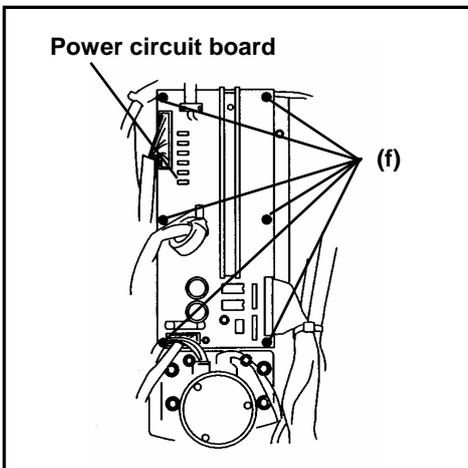


FIG.4

