TOYOTA

SERVICE MANUAL

Embroidery Machine

AD 860

(12 needles)

EXPERT
COMPUTERIZED
EMBROIDERY
SYSTEMS

AISIN

AISIN SEIKI CO., LTD.

How to Use this Service Manual

1. This service manual applies to the AD860.

   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.

Inspection & 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.

1. SPECIFICATIONS

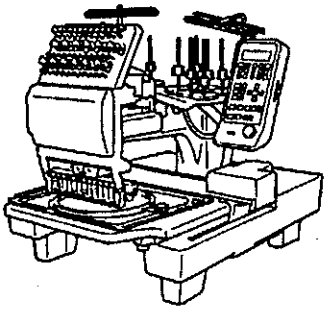
AD860

No	Item	Specifications
1	Type of stitch	Lock stitch type sewing machine(for automatic embroidery only)
2	Rotary hook	Vertical 2 revolution type
3	Thread take-up lever	Cam take-up lever
4	Needle bar stroke	56 mm
5	Number of needles	12 (auto changing)
6	Applicable needles	Standard DB × K5#11 and # 14; or DB × K23#11
7	Stitch speed	1,200 spm (max.),800 spm(standard)
8	Needle changing	Needle socket attachment/removal
9	Thread changing	Thread take-up lever eyelet attachment/removal
10	Presser foot	Interlocked with upper shaft
11	Thread cutter	Horizontal reciprocation
12	Thread wiper	Magnetic drive sliding type (with thread retaining mechanism)
13	Picker	Magnetic drive rocking type
14	Embroidery range	300 mm long × 460 mm wide
15	Embroidery control and indication	Touch switch control with LED/LCD displays
16	Stitch memory	100,000 stitches (Can be increased to 160,000 stitches)
17	Memory back-up	Memory saved during operation and after power off, kept for 4 weeks
18	Weight	75 ± 0.5kg (including table)
19	Machine oil	HIGH WHITE 70
20	Drive motor	AC brushless servo motor (machine revolution)
21	Control motor	AC brushless servo motor (X axis, Y axis)
22	Needle thread failure detection	Needle thread tension detection (proximity switch)
23	Power supply and consumption	100～120/200～240VAC(50/60Hz),320W

CONTENTS

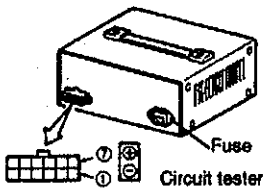
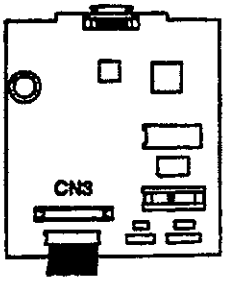
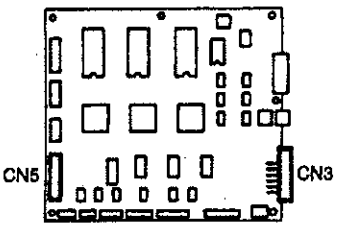
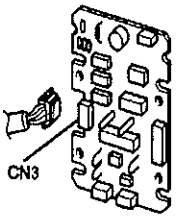
2. TROUBLESHOOTING

2-1 The power supply does not turn on



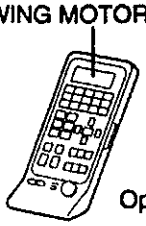
Preliminary inspection

- 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
Power box	Fuse (outside)	Take out fuse and inspect it visually 	250V6.3A, without fusion	Replace fuse.
	5V power supply	Check the voltage across ① and ⑦ with a circuit tester.	5.0to5.2V when turned on	Adjust or replace the power box. See P.43.
Operation control circuit board	Connection of connector CN3		Must be connected correctly	Connect the cable correctly or replace the operation control circuit board See P.66.
Main circuit board	Connection of connector CN3,CN5		Must be connected correctly	Connect the cable correctly or replace the main circuit board. See P.57.
Operation board	Connection of connector CN3	Remove the cover and inspect connection visually 	Must be connected correctly	Connect correctly or replace defective connectors. See P.58.

2-2 An error message is displayed

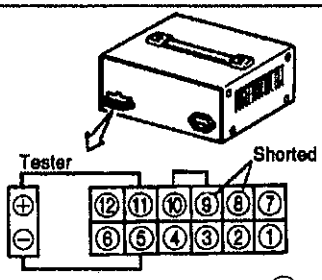
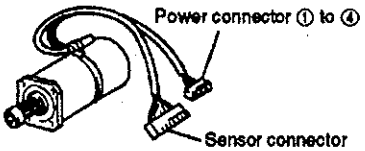
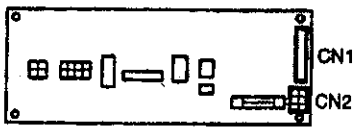
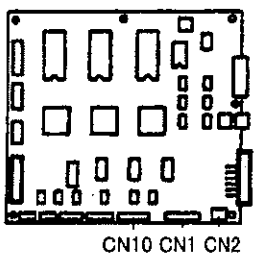
"SEWING MOTOR LOCK"



Operation panel

Preliminary inspection

- Upper shaft torque may be too large
- Catcher may not at the regular position.
- Thread wiper may not be at the regular position.
- Thread may be stuck.
- The threading tube of the threading tube holder may be interfering with the thread take-up lever.

	Item	Method	Standard	Action
Power box	24V power supply	 Check the voltage across ⑤ and ⑪ with a circuit tester while shorting ⑧ to ⑨.	24.0 to 24.5V	Adjust or replace the power box. See P.43.
Sewing motor	Connector connection	Check connector visually.	Must be connected correctly	Connect correctly
	Resistance	 Disconnect the power connector, and check the resistance between ①and②,①and③,②and③ with a circuit tester.	0.4 to 0.6 Ω	Replace. See P.60.
Power circuit board	Connection of connector CN1 and CN2	 Check the connector visually.	Must be connected correctly	Connect correctly or replace See P.55.
Main circuit board	Connection of connector CN1,CN2 and CN10		Must be connected correctly	Connect the cable correctly or replace the main the circuit board. See P.57.

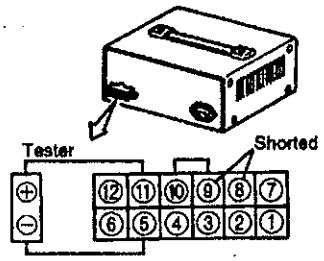
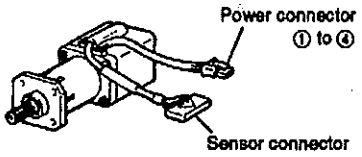
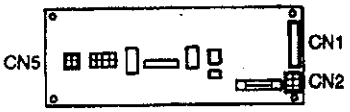
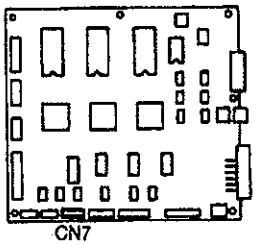
2-3 An error message is displayed

"X MOTOR LOCK"

Operation panel

Preliminary 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
Power box	24V power supply	 Check the voltage across ⑤ and ⑪ with a circuit tester, while shorting ⑧ to ⑨.	24.0 to 24.5V	Adjust or replace the power box. See P.43.
X motor	Connection of power and sensor connectors		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.	0.8 to 1.2 Ω	Replace. See P.62.
Power circuit board	Connection of connectors CN1 CN2 and CN5	 Check the connector visually.	Must be connected correctly	Connect correctly or replace. See P.55.
	Fuse	Take out the fuse and check it visually.	125V,20A Must be in good condition.	Replace the fuse.
Main circuit board	Connection of connector CN7		Must be connected correctly.	Connect correctly or replace. See P.57.

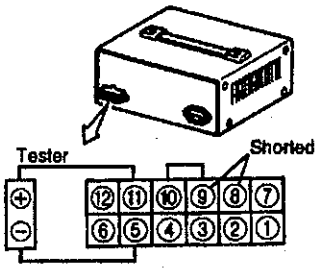
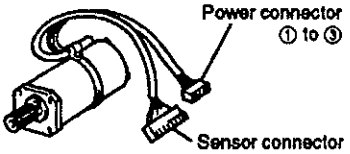
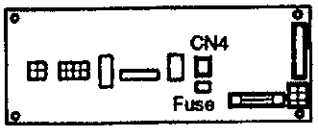
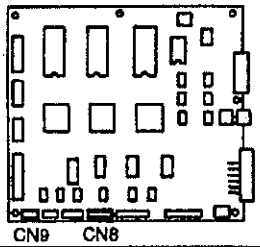
2-4 An error message is displayed

"Y MOTOR LOCK"

Operation panel

Preliminary 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
Power box	24V power supply	 Check the voltage across ⑤ and ⑪ with a circuit tester, while shorting ⑧ to ⑨.	24.0 to 24.5V	Adjust or replace the power box. See P.43.
Y motor	Connection of power and sensor connectors		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 0.6 Ω	Replace. See P.63.
Power circuit board	Connection of connectors CN1,CN2 and CN4	 Check the connector visually.	Must be connected correctly	Connect correctly or replace. See P.55.
	Fuse	Take out the fuse and check it visually.	125V,20A Must be in good condition.	Replace the fuse.
Main circuit board	Connection of connector CN8,CN9.		Must be connected correctly.	Connect correctly or replace. See P.57.

2-5 An error message is displayed

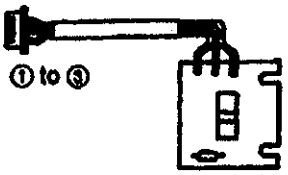
"NEEDLE CASE POSITION ERROR"

Operation panel

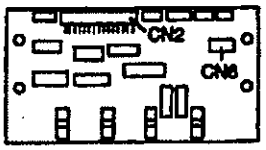
Preliminary inspection

- There should be no contact between the thread take-up lever and the threading tube holder.
- There should be no contact between the needle bar and the chuck plate.
- The threading tube may not mounted to the thread take-up lever.
- The needle socket may not mounted to the needle bar.

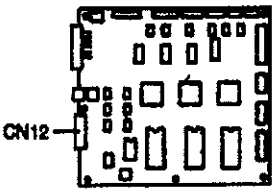
Needle bar position sensor

Item	Method	Standard	Action
Connection of sensor connector	In case the display does not show "NEEDLE CASE POSITION ERROR" when turn the power ON, go to the "change to the TEST MODE" menu.	Must be connected correctly.	Connect correctly
Input voltage	 Turn the power on and check the voltage across ② and ③ with a circuit tester.	When obstructed: 3.5~5V. When not obstructed: 0~0.8V.	Replace.

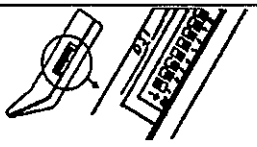
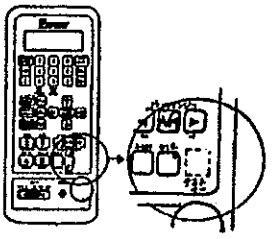
Needle position circuit board

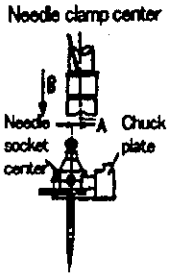
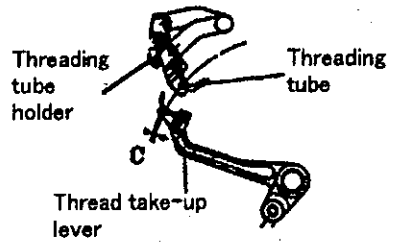
Item	Method	Standard	Action
Connection of connectors CN1,CN2 and CN6.	 Remove the top cover and check the connection.	Must be connected correctly.	Connect correctly or replace. See P.64.

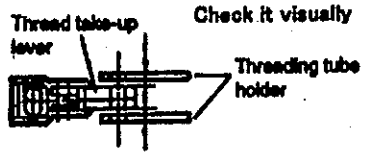
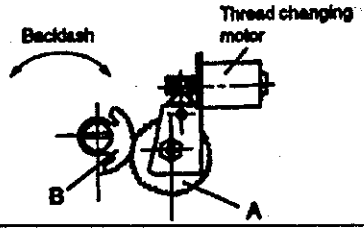
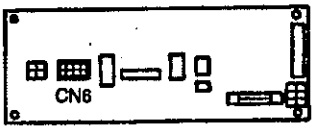
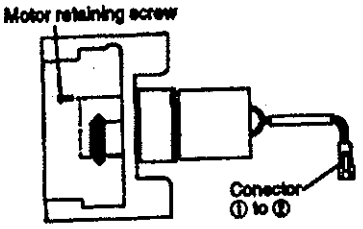
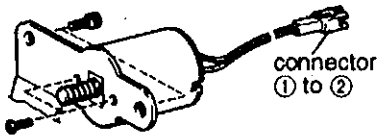
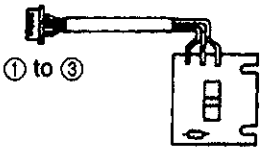
Main circuit board

Item	Method	Standard	Action
Connection of connectors CN12.		Must be connected correctly.	Connect correctly or replace. See P.57.

Change to the TEST MODE

Item	Method	Action
The dip swith position.	Turn the power OFF. Set the dip switch 1-1 to the ON position. 	Check Instruction See P.67.
Section of TEST MODE	 Turn the power back ON and press the SET key. Move the cursor by pressing the down arrow key to set at #2 for MAIN ROM, then press the SET key.	

	Item	Method	Standard	Action
Needle socket [step ①]	Needle bar direction.	Move the needle bar to the needle exchanging position under "STEP 1" mode. Confirm that the needle socket to be inserted lightly into the chuck plate by rotating the needle case drive shaft.  Check the above for needle bars No.1 and No.12. If it is no problem, press the TEST key to change the "STEP 2".	Must insert smoothly into the chuck plate.	Loosen the screw of needle bar holder and adjust the needle bar direction.
	Standby position. (Height)		Must not vibrate up and down direction.	Adjust. See P.32.
Needle socket [step ②]	Standby position (Back/front, right/left: A)	If the display "NEEDLE CASE POSITION ERROR" without moving the needle case when change the "STEP 2", skip to the "Power circuit board " menu.  Rotate the hand wheel forward / backward / check the weight of putting on / taking off the needle clamp from / to the needle socket. Check the above for needle bars No.1, No.6 and No.12. If it is no problem, press the TEST key to change the "STEP 3".	A=0.4 mm or less	Adjust. See P.32.
	Inset / removal force : B		B= 2～3.3 kg	Replace the needle clamp.
Threading tube holder [step ④]	Threading tube receiving position	If the display shows "NEEDLE CHANGE ERROR" without moving the threading tube holder when change the "STEP 4", skip to the "Thread take-up lever thread changing motor" menu.  Press the TEST key to change the STEP 4. Check the clearance between the thread take-up lever and the threading tube holder should be 1.5 to 2.5 mm.	C=0±0.5 mm C: The position of the threading tube receiving section between the thread take-up lever and the threading tube holder must be aligned.	Adjust. See P.34.

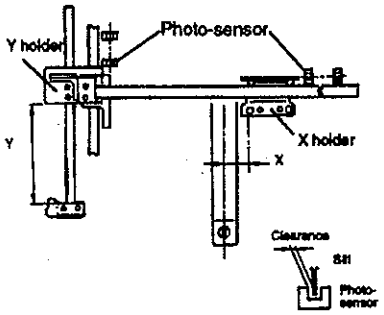
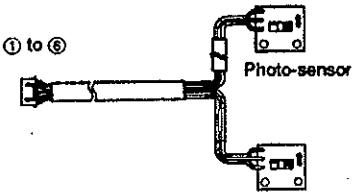
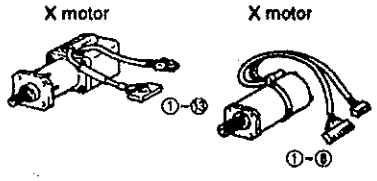
	Item	Method	Standard	Action
Threading tube holder	Threading tube holder position	 B: Clearance between the threading tube holder and the thread take-up lever	B = More than 1mm	Adjust. See P.34.
	Backlash in gears A and B		0.05～0.1 mm	Adjust. See P.34.
Power circuit board	Connection of connector CN6.	 Check the connector visually.	Must be connected correctly.	Connect correctly or replace. See P.59.
Thread change motor	Motor retaining screw	 Disconnect the connector and check the resistance between ① and ② with a circuit tester. If it is no problem, go back to the "Needle socket[Step ②]menu	Must be tight.	Tight if loose.
	Connection of connector		Must be connected correctly	Connect correctly
	Resistance		20 to 22 Ω	Replace See P.52.
Thread take-up lever thread changing motor	Motor securing screw and retaining screw	 Disconnect the connector and check the resistance between ① and ② with a circuit tester.	Must be right	Tight if loose.
	Connection of connector		Must be connected correctly	Connect correctly
	Resistance		27 to 32 Ω	Replace
Thread take-up lever position sensor	Connection of sensor connector		Must be connected correctly	Connect correctly
	Output voltage	Turn the power on and check the voltage across ② and ③ with circuit tester. If it is no problem, go back to the "Threading tube holder [STEP ④]"menu.	When obstructed: 3.5～5V When not obstructed: 0～0.8V	Replace

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

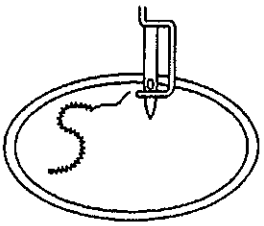
Operation panel

Preliminary inspection

X.Y holder → Limit sensor → X.Y motor

Item	Method	Standard	Action
X.Y holder position check	 Press the emergency stop button and move the holder manually. Check the distances X and Y when photo-sensor has been turned on.	X=55 ±1mm Y=199.4 ±1mm C=1± 0.5mm	Adjust See P.39.
Limit sensor: Connection of sensor connector	 Turn the power on and check voltage across ⑤ (green)and ⑥(blue) with a circuit tester.	Must be connected correctly.	Connect correctly.
Output voltage		When obstructed: 3.5～5V When not obstructed: 0～0.8V	Replace.
X.Y motor: Phase U, phase V, phase W, phase A and phase B output	 Press the emergency stop button. While turning the motor by hand, check the voltage of the sections below with a circuit tester. (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(brownand black) ⑦ +A(orange) ⑧ -A(orange and black) ⑨ +B(pink) ⑩ -B(pink and black) (y motor) Across ⑦ GND (red and black) and: ① U(yellow) ② V(white) ③ W(brown) ④ A(orange) ⑤ B(pink)	X motor : in the range of 0 to 3.5 V Ymotor : in the range of 0～5V	Replace. See Pgs. 62 and 63.

2-7 Thread comes off needle.

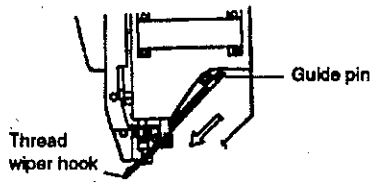
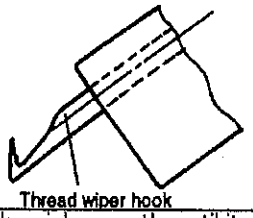
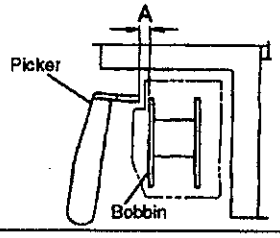
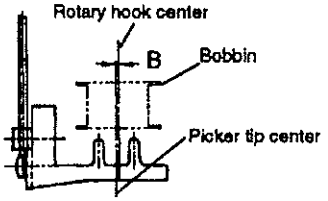
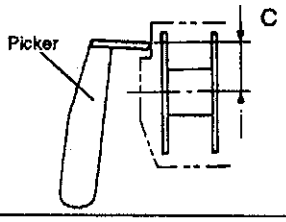


Preliminary inspection

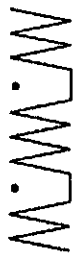
- The needle thread tension may be too high.
- The bobbin thread tension may be too high.
- The thread may be stuck on the threading tube holding section.
- The thread may e stuck on the thread take-up lever.
- The margin of the needle thread may be insufficient. (Set 5 for [F1]key(2).)

Thread wiper mechanism

Picker

Item	Method	Standard	Action
Thread wiper hook return	 Push the guide pin down as far as it will go in the direction o the arrow and check the returning movement of the pin.	Must return smoothly.	Adjust. See P.31.
Hook tip damage		No damage is identified on the hook tip.	Repair.
Clearance between the picker and the bobbin	Press the picker gently until it stops. Check the clearance between the picker tip and the bobbin. 	A=0.5～1.0mm	Adjust. See P.30.
Picker right/left position	 Clearance between the picker tip center and rotary hook center	B=1mm or less	Adjust. See P.30.
Picker height		C=7～9 mm	Adjust. See P.30.

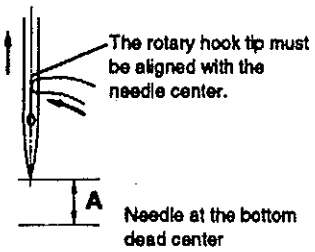
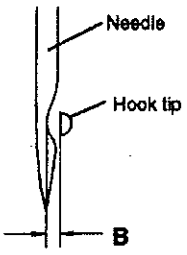
2-8 Skips stitches



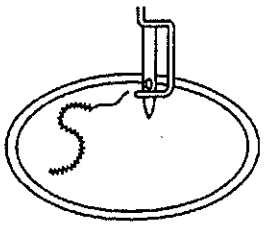
Preliminary inspection

- 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.

Needles and rotary hook →

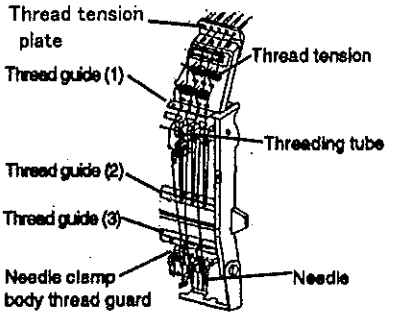
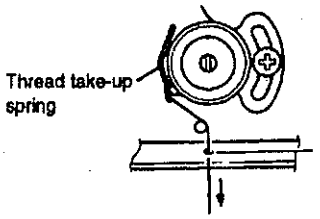
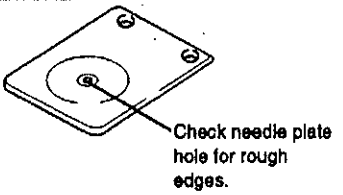
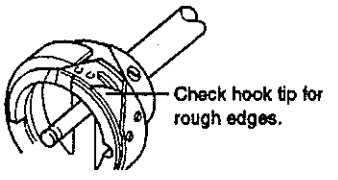
Item	Method	Standard	Action
Needle and rotary hook timing		A=1.9± 0.1mm	Adjust. See P.22.
Needle to hook clearance	 Align the needle to the hook tip, and check the clearance B visually.	B=0.03to 0.07mm	Adjust. See P.22.

2-9 Needle thread breaks

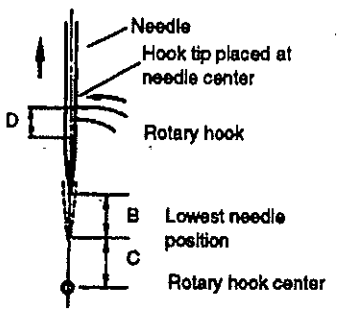
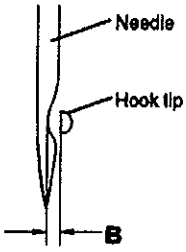


Preliminary inspection

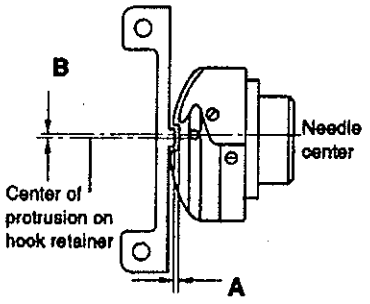
- Needle thread path may be incorrect.
- Thread tension may be too tight.
- A needle may be bent.
- A needle may be fitted incorrectly.
- Needle size may be incorrect for the thread.
- Thread density set to embroidery data may be to high.

	Item	Method	Standard	Action
Needle thread path	Rouge edges or burrs on thread path		Free of rough edges or burrs	Smooth edges with emery paper #800 or replace tough parts.
Thread tension	Thread take-up spring stroke (A)	Hold the thread before the thread tension plate. Pull the thread in the direction of the arrow and the thread take-up spring starts moving. Check the length of thread pulled until the spring stops. 	A=14±1 mm	Adjust. See P41.
	Initial thread take-up spring tension (B)	Hold the thread before the sub thread tension and pull the thread in the direction of the arrow. Check the tension when the thread take-up spring moves approximately 1mm.	B=3～5kg	
Needle plate	Rouge edges in needle plate hole		Free of rouge edges	Repair or replace.
Rotary hook	Rouge edges on rotary hook		Free of rouge edges	Repair or replace. See P.45.

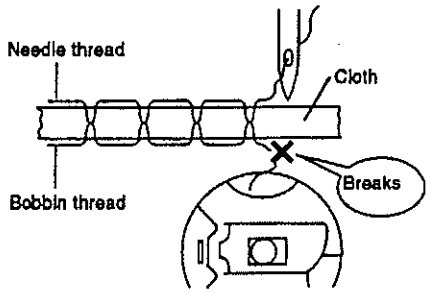
Needles and rotary hook

Item	Method	Standard	Action
Needle lift		B=1.9±0.1mm	Adjust. See P.22.
Needle bar height		C=8.8±0.1mm	Adjust. See P.23.
Needle height (reference value)		D=1.5±1.7mm	Adjust. See P.23.
Needle to hook clearance	 Align the needle to the hook tip, and check the clearance B visually.	B=0.03 to 0.07mm	Adjust. See P.22.

Hook retainer

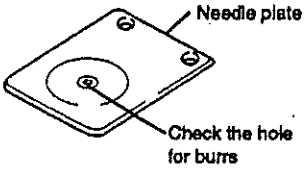
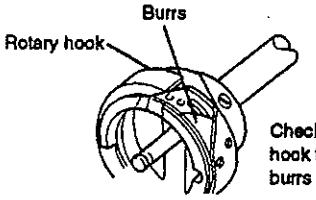
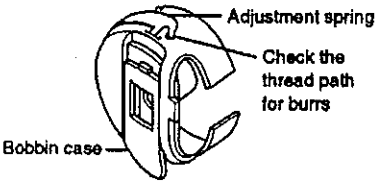
Rouge edges on hook retainer	Check the protrusion on hook retainer visually.	Free of rouge edges	Repair or replace. See P.24.
Clearance under the rotary hook retainer		A=0.6 to 1.0mm	Adjust. See P.24.
Relative positions of the center of the protrusion on the hook retainer and the center of the needle		B=0.3mm or less	Adjust. See P.24.

2-10 Bobbin thread breaks



Preliminary inspection

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

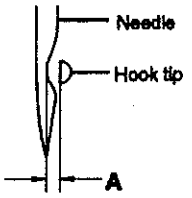
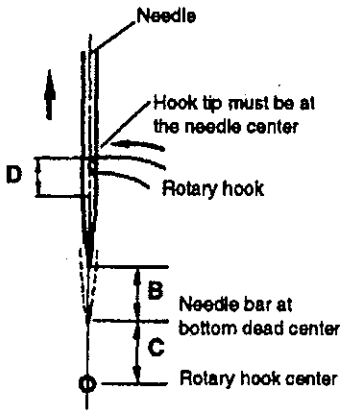
	Item	Method	Standard	Action
Needle plate	Burred edges on hold in the needle plate		Free of burrs	Deburr or replace the needle plate.
Rotary hook	Burred edges on the rotary hook		Free of burrs	Deburr or replace the rotary hook. See P.49.
Bobbin case	Burred edges on the bobbin case		Free of burrs	Deburr or replace the bobbin case.

2-11 Needle breaks

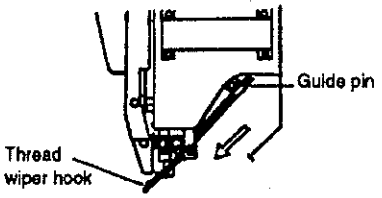
Preliminary inspection

- 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.

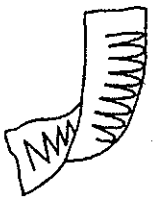
Needle and rotary hook

Item	Method	Standard	Action
Needle to rotary hook clearance	 Align the needle to the hook tip, and check the clearance A visually.	A=0.03 to 0.07mm	Adjust. See P.22.
Needle bat height		B=1.9 ± 0.1mm	Adjust. See P.23.
Needle lift:D (Reference value: C)		C=8.8 ± 0.1mm D=1.5 to 1.7mm	Adjust. See P.22.

Thread wiper mechanism

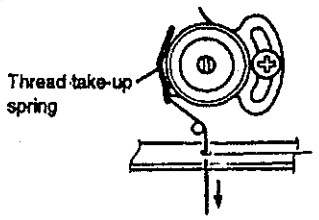
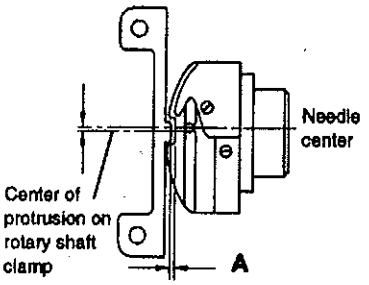
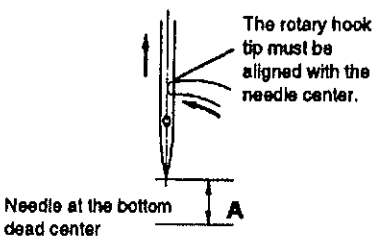
Item	Method	Standard	Action
Thread wiper hook return	 Push the guide pin down as far as it will go in the direction of the arrow and check the returning movement of the pin.	Must return smoothly.	Adjust. See P.31.

2-12 Improper tension

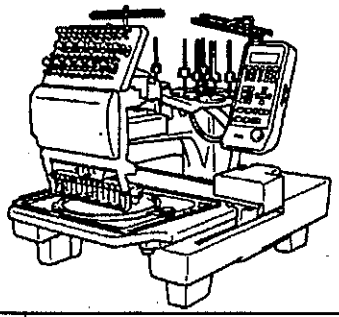


Preliminary inspection

- The thread tension may be too loose.
- The bobbin thread tension may be too loose.
- Needle size may be incorrect for the thread.
- The needle thread may be stuck in the threading tube holder or the thread take-up lever.

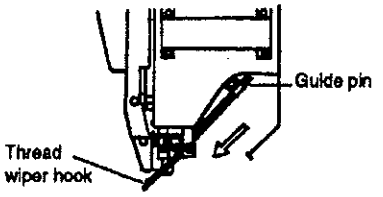
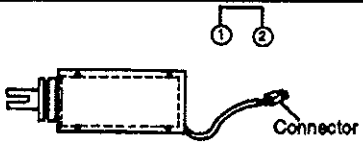
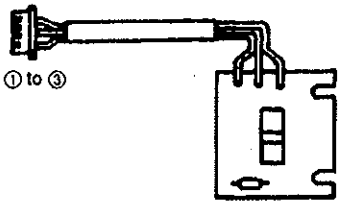
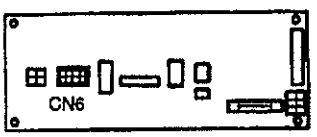
	Item	Method	Standard	Action
Thread tension	Thread take-up spring stroke (A)	Hold the thread before the thread tension plate. Pull the thread in the direction of the arrow, and the thread take-up spring starts moving. Check the length of thread pulled until the sprig stops. 	A=14±1mm	Adjust. See P.41.
	Initial thread take-up spring tension (B)	Hold the thread before the sub thread tension and pull the thread in the direction of the arrow. Check the ltension when the thread take-up spring moves approximatey 1mm.	B=3～5g	
Hook retainer	Clearance under the rotary hook retainer	Check protrusion on hook retainer visually.	A=0.6 to 1.0mm	Adjust. See P.24.
	Relative positions of the center of the protrusion on the hook retainer and the center of the needle		B=0.3mm	
Needle and rotary hook	Needle and rotary hook timing		A=1.9±0.1mm	Adjust. See P.22.

2-13 Thread wiper hook does not operate

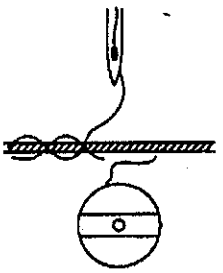


Preliminary inspection

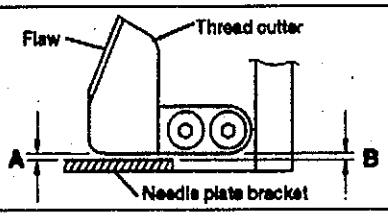
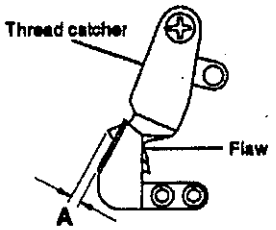
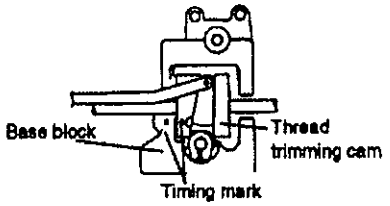
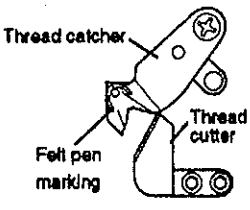
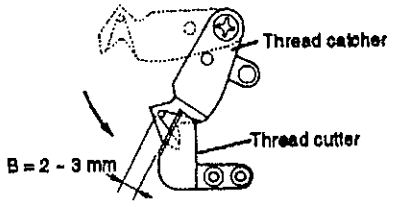
- Thread wiper hook may need cleaning (lint, dust, etc.)

	Item	Method	Standard	Action
Thread wiper mechanism	Thread wiper hook return	 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.	Must return smoothly.	Adjust. See P.31.
Thread wiper solenoid	Connection of thread wiper solenoid connector		Must be connected correctly.	Connect correctly.
	Resistance of thread wiper solenoid	Disconnect the connector and check the resistance between ③ and ⑪ with a circuit tester.	5.8～6.2 Ω	Replace.
Thread wiper sensor	Connection of sensor connector		Must be connected correctly.	Connect correctly.
	Output voltage	Turn the power on and check the voltage across ② and ③ with a circuit tester.	When obstructed: 3.5～5V When not obstructed: 0～0.8V	Replace.
Power circuit board	Connection of connector CN6	 Check the connection condition visually.	Must be connected correctly.	Replace. See P.55.

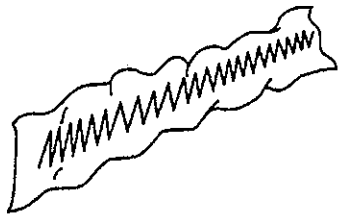
2-14 Thread trimming fails



Preliminary inspection

	Item	Method	Standard	Action
Thread cutter	Flaw on the thread cutter		Free of flaws	Repair or replace. See P.46.
	Fitted position of the thread cutter		A=B	Adjust. See P.25.
Thread catcher	Flaw on the thread catcher		Free of flaws	Repair or replace. See P.47.
	Fitted position of the thread catcher	Check the position of the thread cutter when the cutter return to the waiting position after cutting.	A=0.6 to 1mm	Adjust. See P.26.
	Thread trimming timing	 Place the needle bar at the bottom dead center and check that the timing mark on the thread trimming cam matches that on the base block.	The timing mark on the thread trimming cam must match that on the base block.	Adjust. See P.27.
Blade pressure	Thread cutter evenness	 Smear the thread catcher with a felt pen, and check if the thread cutter makes contact evenly.	Must be contact evenly.	Adjust. See P.28.
	Blade pressure		B=2~3mm (0.6~1.5kg)	Adjust. See P.28.

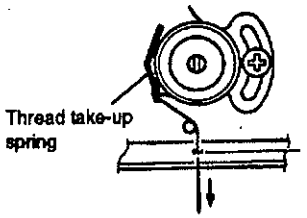
2-15 Puckering



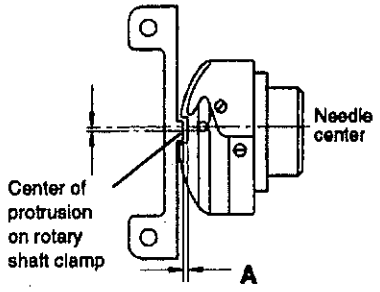
Preliminary inspection

- 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.

Thread tension

Item	Method	Standard	Action
Thread take-up spring stroke (A)	Hold the thread before the thread tension plate. Pull the thread in the direction of the arrow and the thread take-up spring starts moving. Check the length of thread pulled until the spring stops.	A=14±1mm	Adjust. See P.41.
Initial thread take-up spring tension (B)	 Hold the thread before the sub thread tension and pull the thread in the direction of the arrow. Check the tension when the thread take-up spring moves approximately 1mm.	B=3～5g	

Hook retainer

Item	Method	Standard	Action
Clearance under the rotary hook retainer	Check protrusion on hook retainer visually.	A=0.6 to 1.0mm	Adjust. See P.24.
Relative positions of the center of the protrusion on the hook retainer and the center of the needle		B=0.3mm	

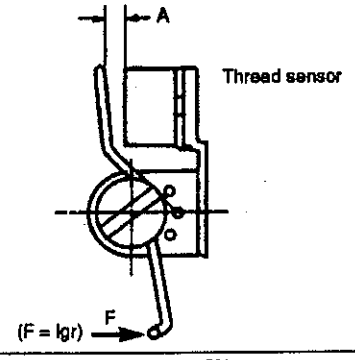
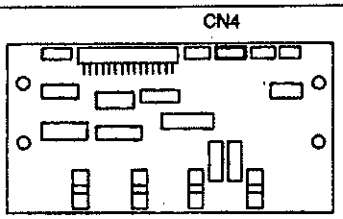
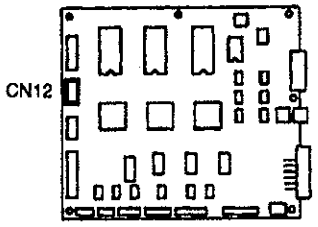
2-16 An error message is displayed

"THREAD CUT ERROR"

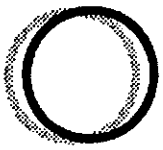
Preliminary inspection

When not displayed even if the needle thread breaks
- The thread sensor switch on the operation panel may not be turned on.

When displayed even if the needle thread is not break.
- The needle thread may not be set correctly.
- The bobbin thread may be break.
- The bobbin thread may be run out.
- The threading tube may not be attached to the thread take-up lever.

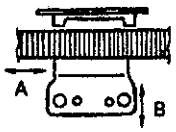
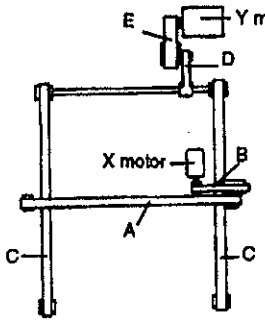
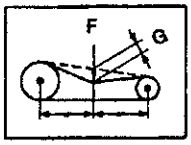
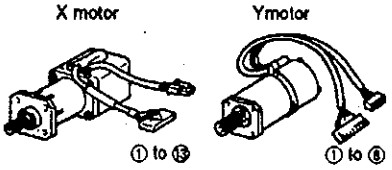
	Item	Method	Standard	Action
Thread sensor	Spring pressure		A= more than 1.5mm	Adjust. See P.42.
	ON-OFF position		Changes when A is 0.1～0.5 mm.	Replace. See P.65.
Needle position circuit board	Clearance under the rotary hook retainer	 Remove the arm cover and check the connection.	Must be connected correctly.	Connect correctly or replace. See P.64.
Main circuit board	Connection of connector CN12	 Check the connector visually.	Must be connected correctly.	Replace. See P.57.

2-17 Stitch registration slips out



Preliminary 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
Magnet holder	Sliding torque	 Turn power off and check the slide torque. (Measurement speed: 10mm/s)	A=650g or less B=850g or less	Adjust. See P.37.
Belt	Belt tension	  F: Force (g) (at span center) G: Deflection (mm)	Belt A F=500 G=6.0±1.0 Belt B F=480 G=0.8±0.4 Belt C F=500 G=5.0±1.0 Belt D F=640 G=1.0±0.4 Belt E F=500 G=1.5+0.5 −0.4	Adjust. See P.37 and P.38.
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 ⑪ 5V(red)and ⑫ GND (red and black) (Y motor) Across ⑥ 5V(red)and ⑦ GND (red and black)	+5V when turned on	Replace. See P.62 and 63.

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 work table.
(2) Remove the needle plate and the hook cover.
(3) Rotate the hand wheel forward so that the needle bar to the top dead center. The lower timing mark of the needle bar must be aligned with the bottom face of the arm jaw (Fig.1).
Note: If the mark is not aligned with the bottom face of the arm jaw, adjust the mark position (Refer to "3-1-2 Needle bar height" on page 23).
(4) Rotate the hand wheel forward so that the needle bar is set to the bottom dead center. Rotate the hand wheel again to align the upper timing mark with the bottom face of the arm jaw or the needle bar is 1.9±0.1 mm above the bottom dead center (Fig.2). The hook tip must be aligned with the needle center (Fig.2).
(5) The clearance between the needle and the hook tip must be 0.03～0.07mm (Fig.2).

[Adjustment]

(1) Slightly loosen the rotary hook retaining screw (a) closest to the hook tip and loosen the other two retaining screws (Fig.3).
(2) Rotate the hand wheel forward so that the needle bar is set to the bottom dead center. Rotate the hand wheel again to align the upper timing mark with the bottom face of the arm jaw (Fig.2).
(3) Loosen retaining screw (a) further and rotate the rotary hook in either direction A or B. Align the hook tip with the needle center (Fig.2) and secure a clearance of 0.03～0.07mm between the needle and hook tip (Fig.4 on page 27).

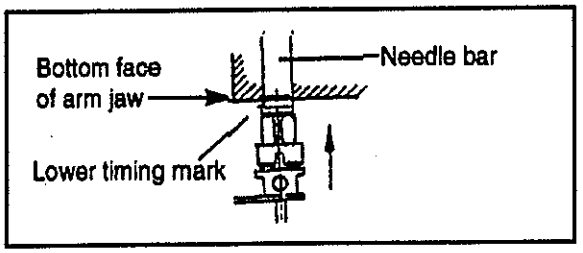


FIG.1

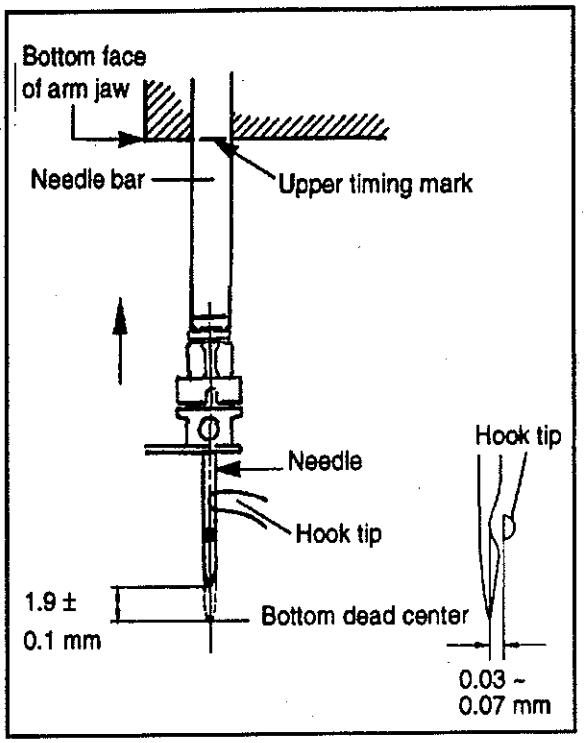


FIG.2

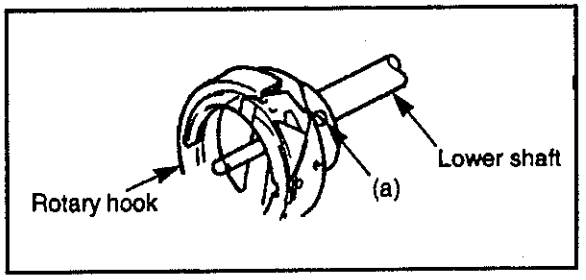


FIG.3

(4) Slightly tighten the retaining screw (a) closest to the hook tip (Fig.3 on page 22).
(5) Rotate the hand wheel forward so that the upper timing mark is aligned with the bottom face of the arm jaw. Check the position of the needle and hook tip (Fig.2 on page 22).
(6) Firmly tighten the three retaining screws (a) (Fig.3 on page 22).
(7) Mount the needle plate, the hook cover and the work table.

2.Needle bar height

[Inspection]

(1) Remove the work table.
(2) Remove the needle plate.
(3) Rotate the hand wheel forward so that the needle bar is lifted from the bottom dead center and the hook tip is aligned with the needle center. The distance from the needle hole top end to the hook tip top end must be 1.5～1.7mm (Fig.1).

Reference: When the hand wheel is rotated forward and the needle bar reaches the bottom dead center, the distance from the rotary hook center to the needle tip must be 8.8±0.1mm (Fig.2).

Note: Check the needle lifting position (rotary hook position) before the inspection.

[Adjustment]

(1) Move the needle bar to the top dead center.
(2) Loosen the retaining screw (a) and position the needle bar so that the distance from the top end of the needle hole to the top end of the hook tip is 1.5～1.7mm(Fig.1).
(3) Rotate the hand wheel forward so that the needle bar is lifted from the bottom dead center and the hook tip is aligned with the needle and the hook tip is aligned with the needle center. The height must be 1.5～1.7mm (Fig.1).

Note: Check that the needle can be easily changed.

(4) Mount the needle plate and the work table.

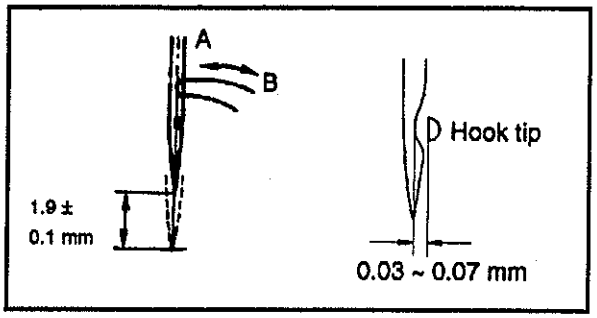


FIG.4

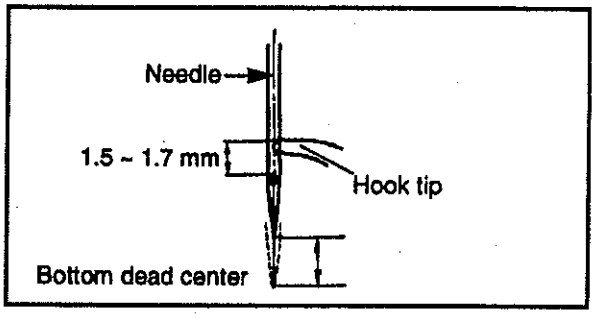


FIG.1

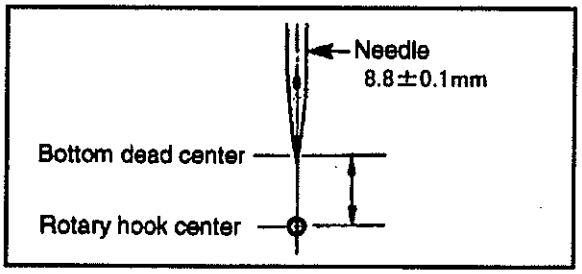


FIG.2

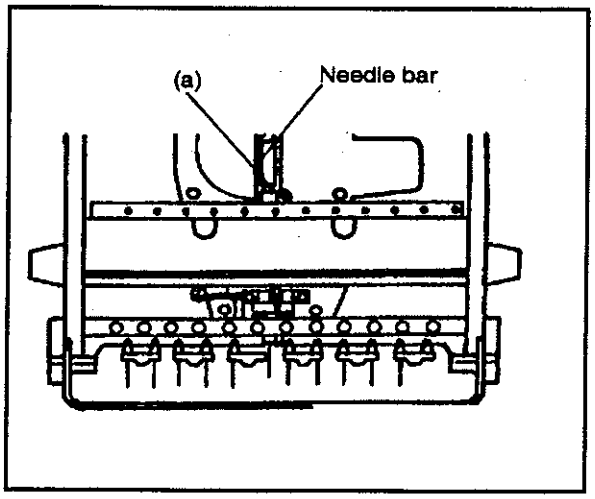


FIG.3

3-2 Position of the hook retainer

[Inspection]

(1) Replace the work table.
(2) Remove the needle plate.
(3) There must be a clearance of 0.6 to 1.0mm between the hook retainer and the rotary hook (Fig.1).
(4) Distance B (clearance between the needle center and the center of the protrusion on the hook retainer) must not exceed 0.3mm (Fig.1).

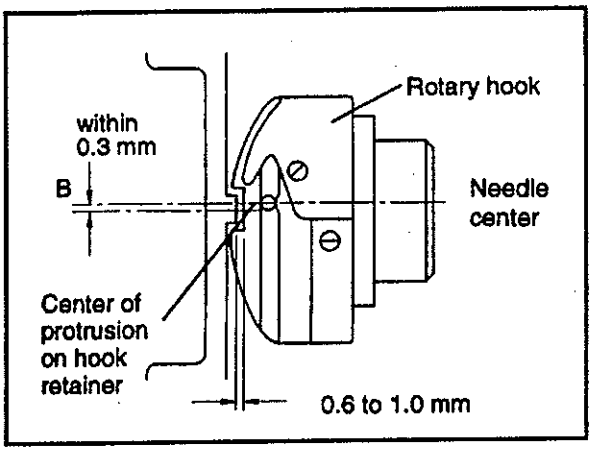


FIG.1

[Adjustment]

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

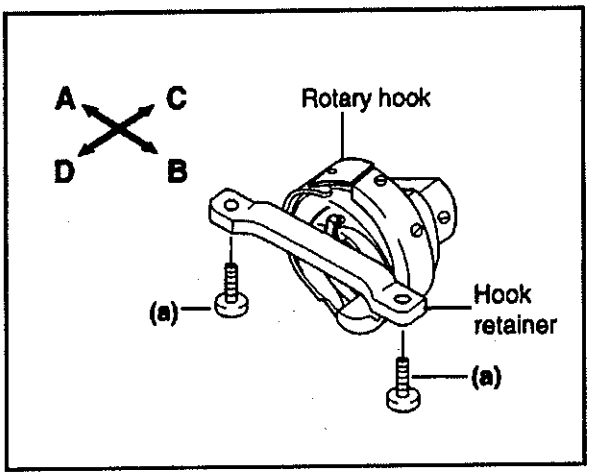


FIG.2

3-3 Position of the stationary thread cutter

[Inspection]

(1) Remove the needle plate.
(2) The thread cutter must be parallel to the needle plate bracket (A=B) (Fig.1).

[Adjustment]

(1) Loosen two retaining screws (a) (Fig.1).
(2) Position the thread cutter parallel with the needle plate bracket, and retighten retaining screws (a) (Fig.1).
(3) Attach the needle plate.

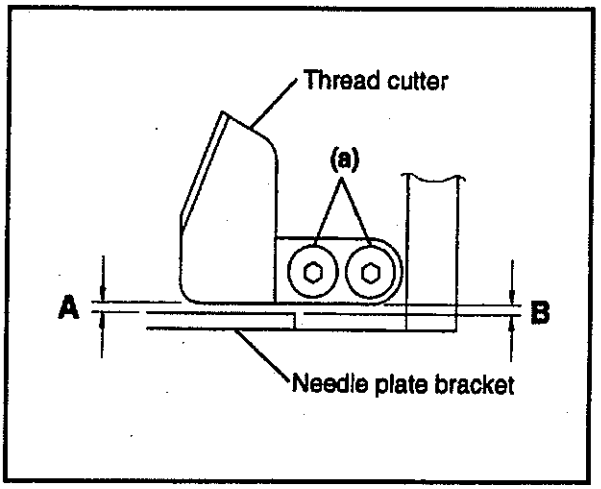


FIG.1

3-4 Waiting position of thread catcher

[Inspection]

(1) Remove the needle plate.
(2) Remove the work table and work table B.
(3) Turn the hand wheel counterclockwise to bring the needle bar to the bottom dead center.
(4) Rotate the hand wheel toward you, while pushing the thread cutter lever in direction A (Fig.1).
(5) The thread catcher to start moving and stop the hand wheel it returns to the waiting position (Fig.2).
(6) At that point, the relative positions of the thread catcher and the thread cutter must be a clearance of 0.6 to 0.1mm. (Fig.2).

Reference:Standby angle of thread catcher = 285±2°
Angle of thread catcher when cutting thread = 60±2°

[Adjustment]

(1) Loosen four retaining screws (a) and remove bed cover A (Fig.3).
(2) Loosen retaining screw (b) (Fig.4).
(3) Move the connecting plate in either direction B or C to make the adjustment (Fig.4).
(4) Retighten retaining screw (b) (Fig.4).
Note: The connecting plate must be free of vertical play.

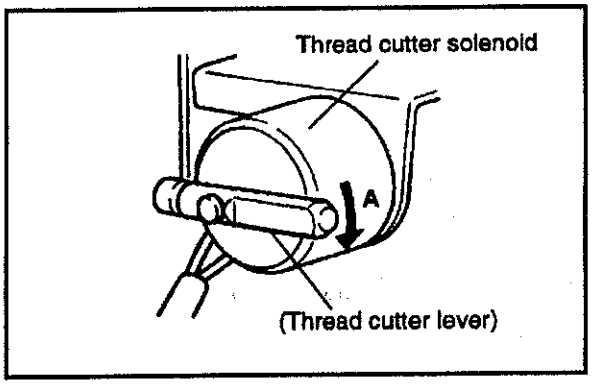


FIG.1

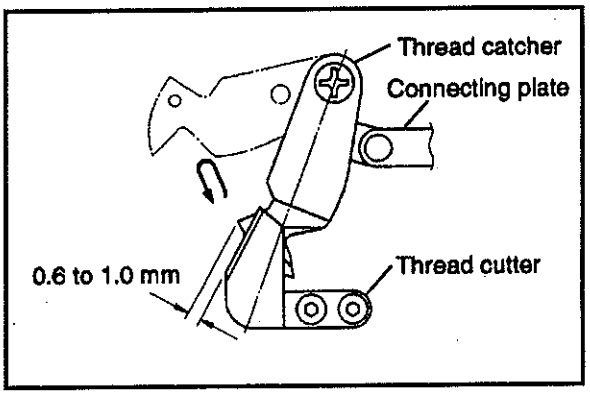


FIG.2

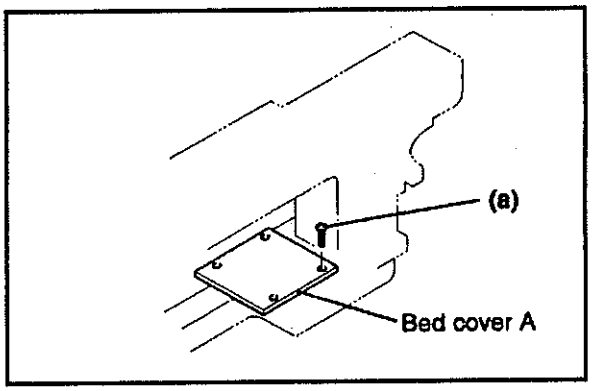


FIG.3

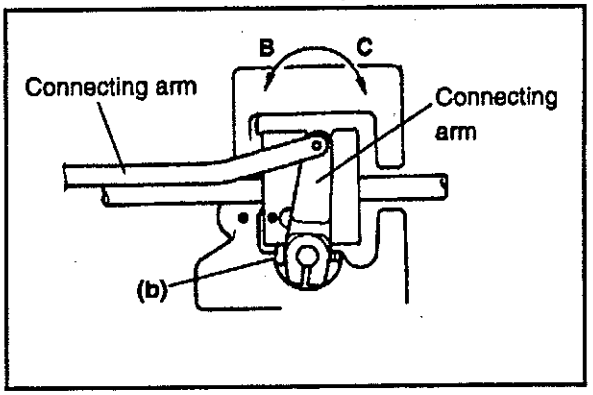


FIG.4

3-5 Thread trimming timing

[Inspection]

(1) Remove four retaining screws (a) and bed cover A (Fig.1).
(2) Turn the hand wheel counterclockwise to bring the needle bar to the bottom dead center.
(3) The thread trimming cam must be aligned with the timing mark on the base block (Fig.2).
Note: Mark alignment allowance: 0.5 mm or less

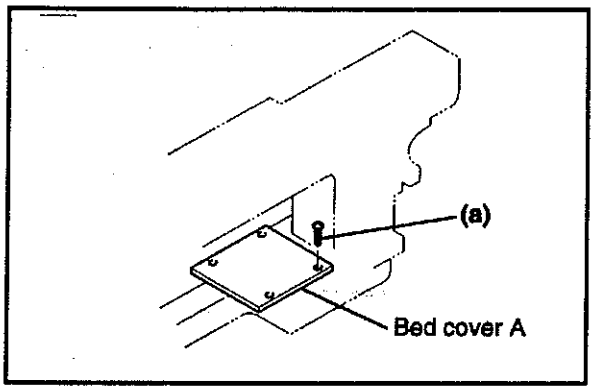


FIG.1

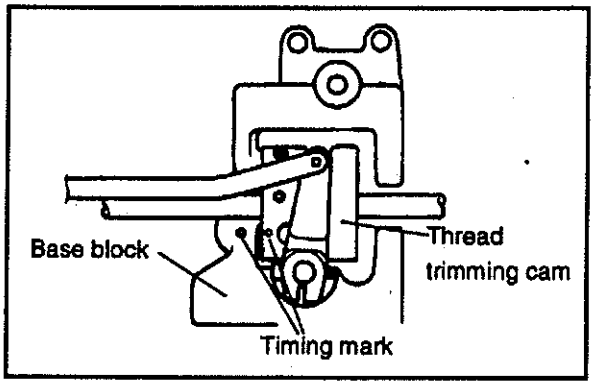


FIG.2

[Adjustment]

(1) If the position of the thread trimming cam is incorrect, rotate the hand wheel backward and loosen thread trimming cam screw ① (Fig.3).
(2) Rotate the hand wheel forward to bring the needle bar to the bottom dead center.
(3) Loosen thread trimming cam screw ② and align the timing mark on the thread trimming cam with that on the base block. Tighten screws ② and ① in this order (Fig.3).
Note: Clearance D between the thread trimming cam and the base block must be 0～0.05mm.

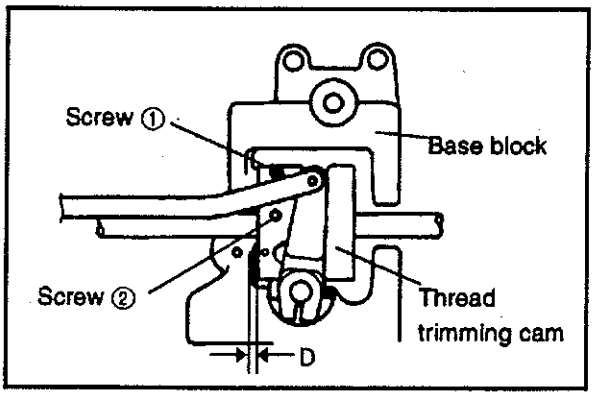


FIG.3

3-6 Blade pressure

[Inspection]

(1) Remove the needle plate.
(2) Remove the work table and work table B.
(3) Turn the hand wheel counterclockwise until the needle bar is at the bottom dead center.
(4) Turn the hand wheel counter clockwise until the needle bar is near the top dead center, while pushing the thread trimming lever in direction A (Fig.1).
(5) Smear the thread catcher with a felt pen (Fig.2).
(6) Turn the hand wheel counter clockwise until the thread catcher completes a trimming cycle, while pushing the thread trimming lever in direction A (Fig.1).
(7) Perform trimming again, and check that the felt pen marking on the thread catcher is scraped evenly (even contact).
(8) Turn the hand wheel counterclockwise further, 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) (Fig.3).

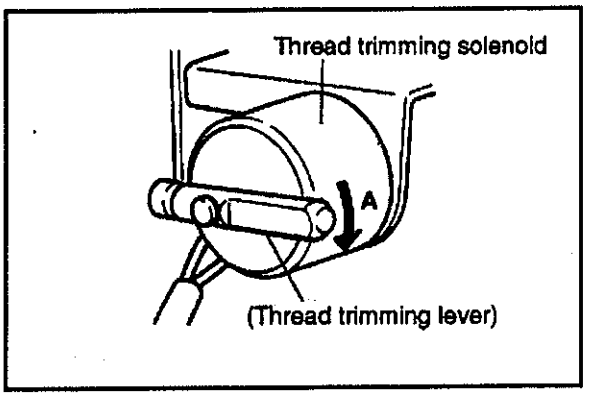


FIG.1

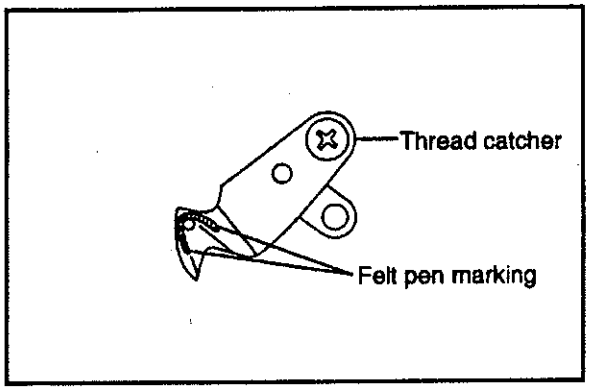


FIG.2

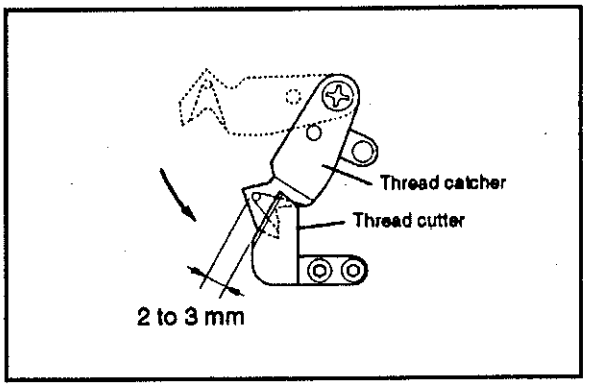


FIG.3

[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) Remove the rotary hook cover.
   (2) 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).
   (3) While steadying the thread cutter by hand, tighten retaining 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) Remove the rotary hook cover and slightly loosen two retaining screw (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 retaining 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 retaining screw (a),tighten the left-side retaining screw (a), then tighten the thread cutter in position with the right-side retaining screw (a)(Fig.5 and 6).
   (2) If the clearance is larger than 3mm, slightly loosen the left-side retaining screw (a), tighten the right-side retaining screw (a), then tighten the thread cutter in position with the left-side retaining screw (a)(Fig.5 and 6).

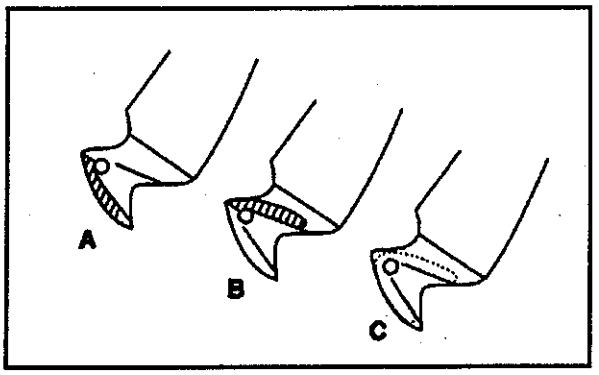


FIG.4

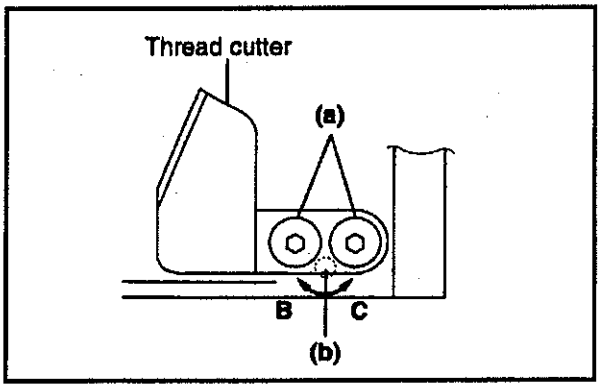


FIG.5

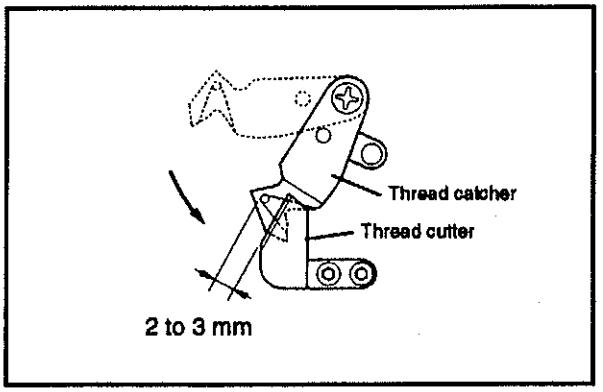


FIG.6

3-7 Picker position

[Inspection]

(1) Remove the work table.(Fig.1).
(2) When the picker solenoid is on, clearance A between the picker tip and the bobbin must be 0.5 to 1.0mm (Fig.1).

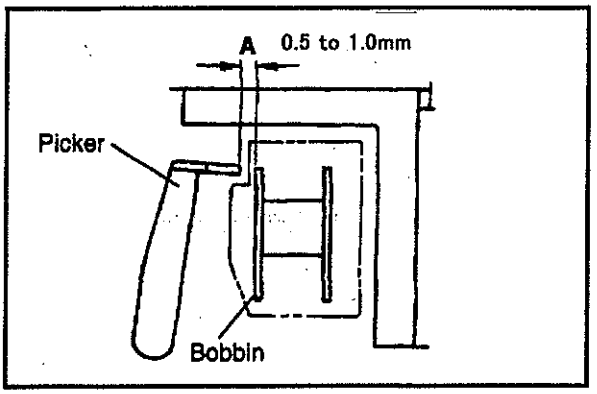


FIG.1

(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.2).

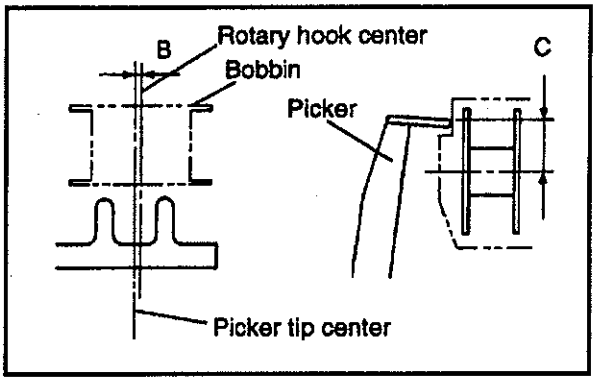


FIG.2

[Adjustment]

(1) If clearance A between the picker tip and the bobbin differs from that specified, loosen the nut to adjust the stopper position. Tighten the nut after adjustment (Fig.3).
(2) If clearance B between the picker tip center and the rotary hook center differs from that specified, loosen two retaining screws (a) to shift the picker bracket. Tighten screws (a) after adjustment (Fig.3).
(3) If the picker height differs from that specified, loosen two retaining screws (b) to adjust the height. Tighten screws (b) after adjustment (Fig.3).

Reference: The standby position of the picker must be approximately aligned with the throat plate tip so that distance D become no more than 1mm.

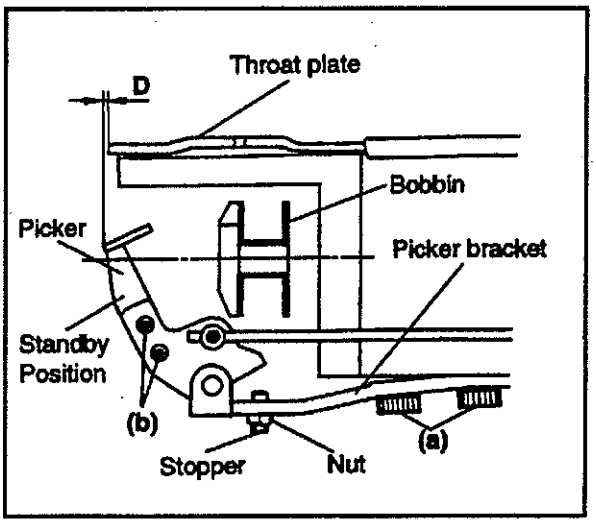


FIG.3

3-8 Position of the thread wiper hook

[Inspection]

(1) Set the needle No.1. Push the guide pin as far as it will go in the direction of the arrow and release the pin. Check that the guide pin returns smoothly (Fig.1). Repeat the same for needle No.12.
(2) Distance A from the needle center to the thread wiper hook tip must be 14～16mm during operation (Fig.2).
(3) Distance B from the needle center to the thread wiper hook top face must be 2～4mm (Fig.2).
(4) Distance C from the right end of the thread wiper hook to the needle center must be 2～4mm (Fig.2).

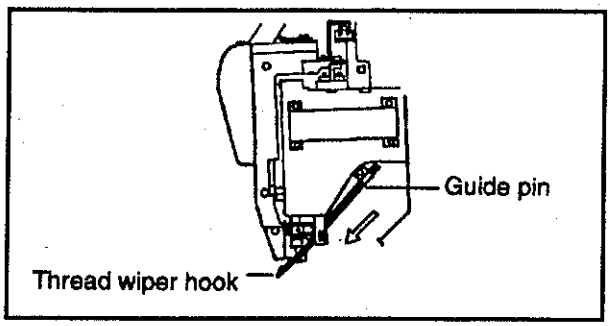


FIG.1

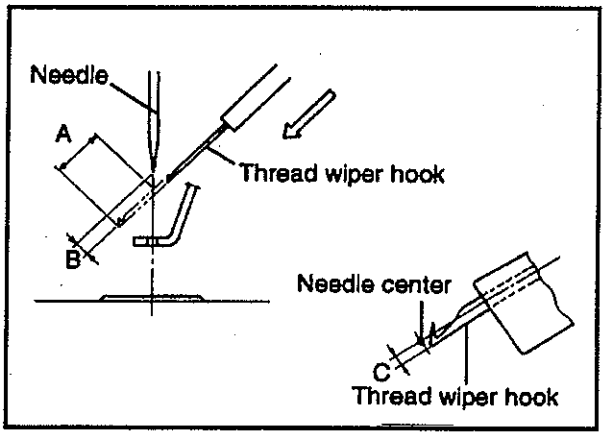


FIG.2

[Adjustment]

(1) If the guide pin does not return to the original position, loosen retaining screw (a) to move the thread wiper base in the direction of the arrow. Position the base where the guide pin moves smoothly and tighten retaining screw (a) (Fig.3).
(2) If distance A from the needle center to the thread wiper hook tip differs from that specified, remove side cover L and loosen four retaining screws (b). Move the thread wiper solenoid left/right to adjust distance A, and tighten retaining screws (b) (Fig.3).
(3) If distance B from the needle center to the thread wiper hook top face differs from that specified, remove side cover L and loosen two retaining screws (c). Move the entire thread wiper base to adjust distance B. Tighten screws (c) after adjustment (Fig.3).
Note: Also adjust distance C from the right end of the thread wiper hook to the needle center.

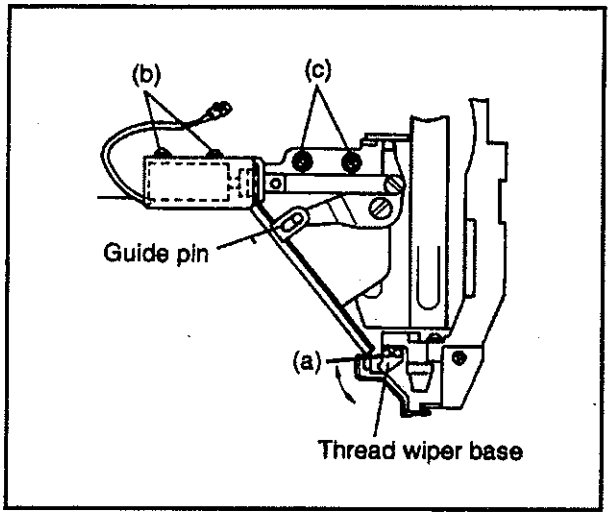


FIG.3

3-9 Needle socket standby position

[Inspection]

(1) Remove the retaining screw and the dip switch cover.
Set the dip switch 1-1 to the ON position, turn the power back on and press the SET key(Figs. 1 and 2).
Move the cursor by pressing the down arrow key to set at #2 for MAIN ROM, then press the SET key(Fig.2).
Press the color change key to select the #12 needle, then press the SET key(Fig.2).

(2) Move the needle bar to the needle exchanging position under "STEP 1"mode (Fig.3).
Note: Press the TEST key to change the step1(Fig.2).

(3) Confirm that the needle socket to be inserted lightly into the chuck plate by rotating the needle case drive shaft with the screwdriver (Fig.4 and 5).
The needle socket should be inserted smoothly and no vibration up and down.

(4) Move the needle case to the left or right under "STEP 2" mode.
Note: Press the TEST key to change the step 2 (Fig.2).
Rotate the hand wheel and check the weight of taking off / putting on needle clamp from / to the needle socket (Fig.5).
The inset/removal force of the needle socket is 2.0 to 3.3kg.

(5) Rotate the hand wheel forward to the position shown in Fig.5. Clearance A between the needle clamp body center and the needle socket center must not exceed 0.4mm.
Note: Move the needle case to the right end and check the position of needle socket No.1 and repeat the previous inspection.

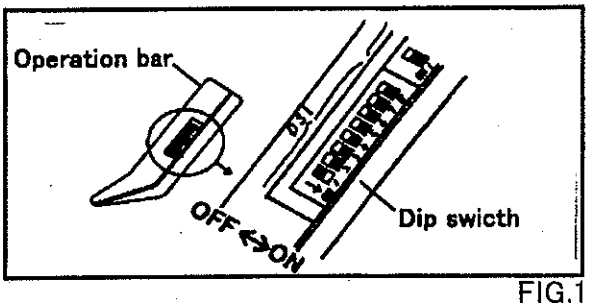


FIG.1

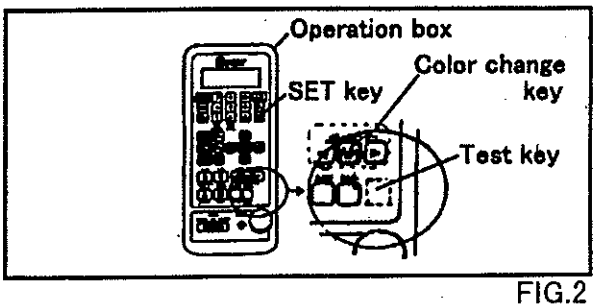


FIG.2

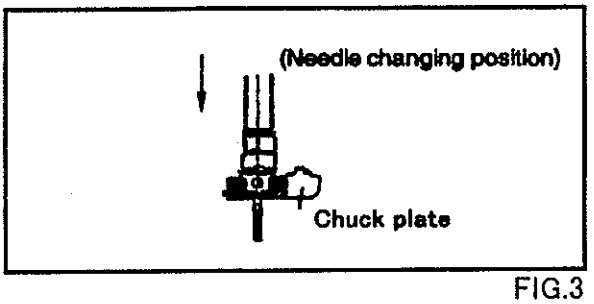


FIG.3

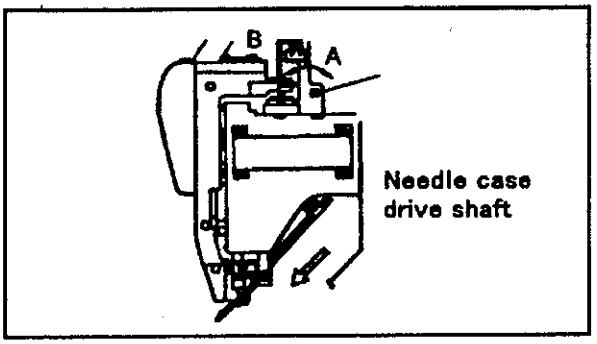


FIG.4

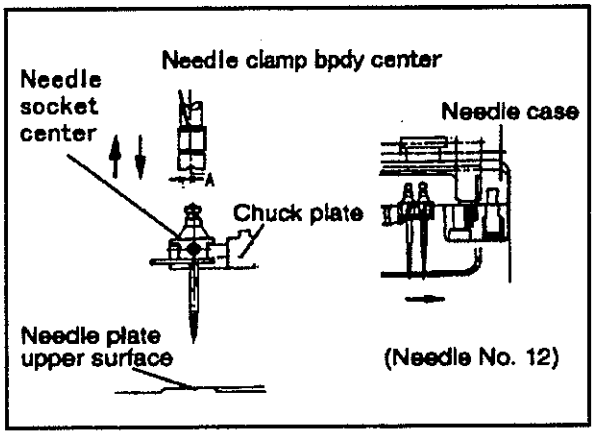


FIG.5

[Adjustment]

(1) If the needle socket stuck in the chuck plate, slightly loosen the retaining screw (a) and rotate the needle bar to the left or right with the M6 spanner(Fig.6).

(2) If the needle bar vibrates up and down, adjust the height of chuck plate by loosing the nut with the M8 spanner and rotate the dumper guide pin to the left or right until stop the vibration.
After making the adjustment, tighten the nut(Fig.7).

(3) If the inset/removal force is not with in the standard range, loosen the retaining screw (b) and move the chuck plate to the back and forth or right and left for adjustment (Fig.8).
Check the weight of putting on and taking off the needle clamp from the needle socket.
If it is OK, tighten the retaining screw (b) (Fig.8).

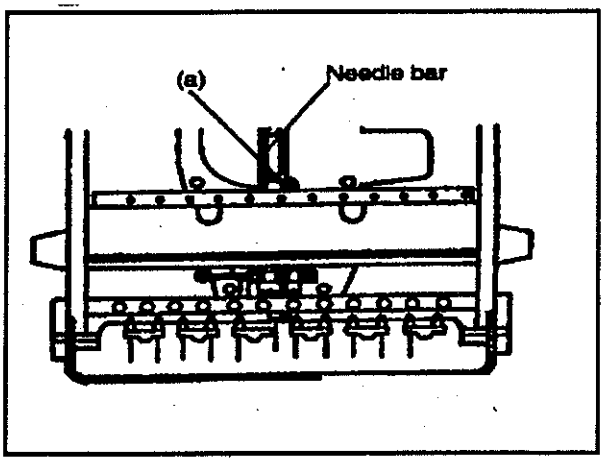


FIG.6

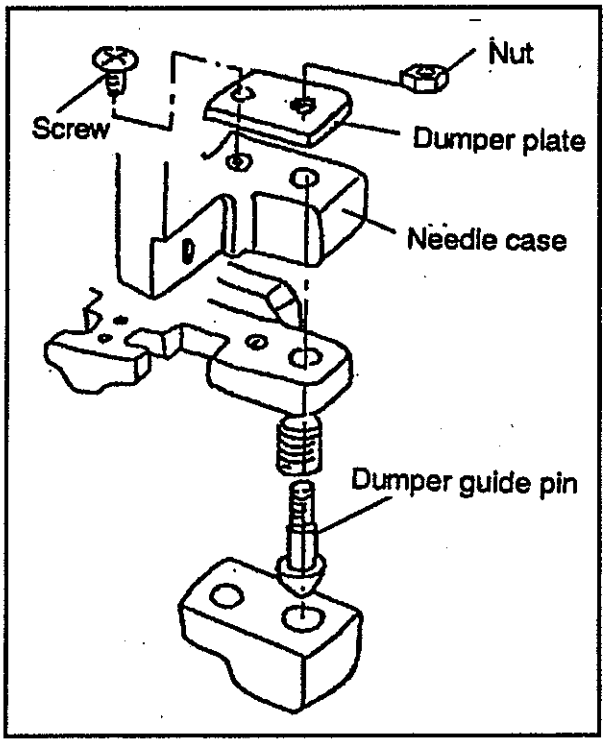


FIG.7

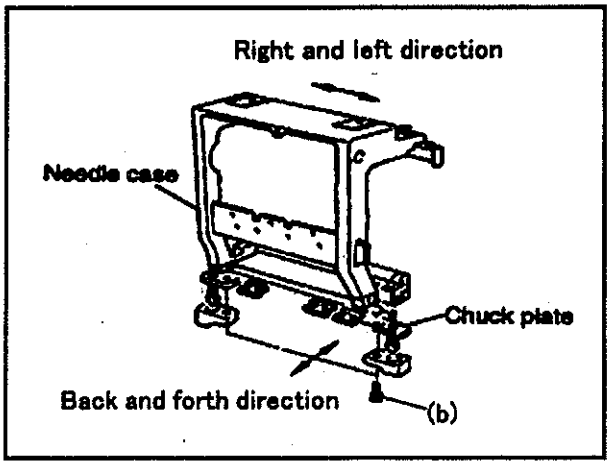


FIG.8

3-10 Position of threading tube holder

[Inspection]

(1) Remove the retaining screw and the dip switch cover.
Set the dip switch 1-1 to the ON position, turn the power back on and press the SET key (Figs.1 and 2).
Move the cursor by pressing the down arrow key to set at #2 for MAIN ROM, then press the SET key (Fig.2).
Press the color change key to select the #2 needle, then press the SET key(Fig.2).

(2) Move the threading tube holder to the lower position under "STEP 4" mode (Fig.3).
Note: Press the TEST key four times to change the step 4 (Fig.2).

(3) Open the face plate. Check the clearance A between the thread take-up lever and the threading tube holder should be 1.5 to 2.5mm (Reference value).
Note: The position of the threading tube receiving section between the thread take-up lever and the threading tube holder must be aligned (fig.3).B=0±0.5mm.
Note: Select the #1 needle, then press the SET key and repeat the previous inspection (Fig.2).

(4) Check that clearance C between the threading tube holding section and thread take-up lever is more than 1mm (Fig.4).
Note: Check the position for all threading tube holding sections (12 places).
Note: Move the threading tube holder to the lower position under "STEP 4"mode (Fig.3).

(5) Check that distance D from the Face plate bracket attachment surface to the threading tube holder left end is 14 ±0.2mm (Reference value Fig.4).

(6) Check the backlash between the two gears (A) and (B) should be 0.05 to 0.1mm (Fig.5).

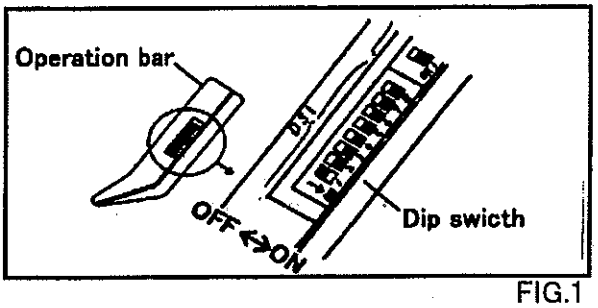


FIG.1

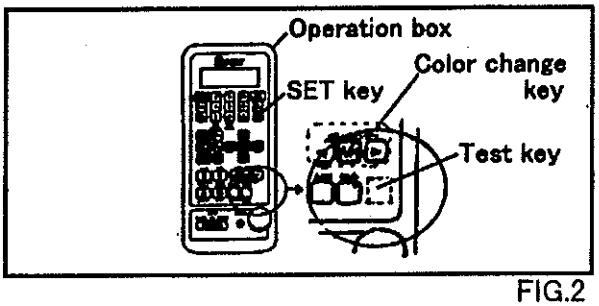


FIG.2

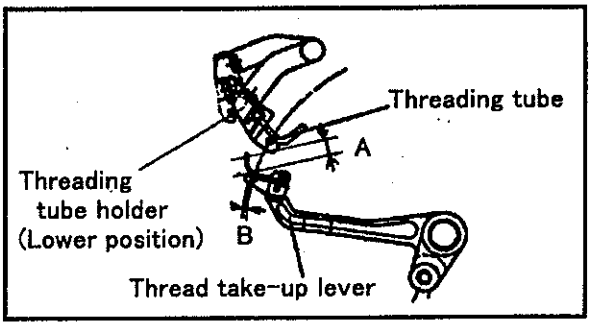


FIG.3

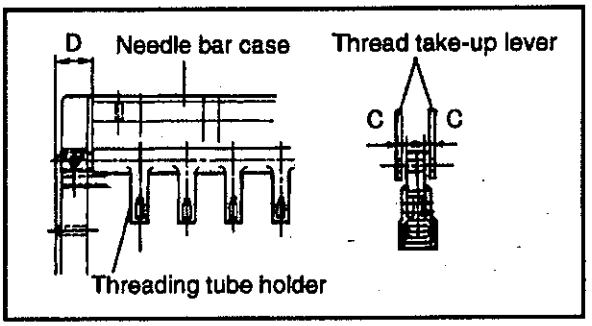


FIG.4

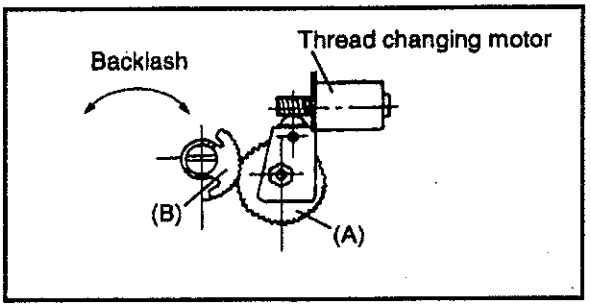


FIG.5

[Adjustment]

(1) If the clearance A is not within the standard range, move the threading tube holder to the upper position under "STEP 6" mode.
Loosen the two retaining screws (a) and adjust the sensor position (Fig.1).
Reference:
*If the clearance is more than 2.5mm, move the sensor to the upward (Sketch A).
*If the clearance is less than 2mm, move the sensor to the downward (Sketch B).
After making the adjustment, tighten the two retaining screws (a) (Fig.1).
Note: Be sure the slit is set in the middle of the sensor gap.

(2) If the clearance is not within the standard range, loosen the retaining screw (b) and adjust the threading tube holding section to the left or right (Fig.2).
After making the adjustment, tighten the retaining screw (b) (Fig.2).

(3) If the distance D is not within the standard range, loosen the two retaining screws (c) and move the threading tube holder support shaft to the left or right (Fig.3).
Note: The threading tube holder, must move smoothly.

(4) If the backlash is not within the standard range, loosen the retaining screw (c) and rotate the support shaft to the left or right for adjustment (Fig.3).
Note: The mark on the support shaft facing upward at a 45° angle is regarded as the standard.

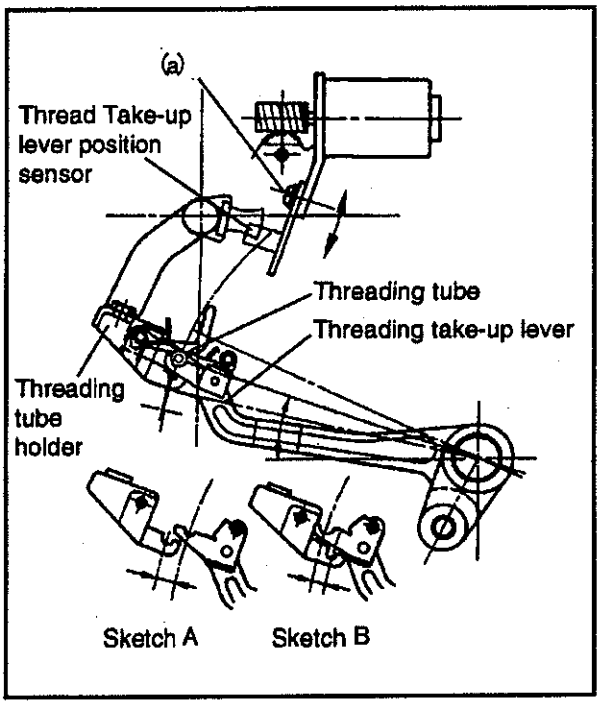


FIG.1

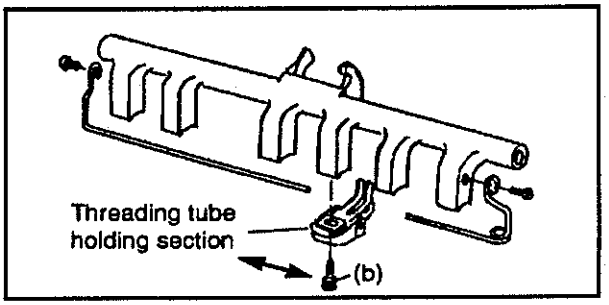


FIG.2

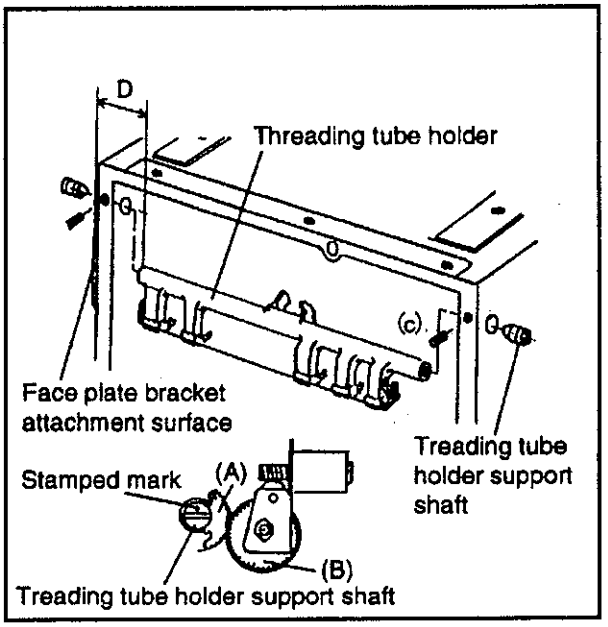


FIG.3

3-11 Tension of upper shaft belt

[Inspection]

(1) Remove work table B.
(2) Remove retaining screw (a) and then the hand wheel (Fig.1).
(3) Remove six retaining screws (b) and then the arm cover rear (Fig.1).
(4) When applying a force of 0.46 kg to the upper shaft belt, amount of deflection A must be 4.3±0.3mm (Fig.2).

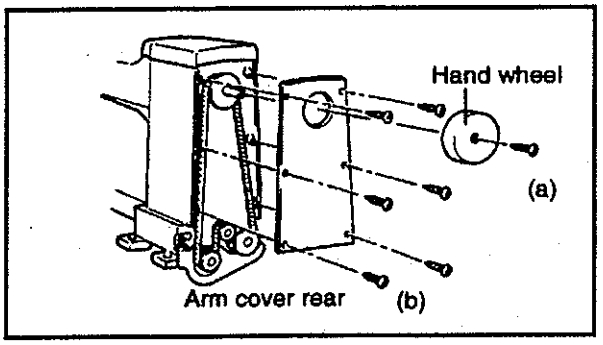


FIG.1

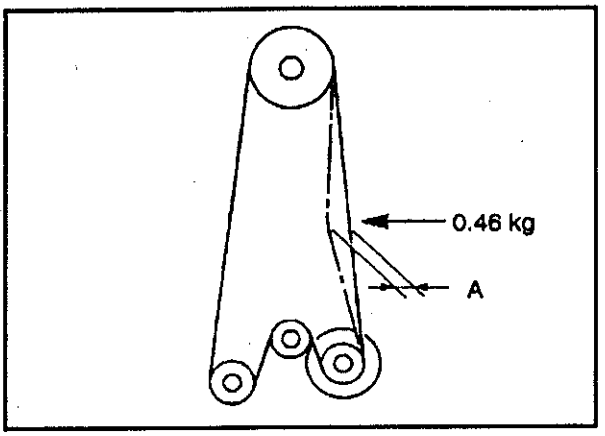


FIG.2

[Adjustment]

(1) If the amount of defection of the upper shaft belt differs from that specified, loosen retaining screw (c) (Fig.3).
(2) Loosen the nut and turn adjustment screw (d) Secure the nut after adjustment (Fig.3).
(3) Tighten retaining screw (c) (Fig.3).
(4) Mount the arm cover rear, hand wheel, and work table B (Fig.1).

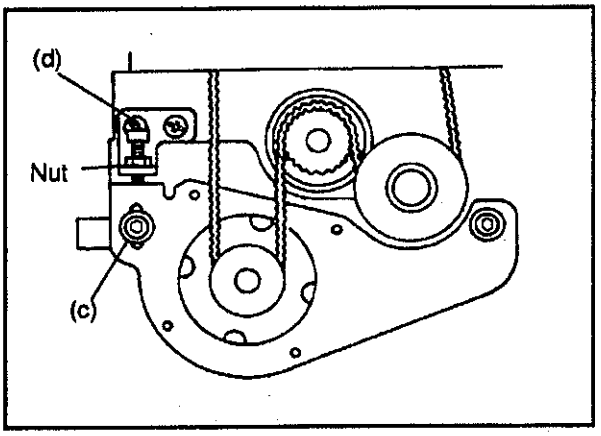


FIG.3

3-12 Tension of drive belts A & C

[Inspection]

(1) Loosen two retaining screws (a) and then remove the work table (Fig.1).
(2) Remove twelve retaining screws (b) and then remove covers R and L (Fig.1).
(3) Remove retaining screw (c) and remove X.Y covers R and L (Fig.1).
(4) Loosen four retaining screws (d) and remove X.Y cover C (Fig.1).
(5) When applying a force of 500g to drive belt A, amount of deflection G must be 6.0±1.0mm(Fig.2).
(6) When applying a force of 500kg to drive belt C, amount of deflection G must be 5.0±1.0mm (Fig.2).

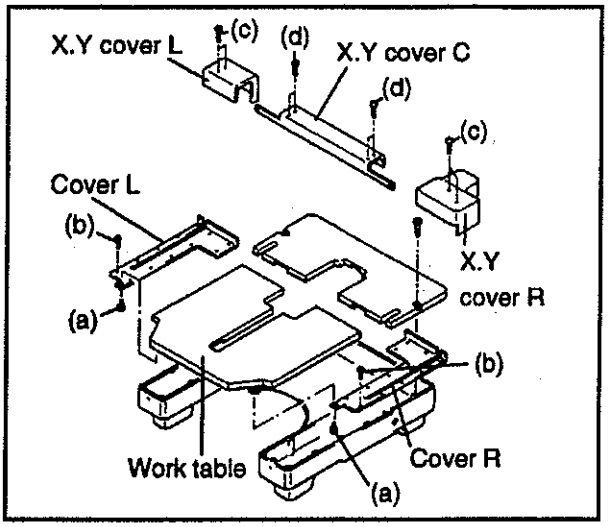


FIG.1

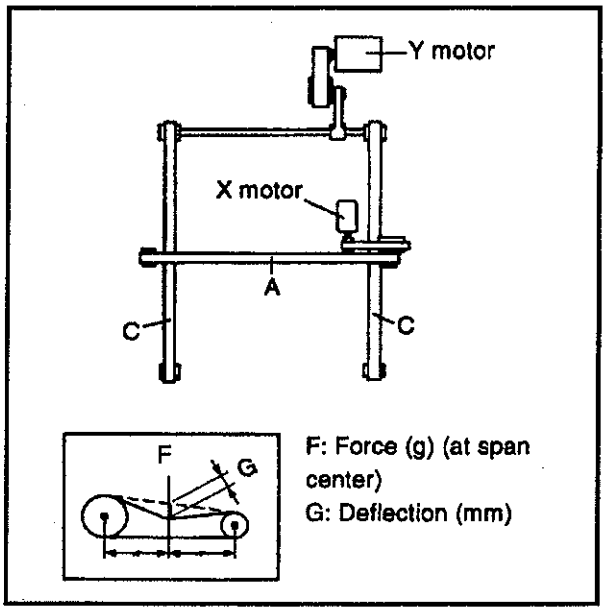


FIG.2

[Adjustment]

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

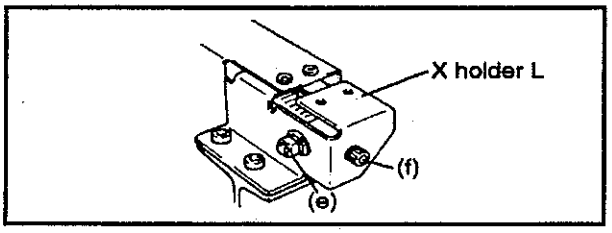


FIG.3

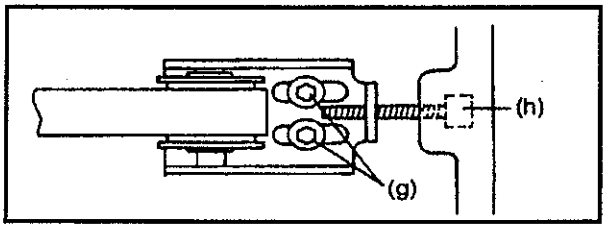


FIG.4

3-13 Tension of deceleration belts B, D, & E

[Inspection]

(1) Loosen two retaining screws (a) and remove the work table (Fig.1).
(2) Loosen retaining screw (b) and remove X.Y cover R (Fig.1).
(3) Loosen two retaining screws (c) and remove work table B (Fig.1).
(4) When applying a force of 480g to the center of deceleration belt B, amount of deflection G must be 0.8±0.4mm (Fig.2).
(5) When applying a force of 640g to the center of deceleration belt D, amount of deflection D must be 1.0±0.4mm (Fig.2).
(6) When applying a force of 500g to the center of deceleration belt E, amount of deflection D must be $1.5^{+0.5}_{-0.4}$ mm (Fig.2).

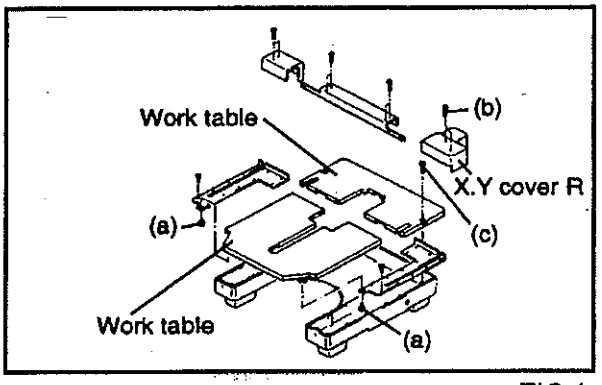


FIG.1

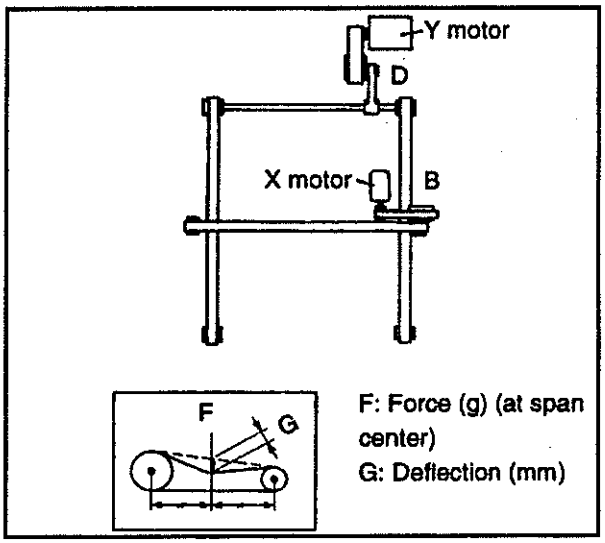


FIG.2

[Adjustment]

(1) If the amount of deflection of deceleration belt B differs from that specified, loosen two retaining screws (d) and turn retaining screw (e) in the direction of the arrow. Tighten two retaining screws (d) after adjustment (Fig.3).
(2) If the amount of deflection of deceleration belt D differs from that specified, loosen four retaining screws (f) and turn retaining screw (g) in the direction of the arrow. Tighten four retaining screws (f) after adjustment (Fig.4).
(3) If the amount of deflection of deceleration belt E differs from that specified, loosen two retaining screws (h) and turn retaining screw (i) in the direction of the arrow. Tighten two retaining screws (h) after adjustment (Fig.4).

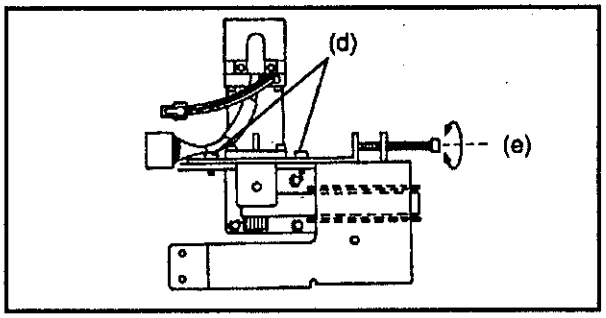


FIG.3

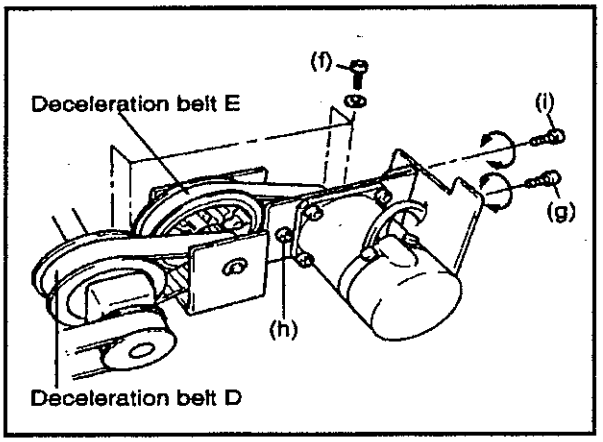


FIG.4

3-14 Limit sensor

[Inspection]

(1) Loosen two retaining screws (a) remove the work table (Fig.).
(2) Remove twelve retaining screws (b) and then cover L (Fig.1).
(3) Remove retaining screw (c) and then X.Y covers R and L (Fig.1).
(4) Remover four retaining screws (d) and then X.Y cover C (Fig.1).
(5) Turn power on and carry out home position return.
Note: Press the[SET]key.
(6) Connect the circuit tester as shown in Fig.2.
(7) Press the emergency stop button and move the X,Y holder manually. Check distances X and Y when limit sensors AX and AY have been turned on (Fig.3).
Reference: X=55±1mm

Y=199.4±1mm

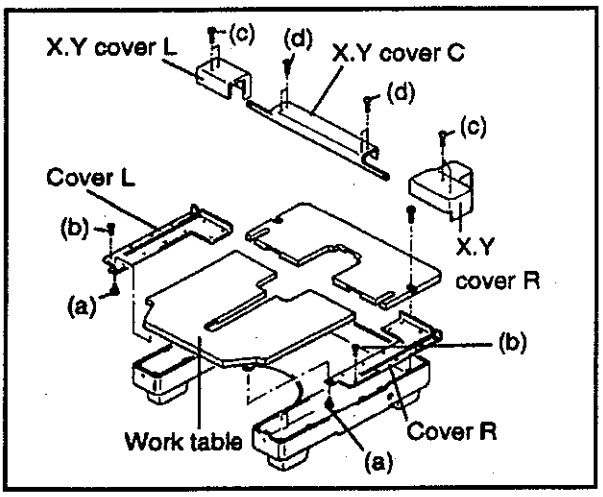


FIG.1

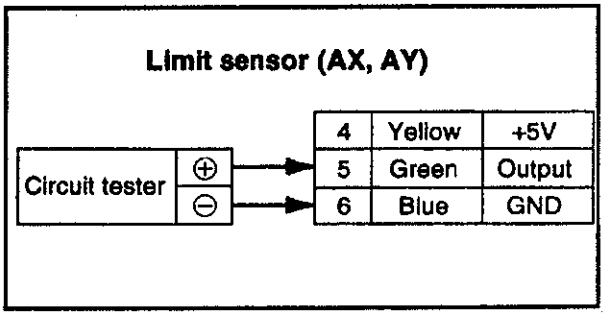


FIG.2

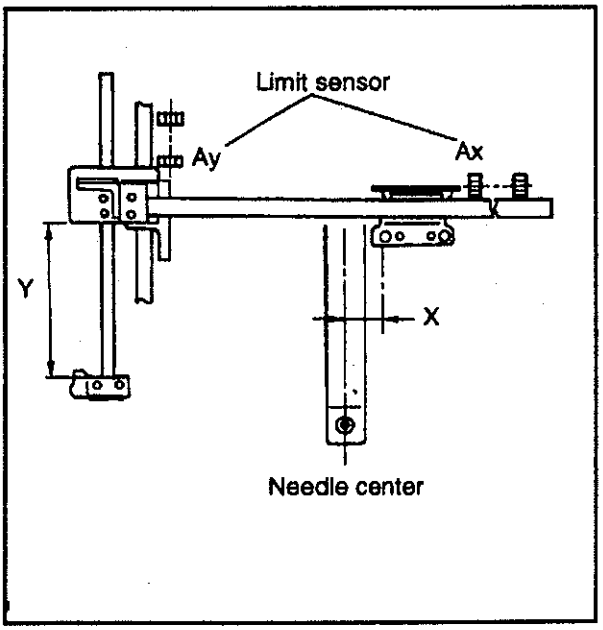


FIG.3

[Adjustment]

(1) If either the X or Y distance differs from that specified, press the emergency stop button and manually move either distance to the designated position.

(2) If the X distance differ from that specified, connect the circuit tester to the AX connector as shown in Fig.1.

(3) Loosen two retaining screws (a) provided under the belt. Move the sensor bracket until the sensor is turned on and tighten retaining screw (a) (Fig.2).

Note: If the satisfactory condition cannot be obtained at step (3), move the slit. Note that the slit is placed is placed in the center of the sensor slot (Fig.3).

(4) If the Y distance differs from that specified, connect the circuit tester to the AY connector as shown in Fig.1.

(5) Loosen two retaining screws (b). Move the sensor bracket until the limit sensor is turned on and tighten retaining screw (b) (Fig.4).

Note: If adjustment is not successful after step (5), move the slit. Note that the slit is placed in the center of the sensor slot (Fig.5).

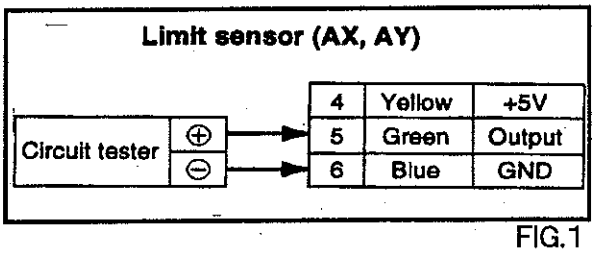


FIG.1

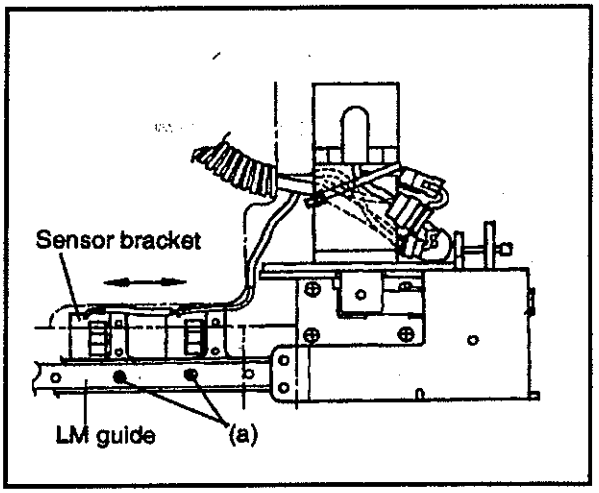


FIG.2

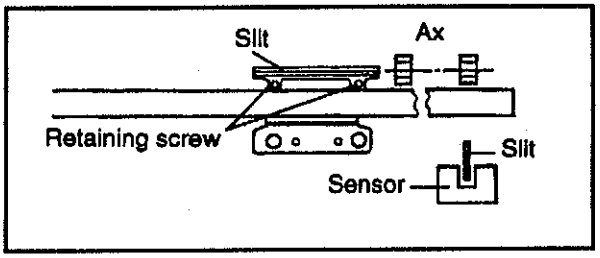


FIG.3

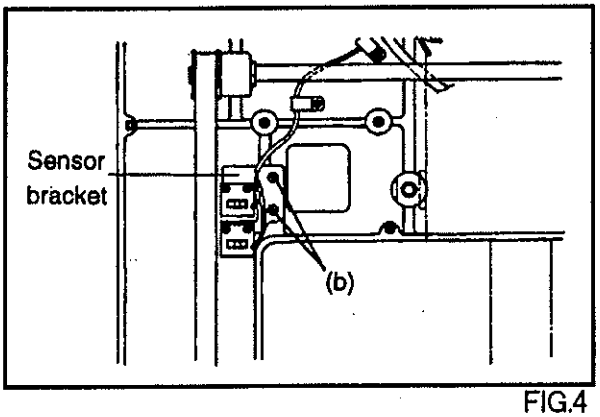


FIG.4

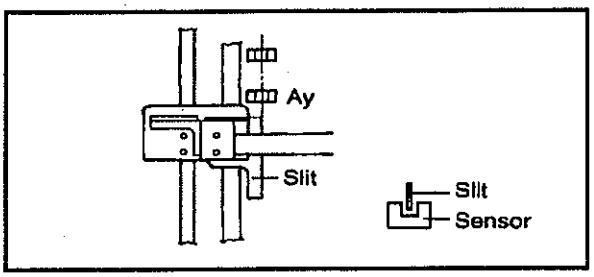


FIG.5

3-15 Thread take-up spring

[Inspection]

(1) Stroke: Hold needle thread before the thread tension plate. Pull the thread in direction A and the thread take-up spring starts moving. The length of thread pulled until the spring stops is regarded as the stroke. The thread take-up spring stroke must be 14±1mm (Fig.1).

(2) Initial tension: Hold the needle thread before the thread tension plate and pull the thread in direction A. The initial tension is regarded as the force required to move the thread take-up spring 1mm. The initial thread take-up 1mm. The initial thread take-up spring tension must be 3~5g (Fig.1).

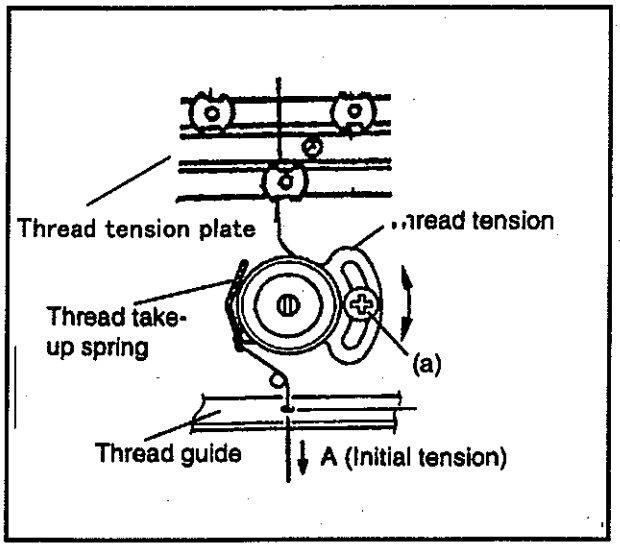


FIG.1

[Adjustment]

(1) If the thread take-up spring stroke differs from that specified, loosen retaining screw (a) and move the entire thread tension in the direction of the arrow or adjustment (Fig.1).

(2) If the initial thread take-up spring tension differs from that specified, set a screwdriver into the thread tension shaft and turn it in either direction B or C for adjustment (Fig.2).

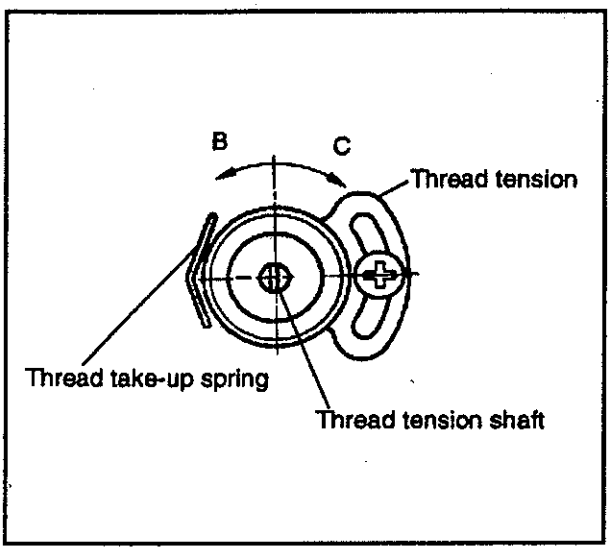


FIG.2

3-16 Thread sensor

[Inspection]

(1) Rocking arm tip movement A must be 1.5mm or more when spring pressure F of the arm is 1g.(Fig.1).
(2) The proximity switch is turned on/off when rocking arm tip movement A is 0.1 ~0.5mm (Fig.1).

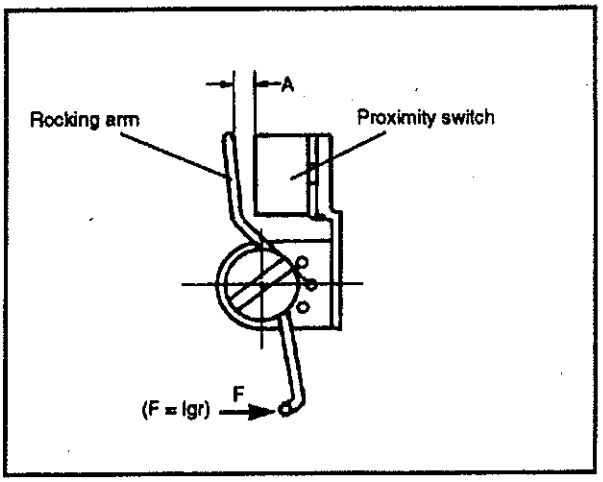


FIG.1

[Adjustment]

(1) If the spring pressure of the rocking arm tip differs from that specified, remove the fulcrum shaft and change the insertion position of the sensor spring (Fig.2).
(2) If the proximity switch is not turned on/off correctly, replace the switch (Fig.1). (Refer to "4-16 Thread sensor" on page 65).

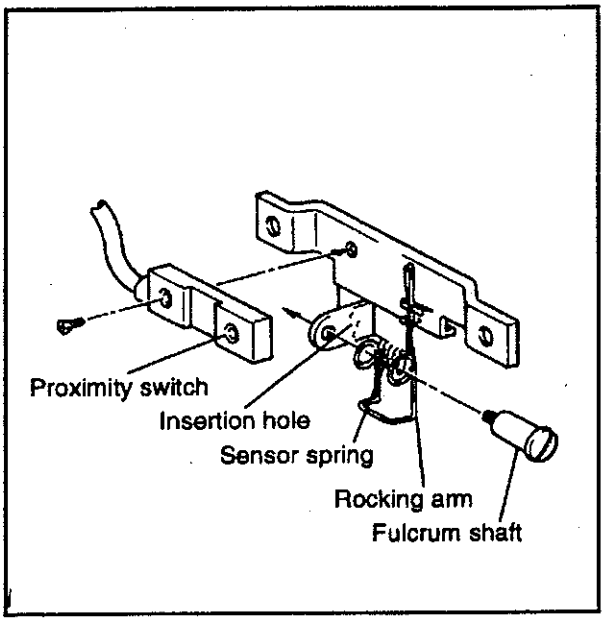


FIG.2

3-17 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.
(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.

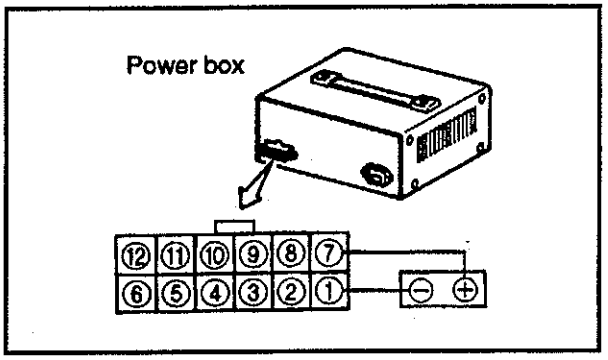


FIG.1

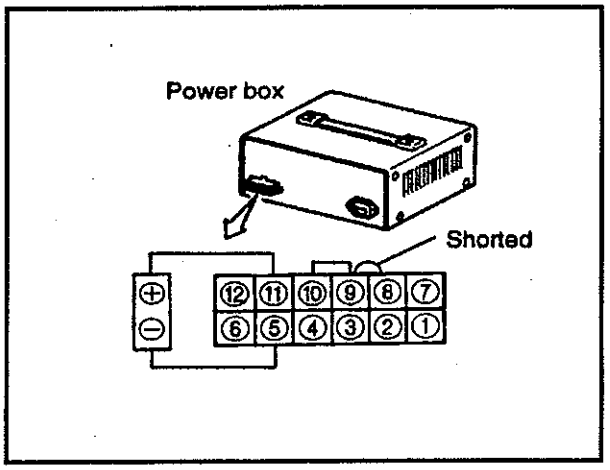


FIG.2

[Adjustment]

(1) Remove eight retaining screws (a) and then the case cover (Fig.3).
(2) Turn power on.
(3) If the 5V power supply differs from that specified, replace the circuit board (Refer to "4-6 5V power supply" on page 54).
(4) If the 24V power supply (⑤～⑪) differs from that specified, adjust power using VR1 (Fig.3).
(5) Turn power off and mount the case cover.

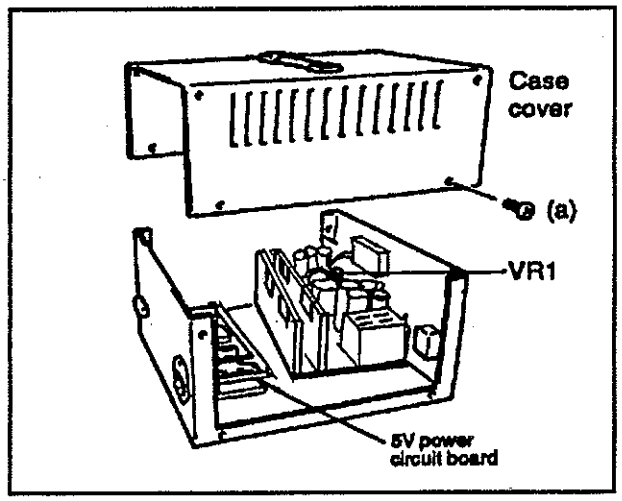


FIG.3

3-18 Press foot height

[Inspection]

(1) Rotate the hand wheel forward to bring the presser foot to the bottom dead center (Fig.1).
(2) Check the clearance A between the surface of needle plate and the bottom face of presser foot should be 1.0 to 1.5mm (Fig.1).

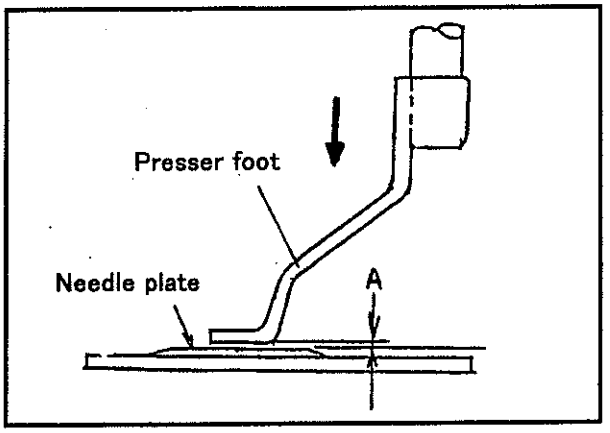


FIG.1

[Adjustment]

(1) If the presser foot height is not with the standard range, rotate the hand wheel forward to bring the presser foot to the bottom dead center (Fig.1).
Reference: **The angle of presser foot when its bottom dead center = 140 ± 1° .**
(2) Loosen the retaining screw (a) and adjust the height. Tighten the retaining screw (a) after adjustment (Fig.2).

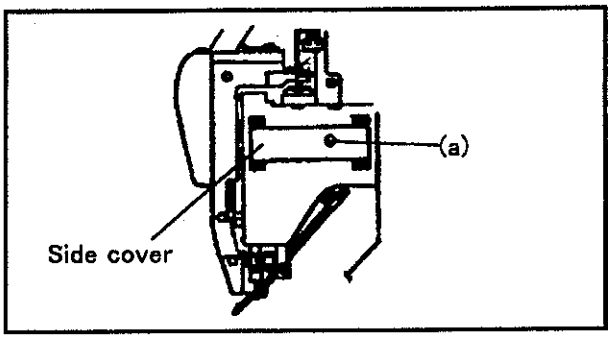


FIG.2

4. REPLACEMENT OF MAIN COMPONENTS

4-1 Rotary hook

[Removal]

(1) Remove the work table.
(2) Bring the needle bar to the top dead center, and remove the needle.
(3) Remove two retaining screws (a), and remove the needle plate (Fig.1).
(4) Remove the hook cover and take out the bobbin case (Fig.1).
(5) Remove retaining screw (b), and remove the hook retainer (Fig.1).
(6) Loosen three retaining screws (c), and remove the rotary hook (Fig.1).

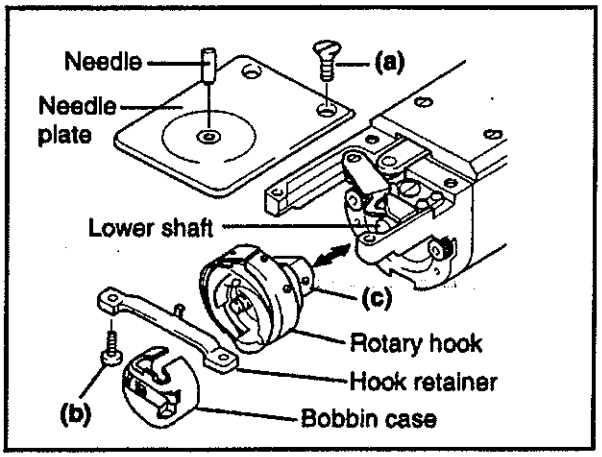


FIG.1

[Installation]

(1) Put the rotary hook along the lower shaft (Fig.1).
(2) Align the protrusion of the hook retainer with the dent in the rotary hook, and temporarily fit the hook retainer with retaining screw (b) (Fig.1).
(3) Attach the needle and rotate the hand wheel to bring the needle bar to the bottom dead center. Rotate the hand wheel again to align the upper timing mark with the bottom face of the arm jaw (Fig.2).
(4) Rotate the rotary hook manually to align the hook tip with the needle center. Secure a clearance of 0.03 ~ 0.07mm between the needle and the hook tip and temporarily tighten retaining screw (c) closest to the hook tip (Figs. 1and 2).
(5) Rotate the hand wheel forward to align the upper timing mark with the bottom face of the arm jaw and check the position of the needle and the hook tip. Firmly tighten three retaining screws (c) (Figs. 1and 2).
(6) Adjust the hook retainer position, and retighten retaining screw (b) (Figs. 1and 3).(Refer to "3-2 Position of the hook retainer" on page 28)
(7) Insert the bobbin case, and attach the needle plate with two retaining screws (a) (Fig.1).
(8) Attach the hook cover and the work table.

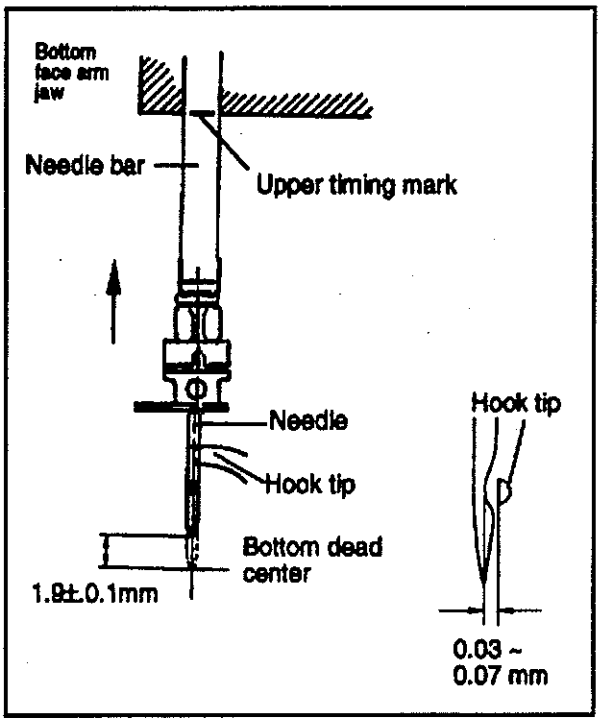


FIG.2

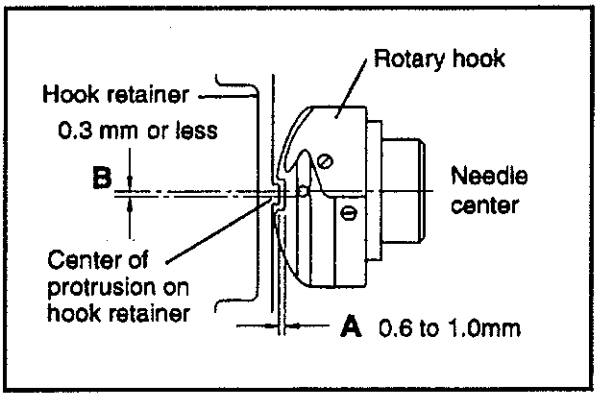


FIG.3

4-2 Thread cutter

[Removal]

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

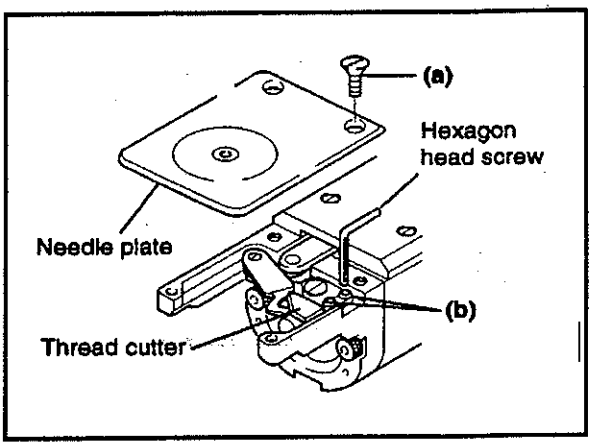


FIG.1

[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 retaining screws(b) (Fig.2).

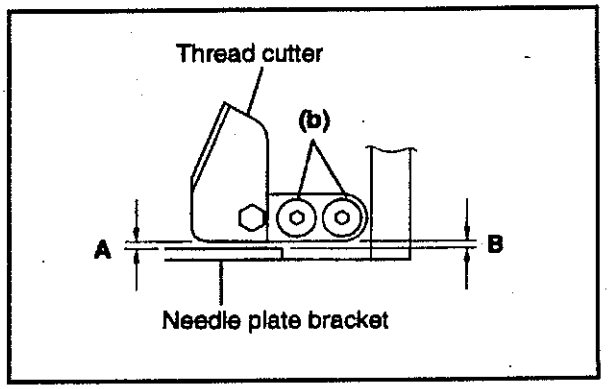


FIG.2

[Inspection]

Check the blade pressure of the thread catcher and the thread cutter (Fig.3). (Refer to "3-6 Blade pressure"on page 28).

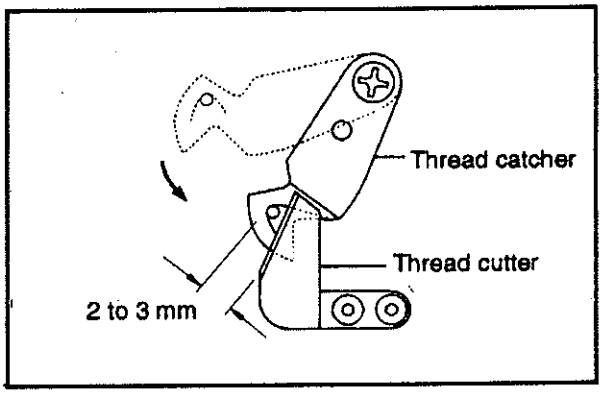


FIG.3

4-3 Thread catcher

[Removal]

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

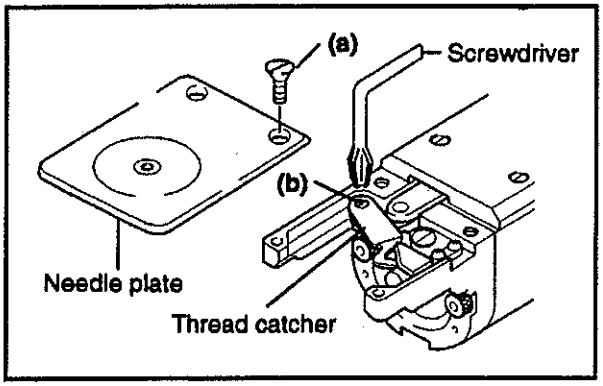


FIG.1

[Installation]

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

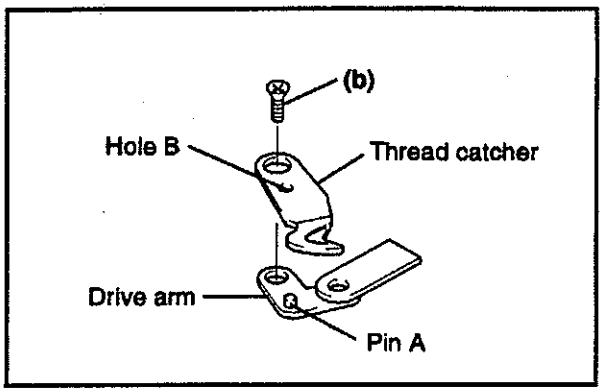


FIG.2

[Inspection]

(1) When the thread catcher is in the waiting position, the dimension between the shoulder and the thread cutter must be 0.6 to 1.0mm (Fig.3). (Refer to "3-4 Waiting position of thread catcher"on page 26).
(2) Check the blade pressure of the thread catcher and the thread cutter (Fig.4).(Refer to "3-6 Blade pressure"on page 28).

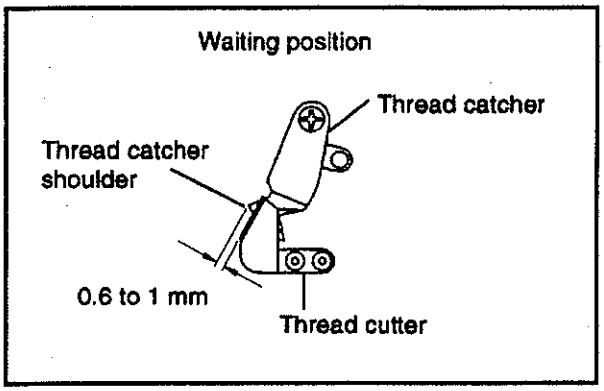


FIG.3

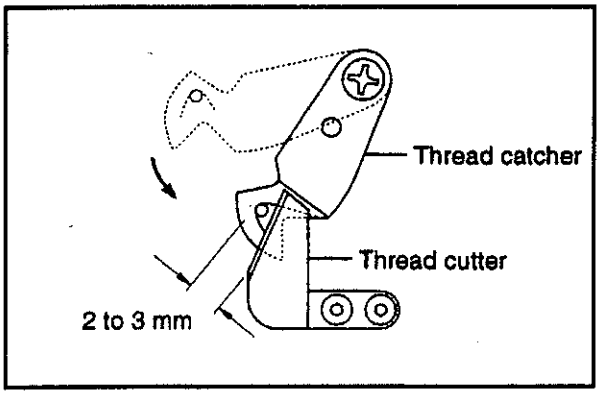


FIG.4

4-4 Needle case

[Remove]

(1) Move the needle to position No.6 and turn power off.
(2) Remove the arm cover, wiper cover, and adjuster base (Fig.1).
(3) Loosen two screws (a) holding the thread wiper hook bracket (Fig.2).
(4) Remove retaining screw (b) and the needle attachment/removal sensor with the bracket (Fig.3).
(5) Remove two retaining screws (c) and the thread sensor with the bracket (Fig.4).
(6) Loosen the screw holding the presser foot (Fig.3).

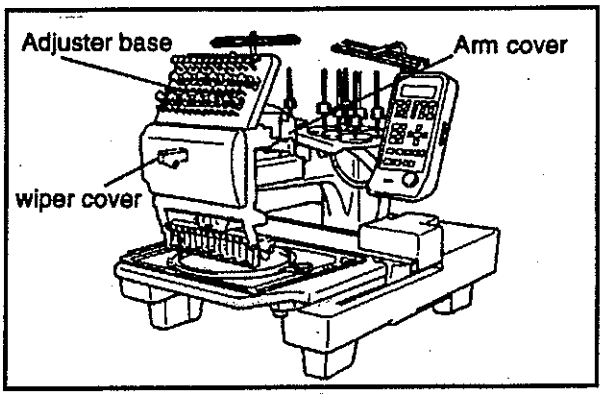


FIG.1

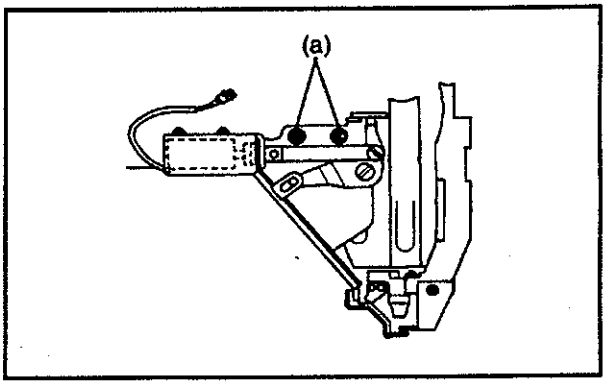


FIG.2

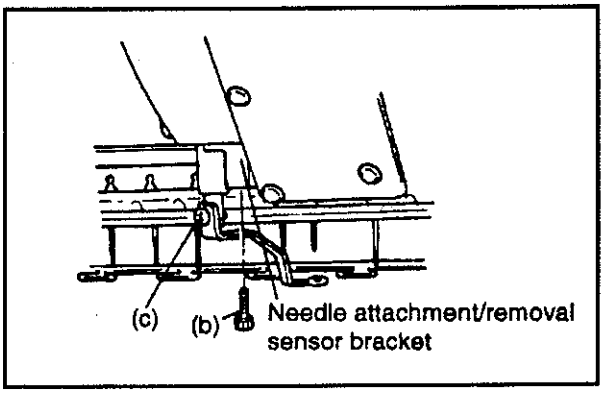


FIG.3

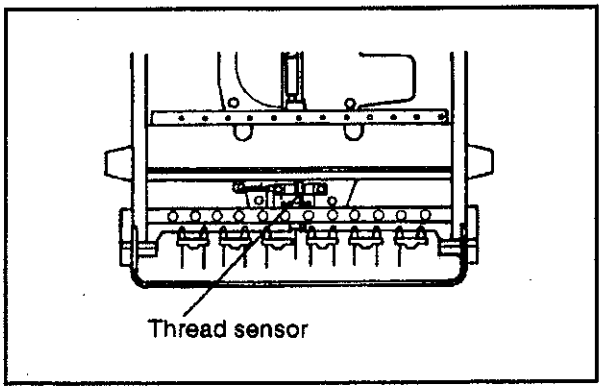


FIG.4

(7) Remove the needle position circuit board and bracket (Fig.5). (Refer to "4-15 Needle position circuit board" on page 64.)
(8) Remove three retaining screws (d) and then the thread change motor bracket (Fig.6).
(9) Remove three retaining screws (e) on the top of the needle case and draw out the guide rail from the right side (Fig.7).
(10) Position the needle bar to the top dead center and remove four retaining screws (f) of the lower guide rail holder. Drawing the needle case out from the bottom of the needle bar, remove the case from the arm (Figs. 8 and 9).

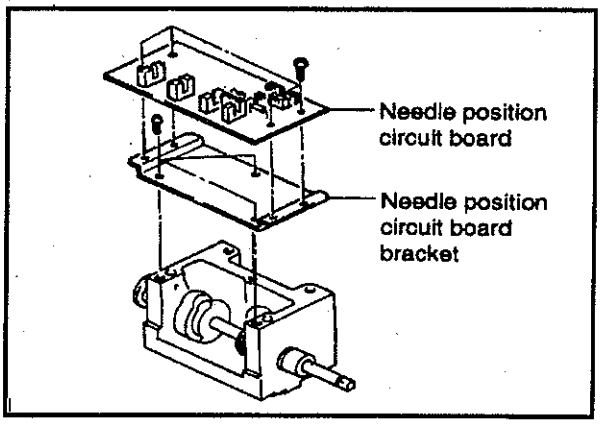


FIG.5

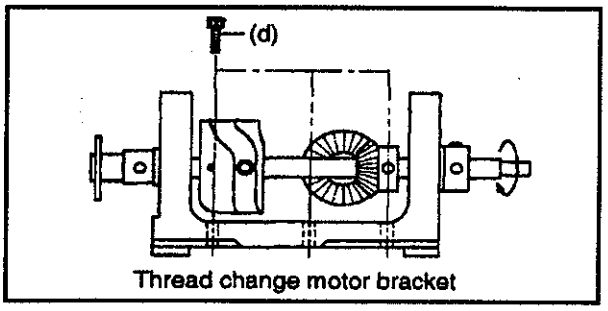


FIG.6

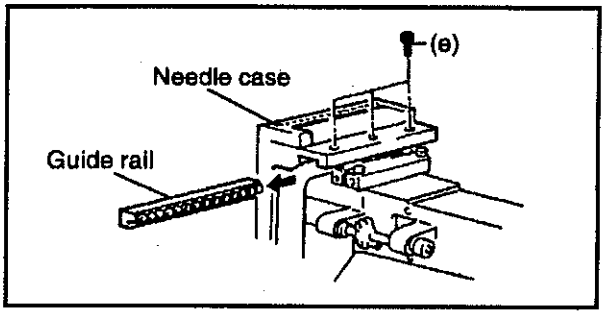


FIG.7

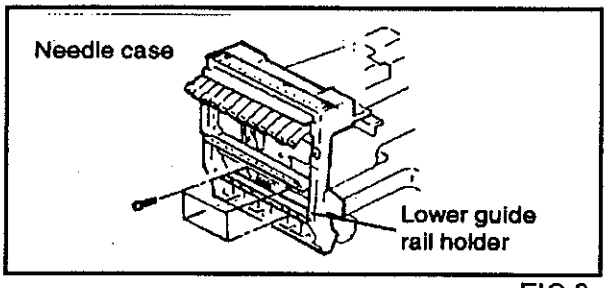


FIG.8

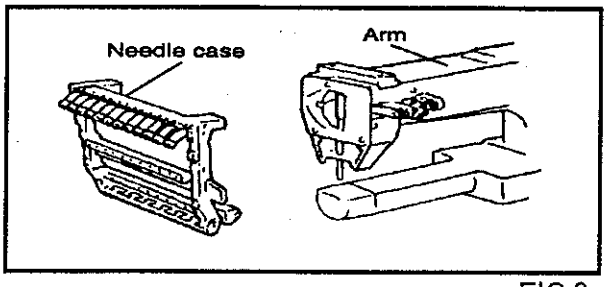


FIG.9

[Installation]

(1) Position the needle bar at the top dead center. Allow the needle case to pass under the needle bar and attach the case to the arm, while supporting the case with your hand (Fig.1).

(2) While inserting the needle case guide rail into the case groove from the right side, set the guide rail into the clearance between lower bearings (Fig.2).

(3) Secure the lower guide rail holder with four retaining screws (a), while pushing the needle case down (Fig.3).

Note: Check that the needle case both edge are free from vertical play.

(4) Temporarily tighten three retaining screws (b) (Fig.2).

(5) Rotate the shaft to bring the mark of the cam to the bottom side .Insert the guide rail collar into the cam groove. Secure the guide rail with three retaining screws (c) (Fig.4).

Note: Use an M6 spanner to rotate the shaft.

(6) Rotate the hand wheel. Move the needle case to align the center of the needle socket with the center of the needle socket holder. Secure the case with three retaining screws (b) (Figs. 2and 5).

Note: Check that the needle socket is mated with the needle socket holder in an upright position.

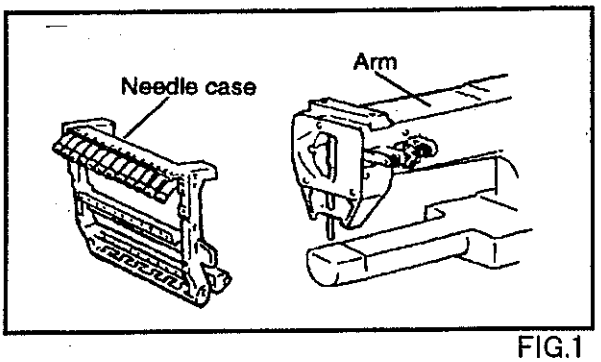


FIG.1

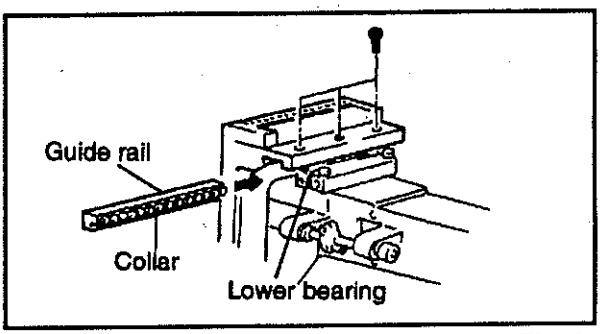


FIG.2

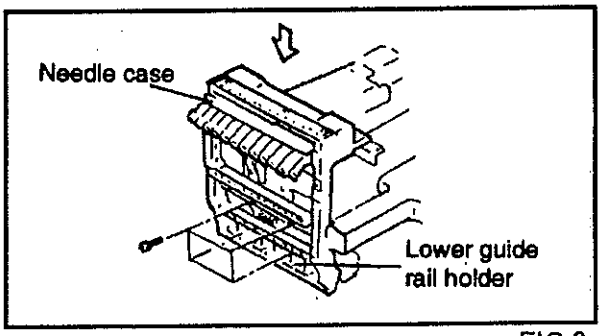


FIG.3

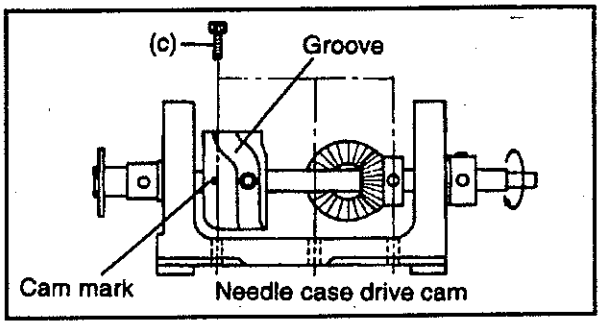


FIG.4

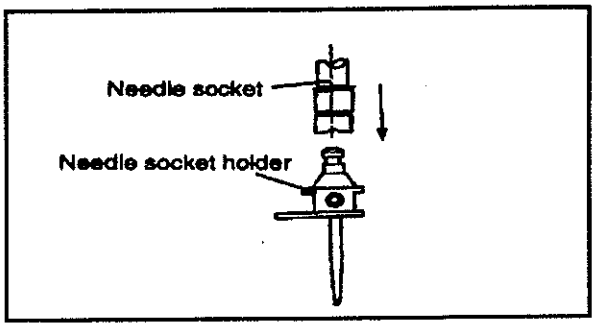


FIG.5

(7) Secure the bracket of the needle position circuit board with three retaining screws (d) (Fig.6).
(8) Secure the needle position circuit board with four retaining crews (e) (Fig.6). (Refer to "4-15 Needle position circuit board"on page 64.)
(9) Secure the thread sensor with retaining screw (f) (Fig.7). (Refer to "4-16 Thread sensor "on page 65.)
(10)Secure the needle attachment/removal sensor with retaining screw (g) (Fig.8).
(11)Mount the thread wiper hook. (Refer to "3-8 Thread wiper hook "on page 31.)
(12)Align the needle center with the center of the presser foot hole and secure with retaining screw (h) (Fig.9).
(13)Turn power on and check that the thread is changed correctly.
Note: If the needle case position error has occurred, carry out adjustment. (refer to "2-4 An error message is displayed"on page 5.)
(14)Mount the adjuster base, side cover, and arm cover.

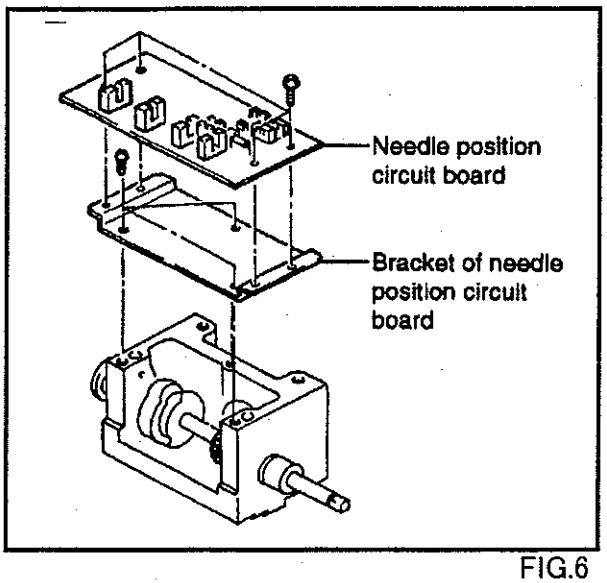


FIG.6

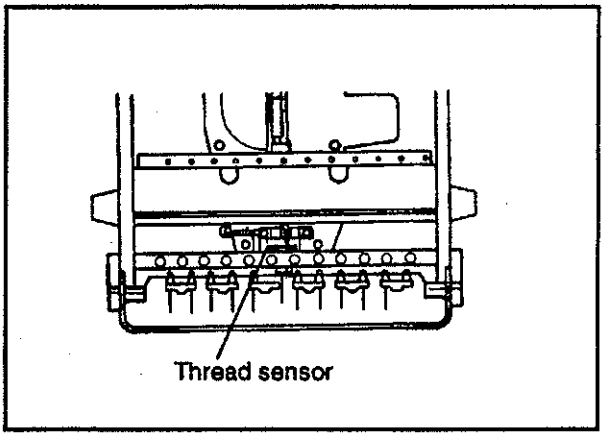


FIG.7

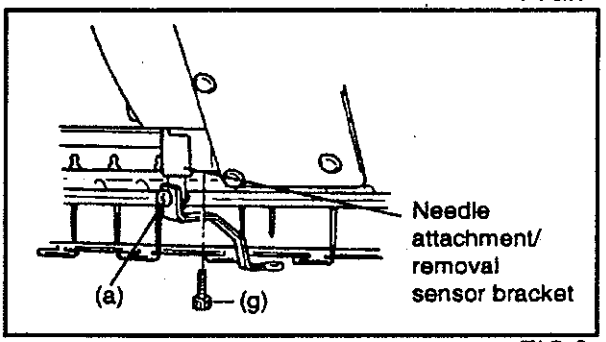


FIG.8

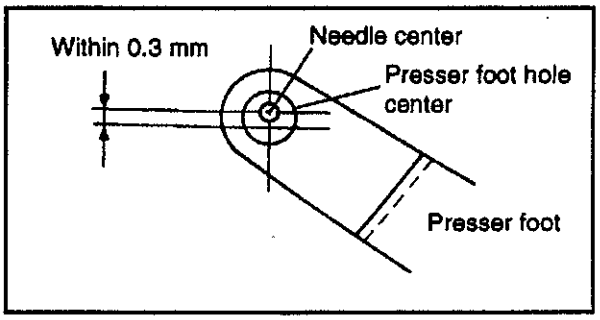


FIG.9

4-5 Thread chang motor

[Removal]

(1) Remove the arm cover, wiper cover, and adjuster base (Fig.1).
(2) Remove the needle position circuit board and the bracket (Fig.2) (Refer to "4-15 Needle position circuit board"on page 64.)
(3) Remove three retaining screws (a) and the thread change motor bracket (Fig.3).
(4) Loosen retaining screws (b), (c),(d), and (e)(two pieces for each),and draw out the shaft from the thread change motor bracket (Fig.3).
(5) Loosen two retaining screws (f) and remove gear ① (Fig.3).
(6) Remove the connector and three retaining screws (g), and the thread change motor (Fig.4).

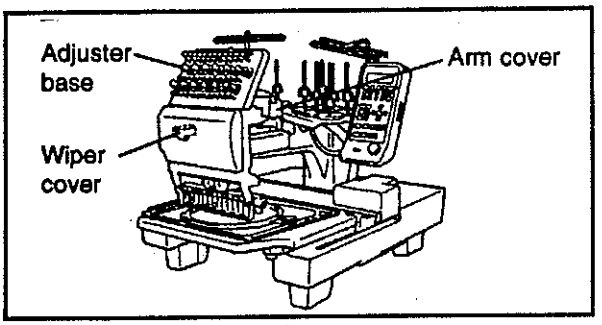


FIG.1

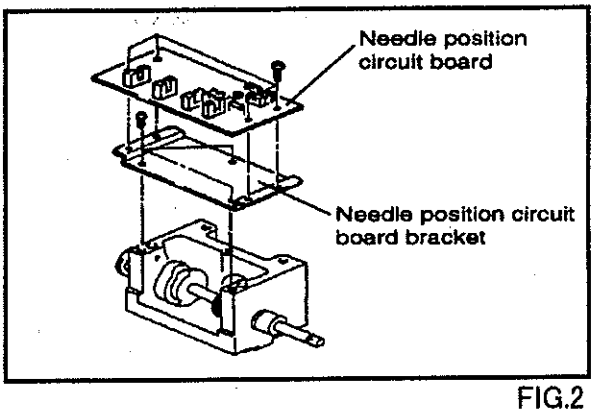


FIG.2

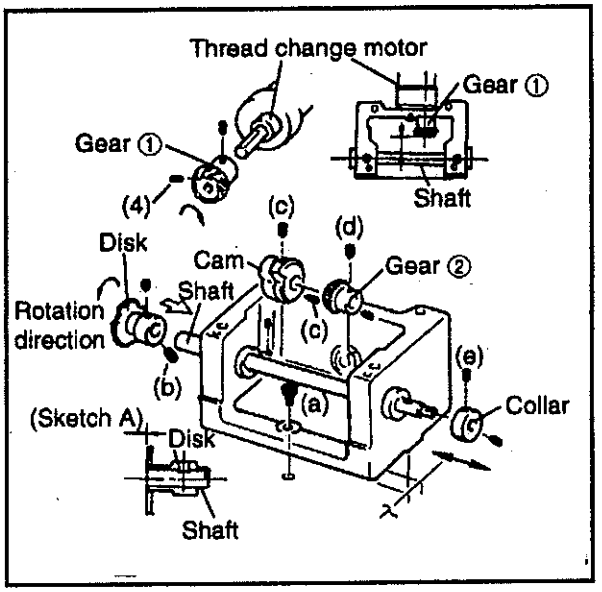


FIG.3

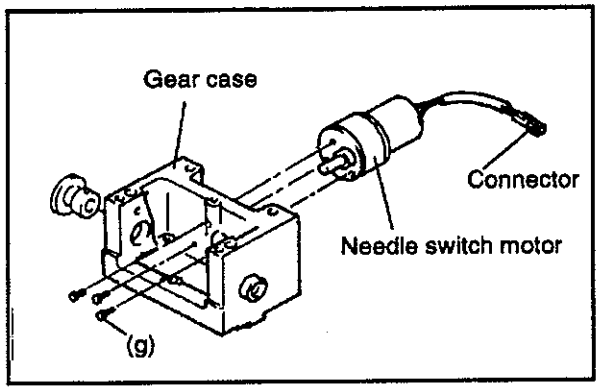


FIG.4

[Installation]

(1) Replace the thread change motor to the gear case using the three retaining screws (g) (Fig.5).
(2) Insert the gear ① to the thread change motor shaft to align the set screw of the gear ① with the flat part of the shaft, then temporarily secure the motor gear ① using the two retaining screws (f) (Fig.6).
(3) Insert the collar to the shaft and the shaft to the gear case from the right side (Fig.6). Insert the shaft to the gear ② the cam and the sensor disk in this order (Fig.6).
Note: Be sure that the mark of the cam must be on the left side.
(4) Slightly loosen the two retaining screws (f) and replace the motor gear ① end 3.0mm from the shaft, then secure it using the two retaining screws (f) (Fig.6).
(5) Replace the sensor disk to align the set screw of the disk with the flat part of the shaft, then secure it using the two retaining screws(b) (Fig.6).
Note: Be sure that the shaft end should be aligned with the flat surface of sensor disk.
(6) Replace the collar to align the set screw of the collar with the flat part of the shaft, then secure it using the two retaining screws(e) (Fig.6).
Note: Be sure that the shaft must not be shift more than 0.03mm.
(7) Replace the gear ② to align the set screw of the gear ② with the flat part of the shaft, then secure it using the two retaining screws (d) (Fig.6).
Note: Be sure that the backlash in between the two gears must be 0.05 to 0.1mm.
(8) Replace the cam to align the set screw of the cam with the set hole of the shaft, then secure it using the two retaining screws(c) (Fig.6).
Note: Rotate the shaft to bring the mark of the cam to the downward.
(9) Replace the gear case to the arm using the three retaining screws (a) (Fig.6).
(10) Replace the bracket using the three retaining screws (h) (Fig.7).
(11) Replace the needle position circuit board using the four retaining screws (i)(Fig.7).

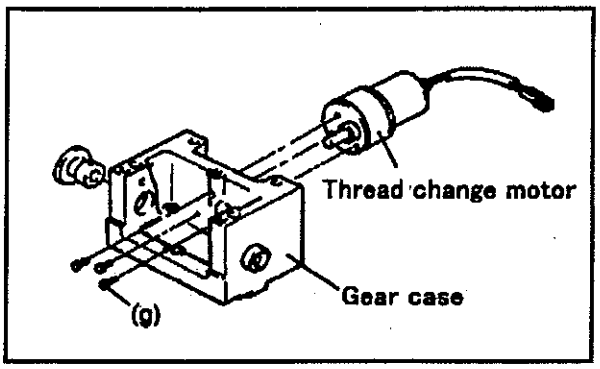


FIG.5

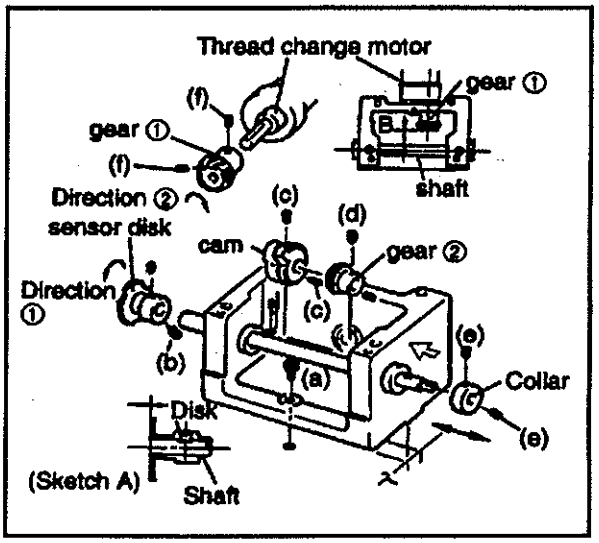


FIG.6

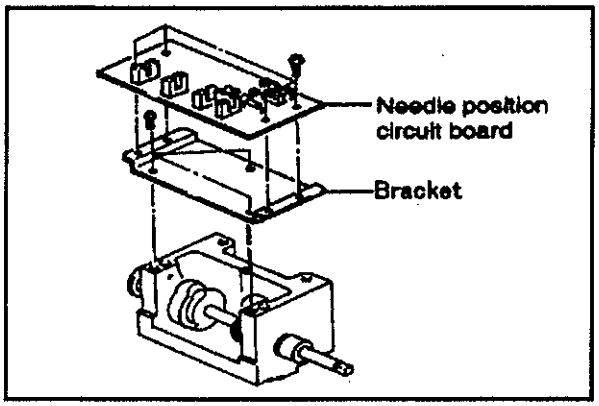


FIG.7

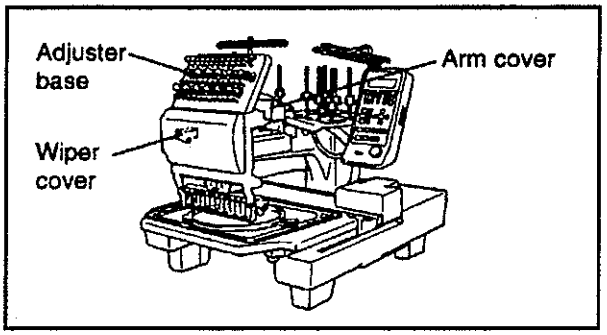


FIG.8

4-6 5V power supply

[Removal]

(1) Remove eight retaining screws (a) and then the case cover (Fig.1).
(2) Remove two retaining screws (b) and then the 5V power supply with the bracket (Fig.1)
(3) Disconnect connectors CN1 and CN2 (Fig.2).
(4) Remove four retaining screws (c) and then the 5V poser supply circuit board (Fig.2).

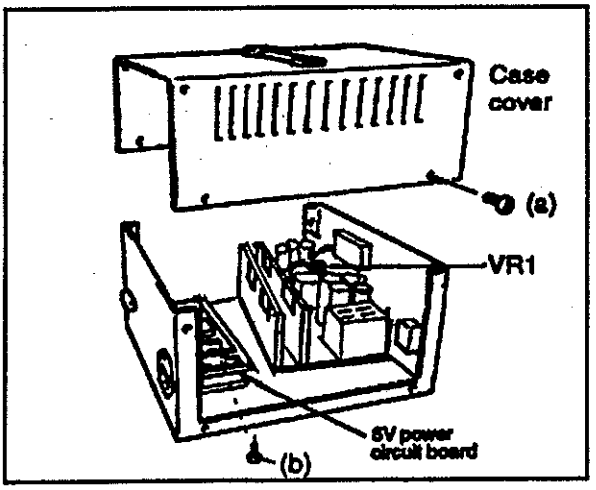


FIG.1

[Installation]

(1) Align the 5V power supply circuit board with the bracket screw hole and secure with four retaining screws(c) (Fig.2).
(2) Plug in the connector and secure the 5V power supply with two retaining screws (b) (Fig.1 and 2).
(3) Mount the case cover with eight retaining screws(a).

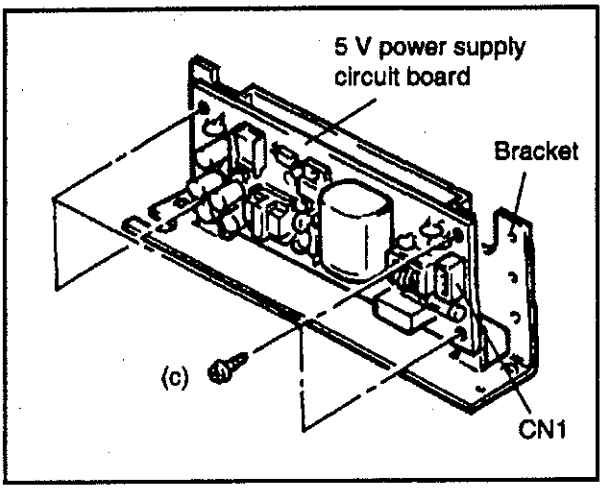


FIG.2

4-7 Power circuit board

[Removal]

(1) Remove two retaining screws (a) and work table B (Fig.1).
(2) Remove six retaining screws (b) and the cover (Fig.2).
(3) Disconnect all connectors.
(4) Remove four retaining screws (c) and the power circuit board (Fig.2).

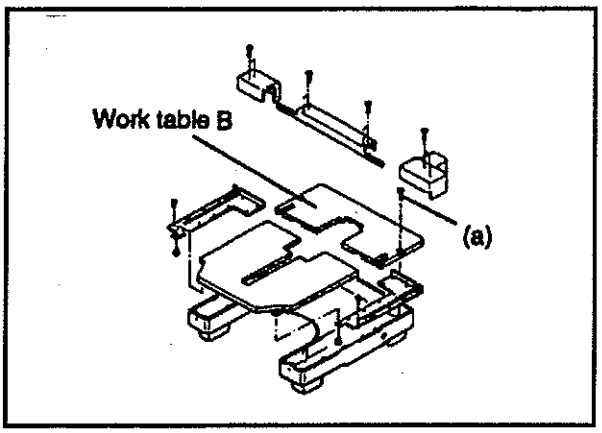


FIG.1

[Installation]

Reverse of[Removal]procedure.

Note: Be sure to insert the spacer when mounting the power circuit board to the circuit board base (Fig.2).

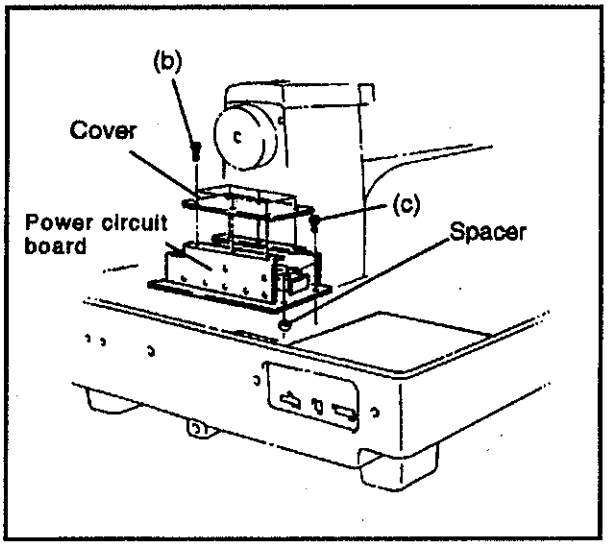


FIG.2

4-8 Thread wiper solenoid

[Removal]

(1) Remove the top cover and the side cover.
(2) Disconnect the connector of the thread wiper solenoid (Fig.1).
(3) Remove four retaining screws (a) and retaining screw (b), and the thread wiper solenoid (Fig.1).

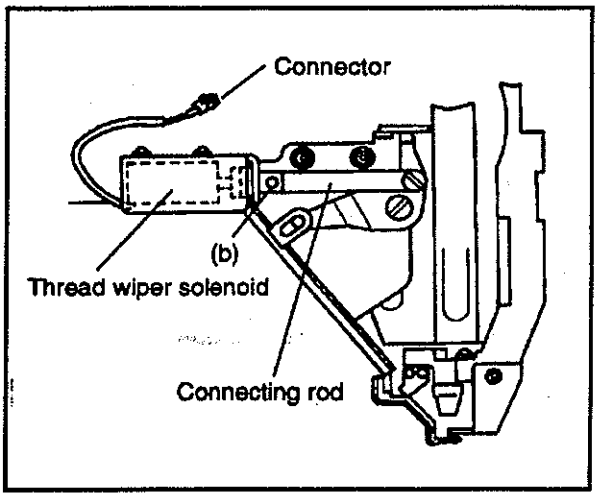


FIG.1

[Installation]

(1) Mount the thread wiper solenoid to the connecting rod with the cord side facing toward you, and secure the solenoid with retaining screw (b) (Fig.1).
(2) Temporarily secure the solenoid to the solenoid base with four retaining screws (a) (Fig.1).
(3) Push the thread wiper hook down as far as it will go in the direction of the arrow. Move the solenoid to the right and left so that distance A from the needle center to the thread wiper hook tip is 14 ~16mm. Firmly tighten set screw (a) (Figs.1 and 2).
Note: Push the guide pin down as far as it will go in the direction of the arrow and release it . Check that the guide pin returns to the original position (Fig.3).
(4) Mount side cover L and the top cover.

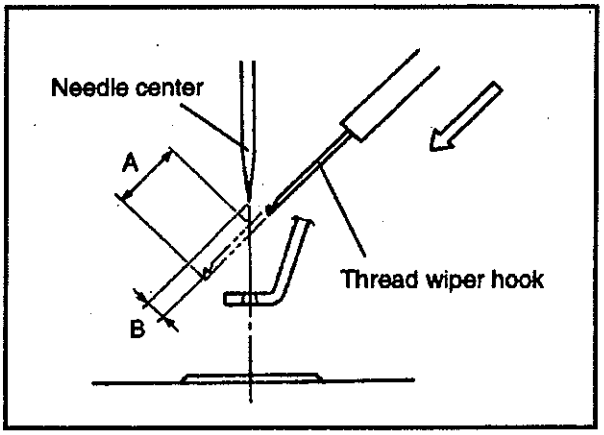


FIG.2

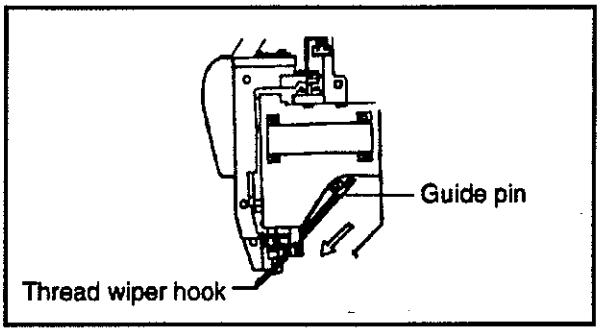


FIG.3

4-9 Main circuit board

[Removal]

(1) Remove two retaining screws (a) and the work table B (Fig.1).
(2) Remove two retaining screws (b). Loosen two retaining screws (c), and disconnect connectors (1) and (2) to remove the circuit board cover (Fig.2).
(3) Disconnect all connectors on the main circuit board.
(4) Remove seven retaining screws (d) and the main circuit board (Fig.2).

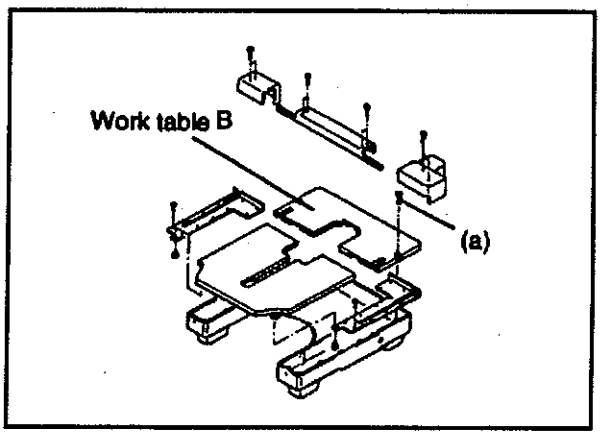


FIG.1

[Installation]

Reverse of[Removal]procedure.

Note: Be sure to insert the spacer when mounting the main circuit board to the circuit board base.

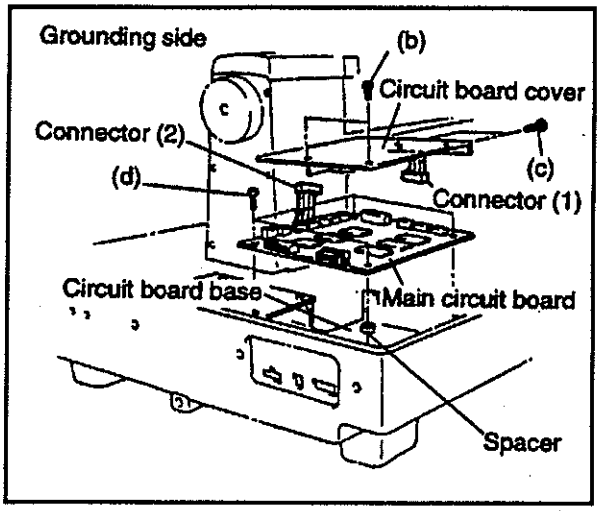


FIG.2

4-10 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).

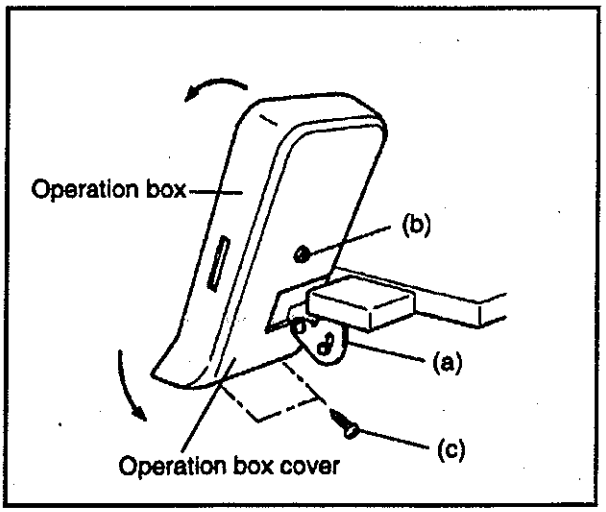


FIG.1

[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).

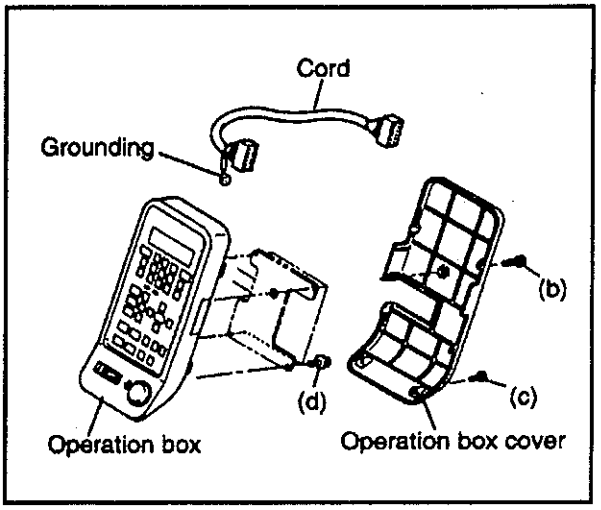


FIG.2

4-11 Upper shaft sensor

[Removal]

(1) Remove the top cover.
(2) Remove two retaining screws (a) and the sensor with the bracket (Fig.1).
(3) Remove two retaining screws (b) and the upper shaft sensor (Fig.2).
(4) Remove work table B.
(5) Remove two retaining screws (c) and loosen two retaining screws (d), and disconnect connectors (1) and (2) to remove the circuit board cover (Fig.3).
(6) Disconnect upper shaft sensor connector CN1 and remove the sensor (Fig.3).

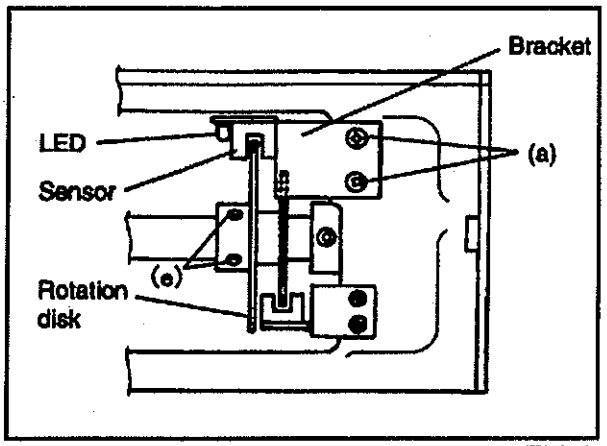


FIG.1

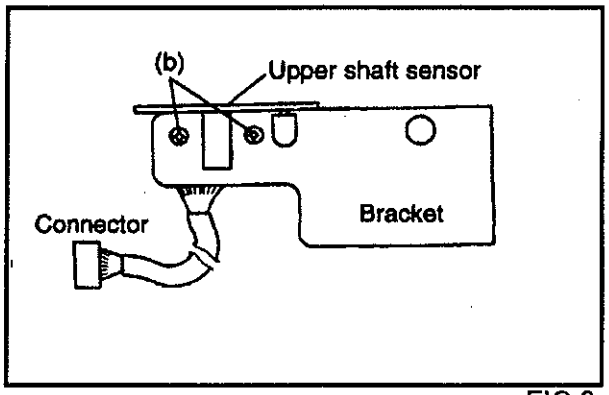


FIG.2

[Installation]

(1) Mount the upper shaft sensor to the bracket with two retaining screws (b) (Fig.2).
(2) Allow the connector to pass the arm and connect it to CN11 on the main circuit board and connect the connectors (1) and (2) (Figs. 2 and 3).
(3) Temporarily secure the bracket with two retaining screws (a). Check the following and firmly secure the screws:A=2 ± 0.5mm and B =C (Fig.4).
(4) Turn power on and rotate the hand wheel forward. Check that the LED lamp on the sensor circuit board lights when the needle bar has reached the bottom dead center (Fig.1).
Note: When the LED lamp does not lighted, loosen two retaining screws (e) and adjust the rotation disk position. Secure the screws after adjustment (Fig.1).
(5) Mount the circuit board cover and the work table B.

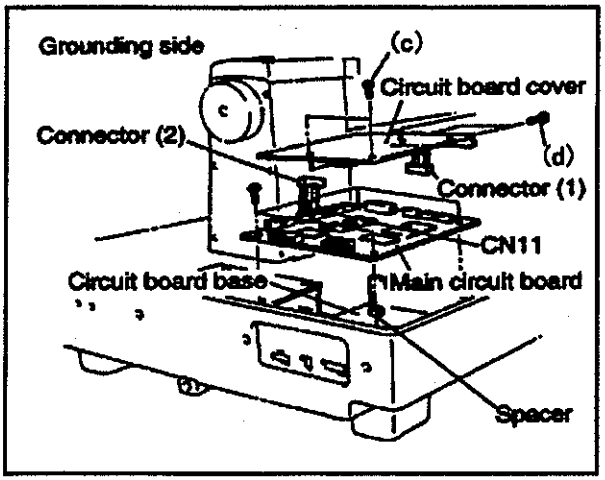


FIG.3

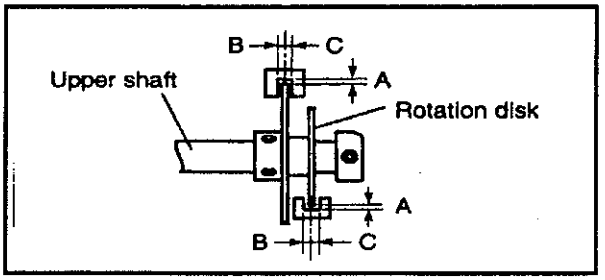


FIG.4

4-12 Sewing machine motor

[Removal]

(1) Remove work table B.
(2) Remove retaining screw (a) and the hand wheel (Fig.1).
(3) Remove six retaining screws (b) and the arm cover rear (Fig.1).
(4) Remove the power circuit board.
(Refer to "Power circuit board" on page 55.)
(5) Remove two retaining screws (c) (Fig.2).
(6) Loosen the nut and retaining screw (d), and remove the bracket.
(7) Remove four retaining screws (e) and the sewing machine motor (Fig.3).

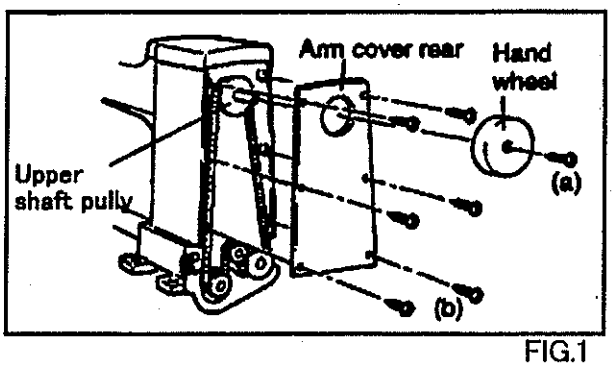


FIG.1

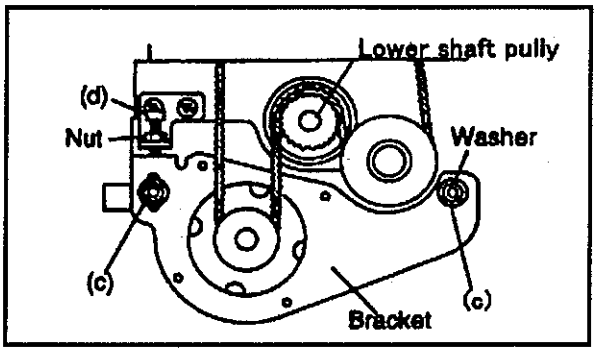


FIG.2

[Installation]

(1) Secure the sewing machine motor to the bracket using the four retaining screws (e) (Fig.3).
Note: Be sure the motor's cord face downward and use the washer.
(2) Remove the four retaining screws (f) and the bed cover A(Fig.4).
(3) Rotate the lower shaft pulley forward to align the timing mark on the thread trimming cam with the mark on the base block (Figs.2 and 5). Rotate the upper shaft pulley forward to bring the needle bar to the lowest center point (Fig.1).
(4) First hook the belt onto the upper shaft pulley and finally the lower shaft pulley (Figs.1 and 2).
Note: Be sure to hold the tight during the belt hook onto the upper and lower shaft pulleys.
(5) Temporarily secure the motor bracket using the two retaining screws (c) (Fig.2).
Note: BE sure to use a washer.
(6) Rotate the upper shaft pulley forward to bring the needle bar to the lowest center point (Fig.1).
Note: Be sure to align the timing mark on the thread trimming cam with the mark on base block (Fig.5).

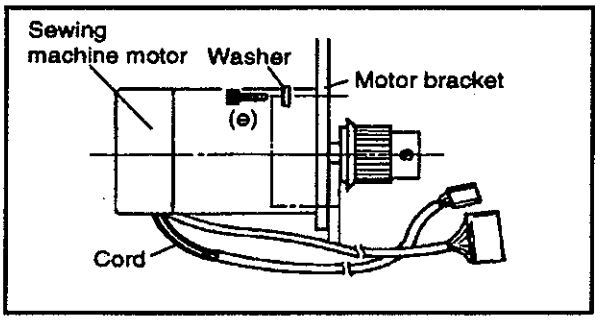


FIG.3

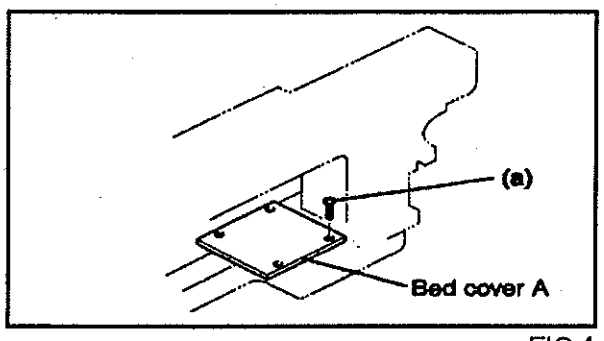


FIG.4

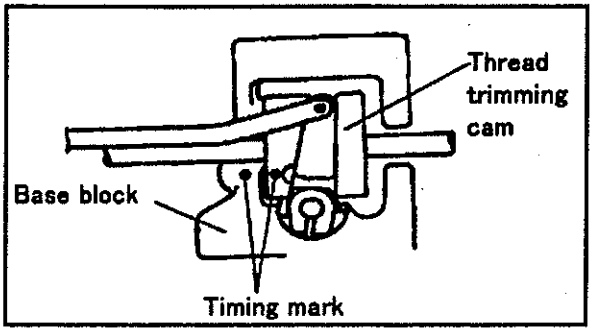


FIG.5

(7) Check the belt tension. If it is not within the standard range, adjust the belt tension using the adjustment screw (d) and check the belt tension again (Fig.6).
(8) Tighten the nut and secure the motor bracket using the two retaining screws (c) (Fig.6 and 7).
(9) Replace the power circuit board, the rear arm cover, the hand wheel and work table B (Fig.1).

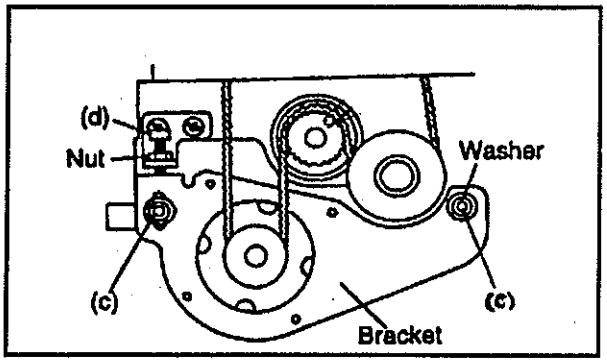


FIG.6

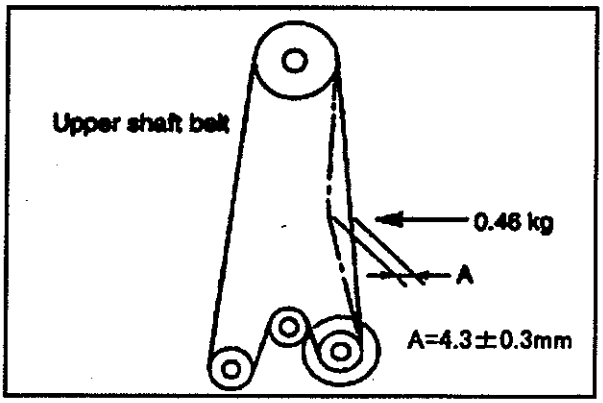


FIG.7

4-13 X motor

[Removal]

(1) Remove X.Y cover R (Fig.1).
(2) Remove two retaining screws (a) and retaining screw (b) (Fig.2).
(3) Disconnect the connectors. Remove four retaining screws (c) and the X motor (Fig.2).

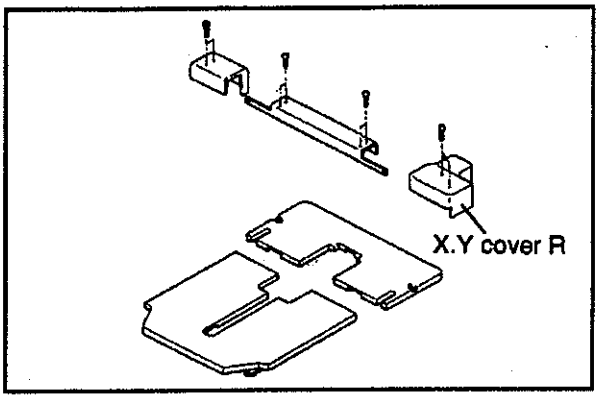


FIG.1

[Installation]

(1) Mount the X motor to bracket A with four retaining screws (c) (Fig.2).
(2) Set the X motor gear to the belt and temporarily secure brackets A and B with two retaining screws (a) (Fig.2).
(3) Adjust the belt tension with retaining screw (b) and firmly tighten two retaining screws (c) (Figs. 2 and 3).
(4) Connect the connectors.

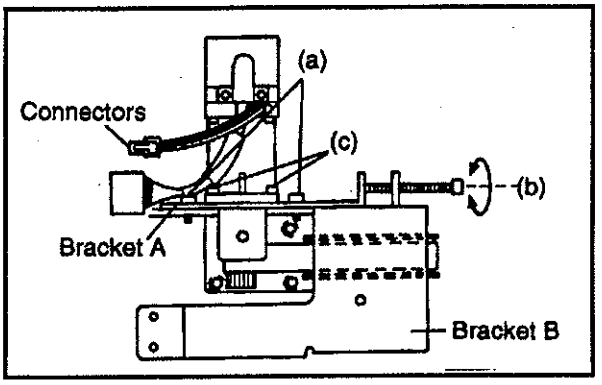


FIG.2

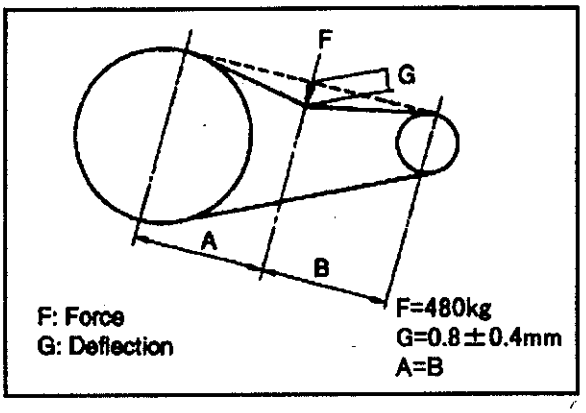


FIG.3

4-14 Y motor

[Removal]

(1) Remove two retaining screws (a) and work table B (Fig.1).
(2) Remove two retaining screws (b) and retaining screw (c) (Fig.2).
(3) Disconnect the connectors. Remove four retaining screws (d) and the Y motor (Fig.2).

[Installation]

(1) Mount the Y motor to bracket A with four retaining screws (d) (Fig.2).
(2) Set the Y motor gear to the belt and temporarily secure brackets A and B with two retaining screws (b) (Fig.2).
(3) Adjust the belt tension with retaining screw (c) and firmly tighten two retaining screws (b) (Fig. 2 and 3).
(4) Connect the connectors. (Fig.2).

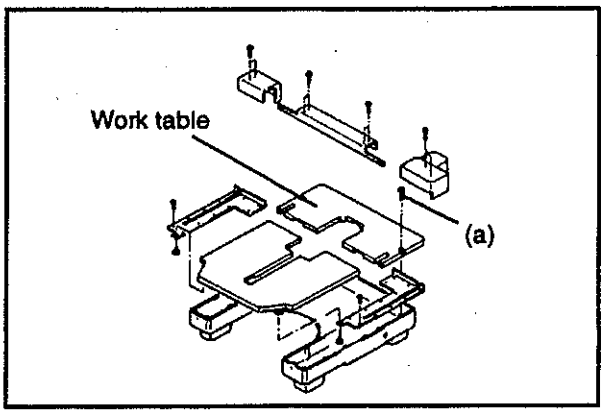


FIG.1

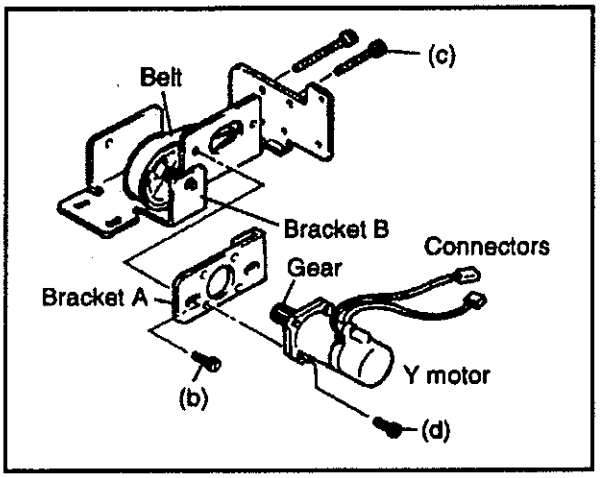


FIG.2

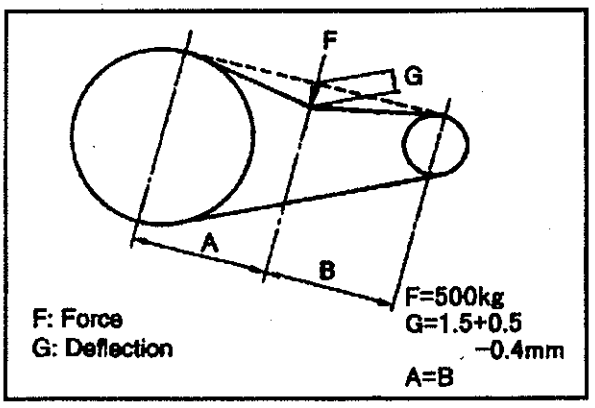


FIG.3

4-15 Needle position circuit board

[Removal]

(1) Remove the arm cover.
(2) Remove retaining screw (a) and the stopper (Fig.1).
(3) Remove four retaining screws (b) and the needle position sensor plate. (Fig.1).
(4) Disconnect the connector.
(5) Remove four retaining screws (c) and the needle position circuit board (Fig.2).

[Installation]

(1) Mount the needle position circuit board with four retaining screws (c) (Fig.2).
(2) Connect all connectors on the circuit board.
(3) Temporarily secure the sensor plate with four retaining screws (b). Position the plate so that it does not contact the photo-sensor slot and firmly tighten the screws (Fig. 1 and 3).
(4) Temporarily secure the stopper with retaining screw (a). Position the stopper so that it slightly contacts the motor shaft and tighten the screw (Fig.1).
(5) Mount the arm cover.

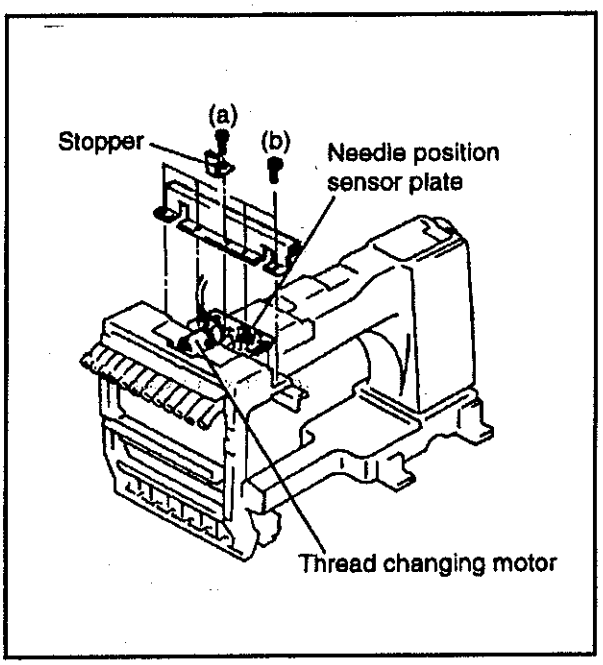


FIG.1

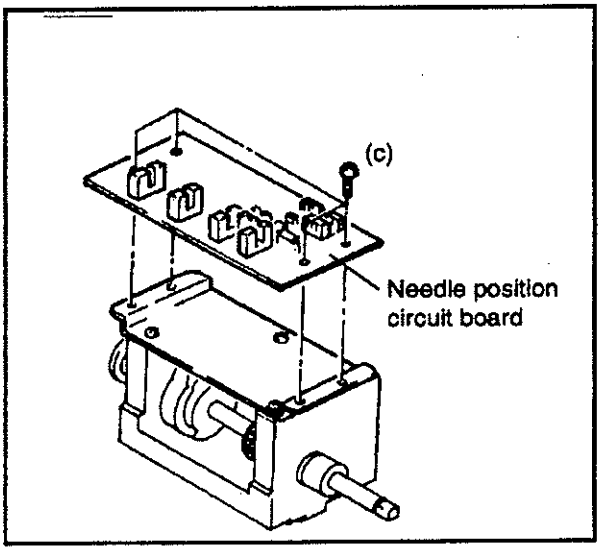


FIG.2

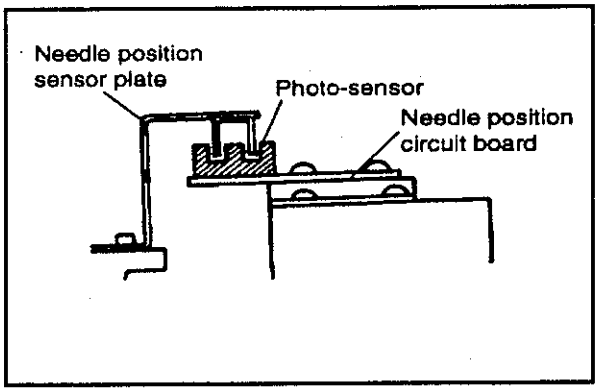


FIG.3

4-16 Thread sensor

[Removal]

(1) Remove the top cover and wiper cover.
(2) Disconnect the sensor connector (Fig.1).
(3) Remove the cord fixtures (2 places) (Fig.2).
(4) Remove retaining screw (a) and the thread sensor (Fig.3).

[Installation]

(1) Temporarily secure the thread sensor with retaining screw (a). Allow the bottom end of the sensor to slightly contact the sensor bracket stopper and tighten retaining screw (b) (Fig.4).
(2) Connect the sensor connector and secure the cord with the fixture (Figs. 1 and 2).
(3) Mount the top cover and side cover L.

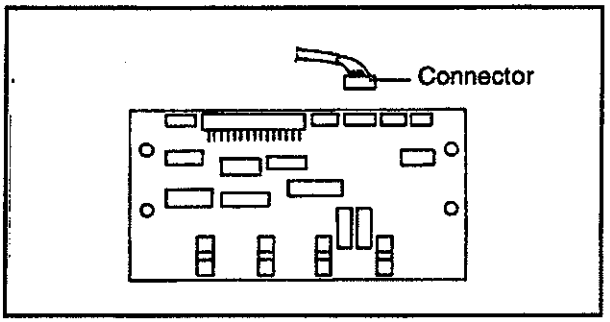


FIG.1

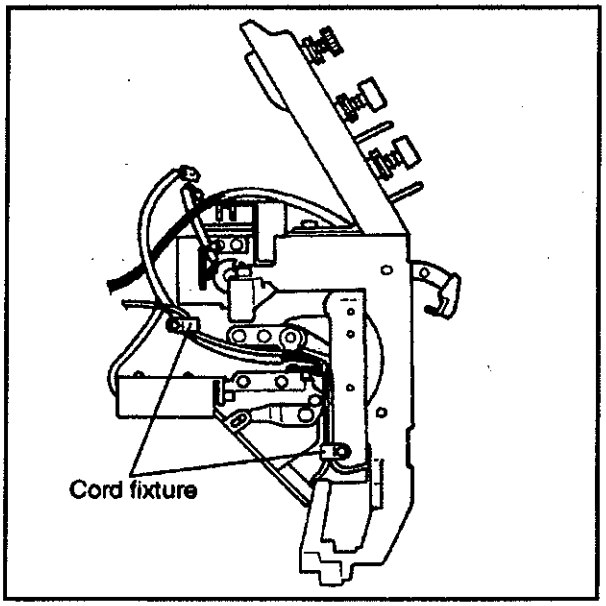


FIG.2

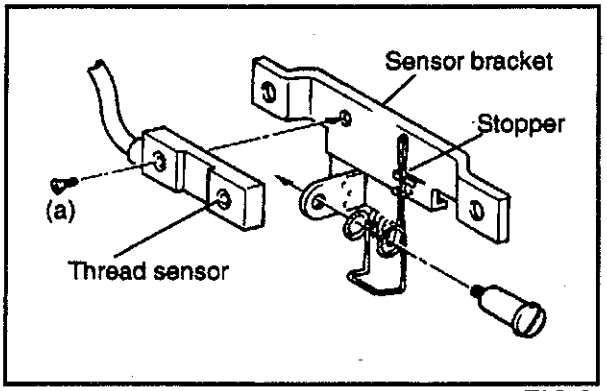


FIG.3

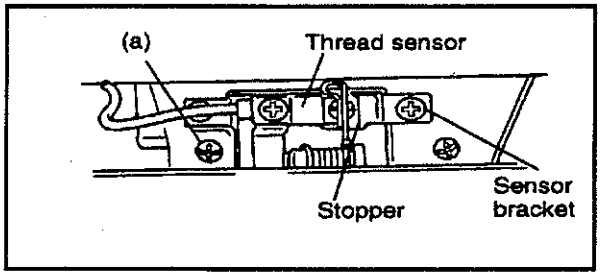


FIG.4

4-17 Operation control circuit board

[Removal]

(1) Remove two retaining screws (a) and the work table B (Fig.1).
(2) Remove two retaining screws (b) and loosen the two retaining screws (c), and disconnect connectors (1) and (2) to remove the circuit board cover (Fig.2).
(3) Remove spacers (1), two retaining screws (d), and the operation control circuit board (Fig.3).

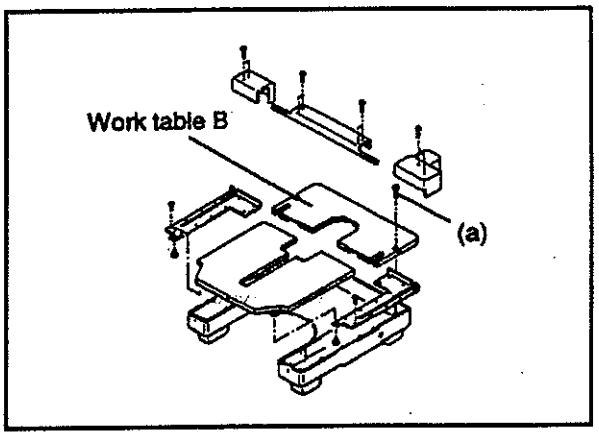


FIG.1

[Installation]

Reverse of [Removal] procedures.

Note: Be sure to check that spacers (2) are firmly tighten when mounting the operation control circuit board to the circuit board cover (Fig.3).

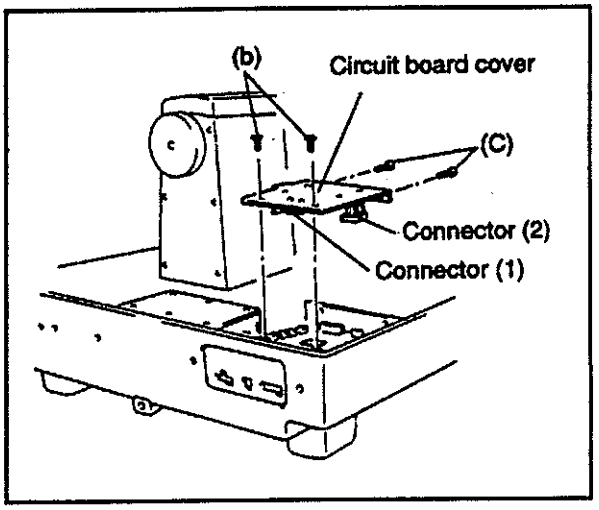


FIG.2

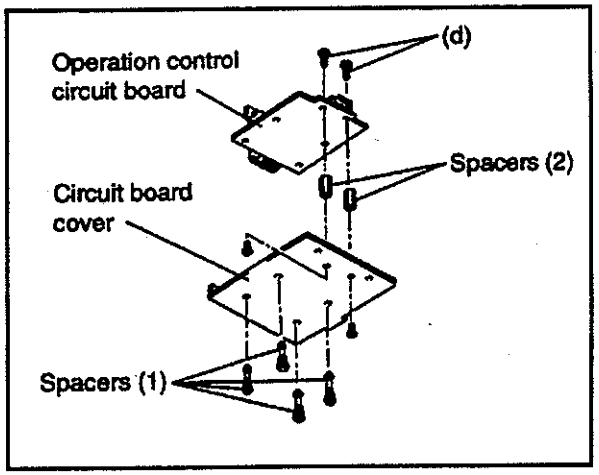


FIG.3

5 TEST MODE

The display shows "NEEDLE CASE POSITION ERROR" when the difficulty with the needle change. The "TEST MODE" is composed of the fifteen steps and each step moves individualy, so it makes easily to check the necessary adjustment.

5-1 Change to the TEST MODE

(1) Be sure the power is OFF.
(2) Remove the retaining screw (a) and the dip switch cover (Fig.1).
(3) Set the dip switch 1-1 to the ON position, turn the power back on and press the SET key (Figs.2 and 3).
(4) Move the cursor by pressing the down arrow key to set at #2 for MAIN ROM, then press the SET key (Fig.3).
Note: Be sure the display shows "Main CPU TEST".

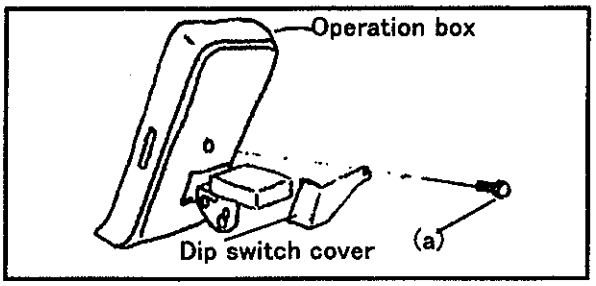


FIG.1

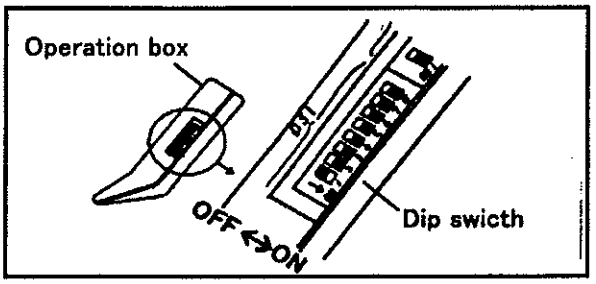


FIG.2

5-2 How to operate the TEST MODE

(1) The "TEST MODE" is composed of the fifteen steps (Chart 1 on page 68).
Reference: The angle of each step allow for ±0.5° .
(2) Press the TEST key once to change the next step (Fig.3).
Note: Be sure press it slow tempo.

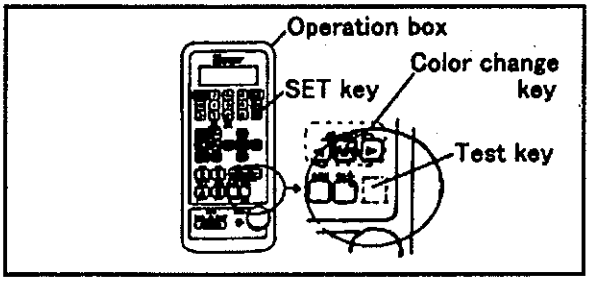


FIG.3