

mitsubishi

Industrial Sewing Machine

INSTRUCTION MANUAL

Electronic Pattern Sewing Machine

Model PLK-1710

A180E104P03



From the library of: Superior Sewing Machine & Supply LLC

In order to operate your sewing machine PLK-1710, in the best condition, please read Instruction Manual carefully and handle and maintain properly the machine.

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1. CONSTRUCTION

PLK-1710 consists of the components shown below.

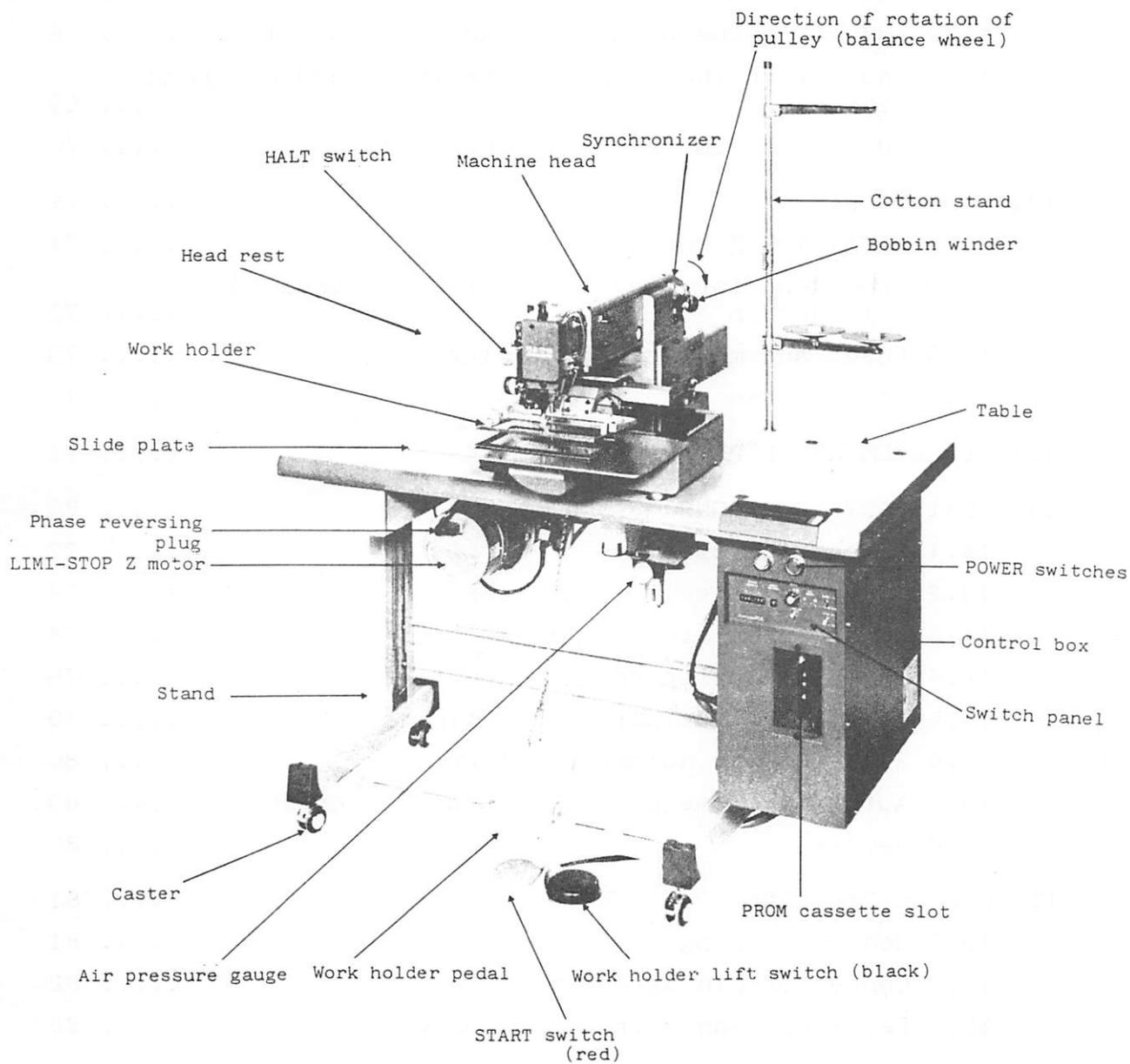


Fig. 1.1

2. FEATURES

(1) Easy pattern change

Stitch data (pattern data) can be stored up to 2,000 stitches (or 10 patterns) in each PROM cassette.

By using a PROM writer (option), pattern data can be written to PROM easily. Memory size can be expanded up to 4,000 stitches when optional (additional) PROM cassette is used together with PROM writer PTN-4000A or PTN-1000ØL.

(2) High-performance fabric feed mechanism

The work holder driven by stepping motors through belts assures high-quality stitching at high speed.

(3) Presser foot motion synchronized with needle motion

Since the presser foot moves vertically, being synchronized with needle motion, "floating" of fabric does not occur. It is particularly advantageous when emblems or any other small pieces are sewn up, or when heavy fabrics are sewn.

(4) Easy work holder replacement

When stitching pattern is changed, the work holder can be replaced immediately.

(5) Pattern enlargement/reduction

A pattern stored in PROM can be enlarged or reduced in X and Y direction independently within a range from 0% to 199%.

(6) "HALT" switch and "JOG" switch

"HALT" switch permitting immediate suspension of stitching and "JOG" switch permitting stitch-by-stitch feed motion are very helpful when used to amend stitches.

By continuously operating the "JOG" switch, checking of stitched pattern and resumption of stitching after suspension can be accomplished easily.

(7) Safety functions

Various failures or errors in operation are visualized by "error indication" lamps.

(8) Full-electronic control system with compact design and reliability

8-bit microprocessor is used in the control system.

(9) Large hook

Double-sized hook reduces labor for replacement of bobbin.

(10) Easy maintenance

o The head can be leaned laterally for easy access to the thread trimmer and other internal mechanisms.

o LIMI-STOP Z motor, having no "frictional clutch" and featuring maintenance-free use, is used as main drive motor.

(11) Work holder pedal

It permits easy and immediate positioning or alignment of fabric and parts.

3. SPECIFICATIONS

3.1 General specifications

Table 3.1 General specifications

Stitching type	Single-needle lockswitch
Needle bar stroke	40mm
Take-up lever stroke	72mm
Needle	DP x 17 #18 (Standard)
Wiper	With wiper release switch
Work holer lift	20mm
Presser foot lift	10mm or more
Presser foot stroke	0, 2 - 10mm (set to 4mm at shipping)
Hook	Full-rotation, automatic lubrication (for under-bed trimmer)
Bobbin case	With racing prevention spring
Bobbin	Thread trimmer type steel bobbin
Lubrication	Manual oiling screw pump for hook lubrication, oil-impregnated cotton lubrication
Lubricant	White spindle oil No.2
Thread trimmer	Fixed and movable knife scissoring, rotary style
Control system	Full-electronic, microprocessor incorporated control
Sewing area	170 x 100mm (approx. 7" x 4") X-Y axes driven by stepping motors
Max. sewing speed	2,000spm (intermittent feed for stitch length less than 2.4mm)
Stitch length	0.2 - 6.2mm
Sewing pattern generation	Sewing patterns are reproduced with data stored in replaceable PROM. Maximum 10 patterns can be stored in each PROM (maximum 2,000 stitches in total). Maximum 4,000 stitches are available with optional PROM.

Sewing operation	Operation starts from home position and ends at the home position.
Return to home position	The home position return function is used if X and/or Y positions deviate during sewing. After the needle stops at UP position, the work holder returns to the home position in X and Y directions simultaneously. (The home position can be changed by adjusting the home position detecting plate.)
Operation START	Sewing starts from the home position when START switch is depressed.
Work holder	First depression of the work holder lift switch causes lowering of the work holder, and another depression causes lifting.
HALT function	Sewing operation stops when HALT switch is operated. After that, the work holder can be moved stitch by stitch along the sewing pattern by pressing "JOG" switch. By depressing the "START switch, the suspended sewing operation can be resumed.
Scale function (Enlargement/Reduction)	Pattern stored in PROM can be enlarged or reduced in X and/or Y direction independently. The scale can be set within a range from 0% to 199% at 1% increment.
Pattern select function	Any one of 10 patterns can be selected.
Sewing speed setting	Sewing speed can be set in nine steps, ranging from 180spm to 2,000spm, at 200spm increment.
Stitch correcting function	Stitch(es) can be corrected or amended by moving the work holder stitch by stitch forward or backward along the pattern by depressing "JOG" switch.
Test function	This function is used to check sewing pattern by letting move the work holder at low speed, without stitching motion.
Error indicator	This indicator displays error or failure in operation.
Main drive motor	LIMI-STOP Z motor (for sewing machine)

Work holder drive	Pneumatic type, 4 +0.5/-0kg/cm ²	
Ambient temperature	5 - 40°C	
Power source	100V type	Single-phase 100V±10%, 50/60Hz, 1kVA
	110V type	Single-phase 110V±10%, 60Hz, 1kVA
	200V type	Three-phase 200V±10%, 50/60Hz, 1kVA
	220V type	Three-phase 220V±10%, 60Hz, 1kVA
Dimensions	1,200(W) x 895(W) x 1,120(H) (Cotton stand is not included)	
Weight	152kg	
Others	Thread trimmer switch is provided.	

3.2 Replacement parts for light and heavy fabrics

Table 3.2

Specification Name of part	For light fabrics	For medium/ heavy fabrics (Standard)	For heavy fabrics
Needle thread tension regula- tor	→	W346065G12	For DY appli- cation (MF82E0210)
Needle thread pretensioner	For light fabrics (Use MF10A1245 only for conical spring)	Standard (MF90E0550)	←
Needle plate	φ1.6 (MS02A0101)	φ2.2 (MS02A1101)	φ2.6 (MS02A2101)
Needle hole diameter			
Presser foot	φ3.5 (I.D. 2.0mm) (MV30A1256)	φ4.5 (I.D. 3.0mm) (MV30A0256)	←
Outer diameter			

Specification Name of part	For light fabrics	For medium/ heavy fabrics (Standard)	For heavy fabrics
Hook	For LS2-180-BIT application (MF45A0120)	For DY appli- cation (MG44B0120)	←
Bobbin case	→	Standard (MS02E0125)	For DY (MS05E0125)
Movable knife	→	(MFO2A0834)	←

Note: Parts for light fabrics and heavy fabrics are optional.

4. INSTALLATION

4.1 Installing the table

- (1) Caster can be locked by pressing down the lever of each caster. To move the sewing machine, release the lock from each caster by lifting the lever.
- (2) Place the sewing machine on flat and rigid floor so that it can be settled down stably.
- (3) The sewing machine can be operated in standing posture, as well as in sitting posture. The table has been factory-adjusted for sitting work. For standing work, adjust the table height as follows:

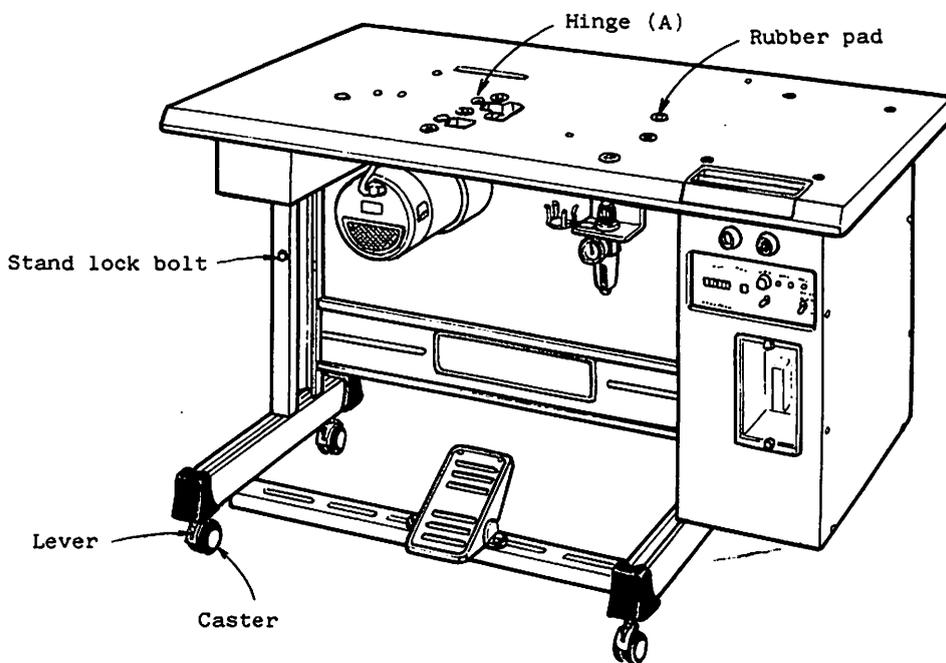


Fig. 4.1

- (a) Remove each three left and right stand lock screws.
- (b) Lift the table and secure it in position with the stand lock screws.
- (c) Loosen the four control box clamping nuts.
- (d) Slide up the control box to position and tighten the four nuts.

Notes: 1. Table height should be changed before the machine head is installed.

2. If table height must be changed after the machine head has been installed, dismount the head and then adjust (for safety).

(4) Put each one rubber pad into six holes in the table.

(5) Put each one hinge (A) into two recesses in the table and secure it with bolt and nut.

*Each hinge (A) should be placed with its chamfered surface faced up, as shown in Fig. 4.2.

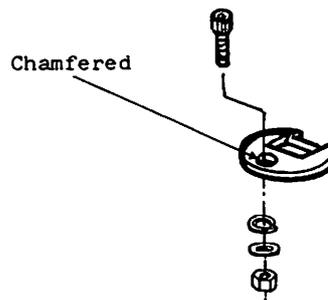


Fig. 4.2

4.2 Installing the machine head (see Fig. 4.3 and 4.4)

(1) Insert the head rest into the corresponding holes in the table.

(2) Attach two hinges (B) to the unpacked machine head.

(3) Put the head on the table so that it rests on the six rubber pads and two hinges.

(4) Raise the head to rest it vertically and pass the cords and air tubes through the holes in the table.

(5) Install the oil pan as shown in Fig. 4.4. and drive four staples to secure the oil pan in position.

(6) Install the V belts to the machine pulley and the motor pulley and return the head to horizontal position.

(7) Install the belt cover (large) to the machine head with screws.

(8) Install the belt cover (small) to the table with screws.

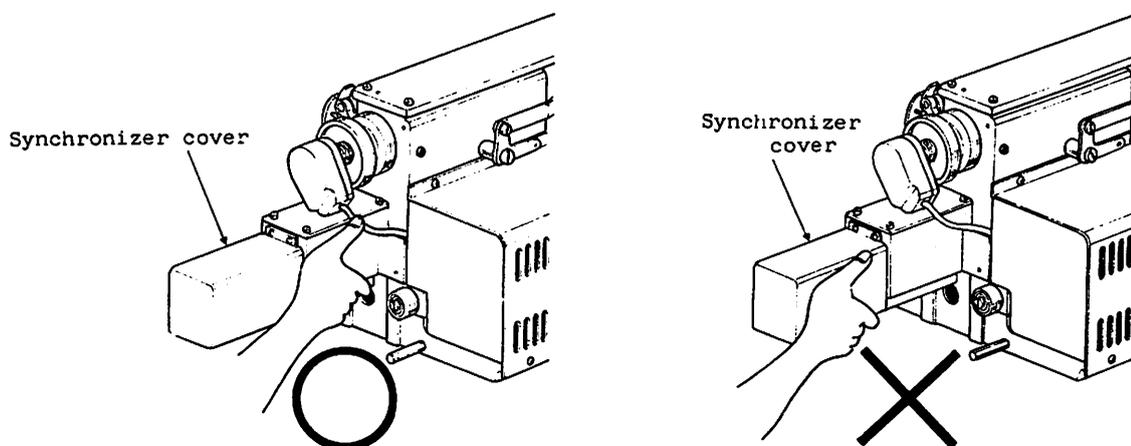
- (9) After the machine head has been installed, remove the handles.

Note: The sewing machine head should be carried by hands with the following caution:

(1) Front of head Two handles (left and right) are provided. Grip these handles to carry.
*Do not apply hand to slide plate.

(2) Rear of head Hold the joint between the Y-synchronizer cover and the arm (preferably on the arm side) by hand.

*If only the Y-synchronizer cover is held, the Y-synchronizer bracket might be warped, whereby malfunction might occur.



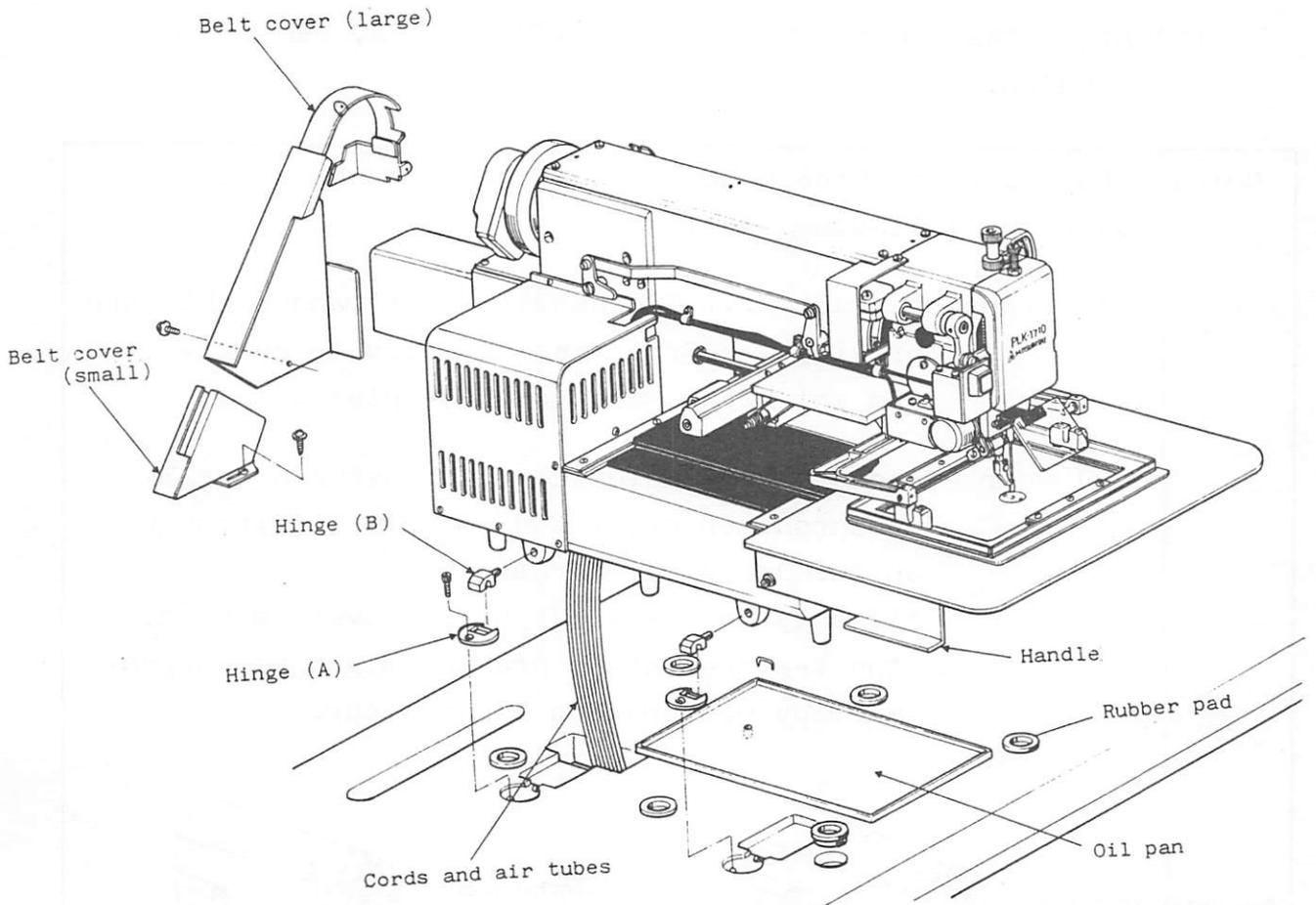


Fig. 4.3

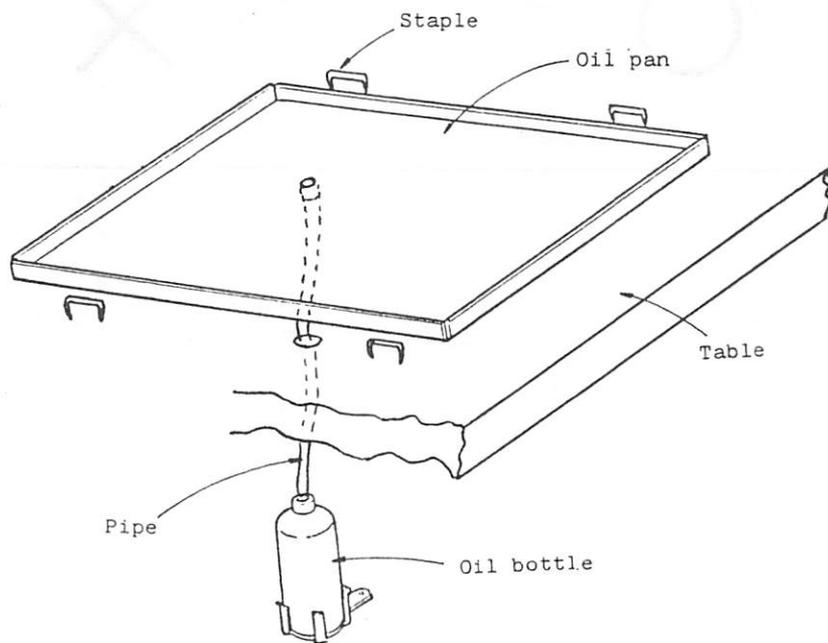


Fig. 4.4

4.3 Installing the air tubes

- (1) Connect four air tubes ("A" - "D") to solenoid valve tube fittings ("A" - "D") shown in Fig. 4.5.
- (2) Connect one air tube to tube fitting "E" shown in Fig. 4.5.
- (3) Air pressure is to be set to $4\text{kg}/\text{cm}^2$.
To set, pull up the air pressure control knob and turn.
After the setting, press down the knob.
- (4) Disconnection of air tube
To disconnect air tube, push forward the end of tube and, while holding down the fitting sleeve, pull the tube.

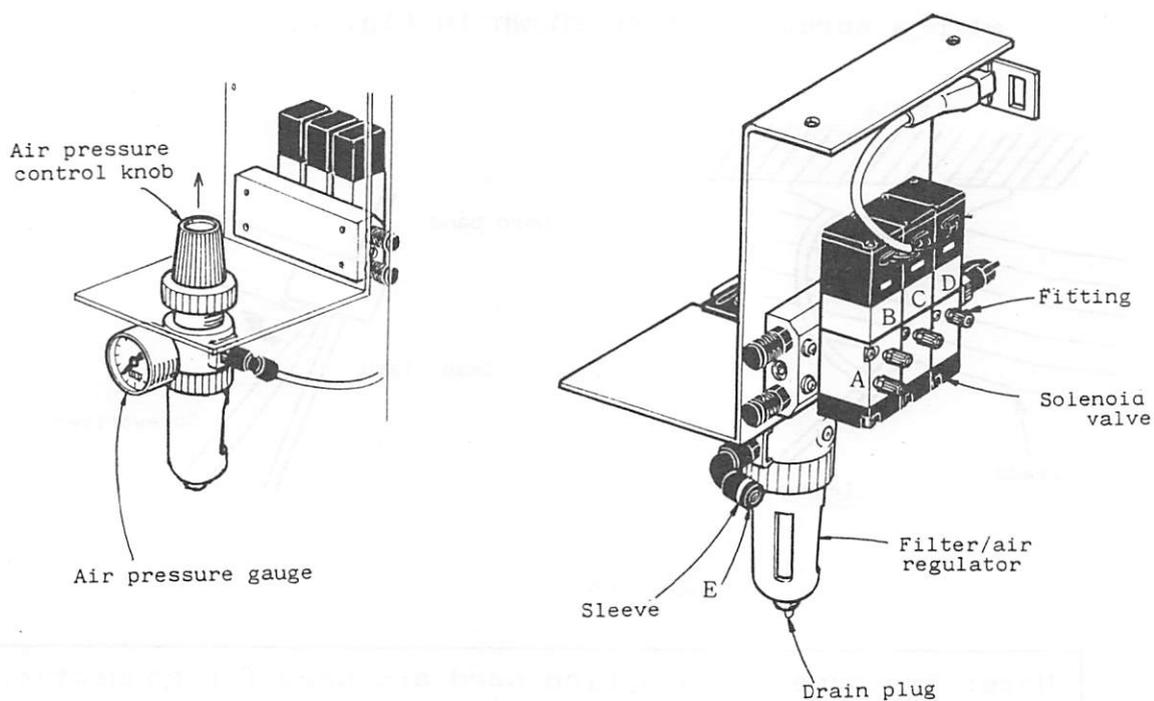


Fig. 4.5

4.4 Connecting the leads

- (1) Pass the lead wires from the machine head through the hole in the table top and connect them to the corresponding connectors in the control box.
(See Fig.4.7 and 4.8)
- (2) Of the cables connected to the connector B, connect the 6-pin plug cable to the solenoid valve connector.
(See Fig.4.7)
- (3) Of the two cables connected to the connector A, insert and fix the 2-pin plug cable into the solenoid valve installation plate. (See Fig.4.7)
*Used with the two-stage pressor foot (option).
- (4) Secure the leads in position with a lead clamp (tie lap) so that they cannot come into contact with the belt. The cord of lead clamp can be released by levering it with a screwdriver as shown in Fig. 4.7.

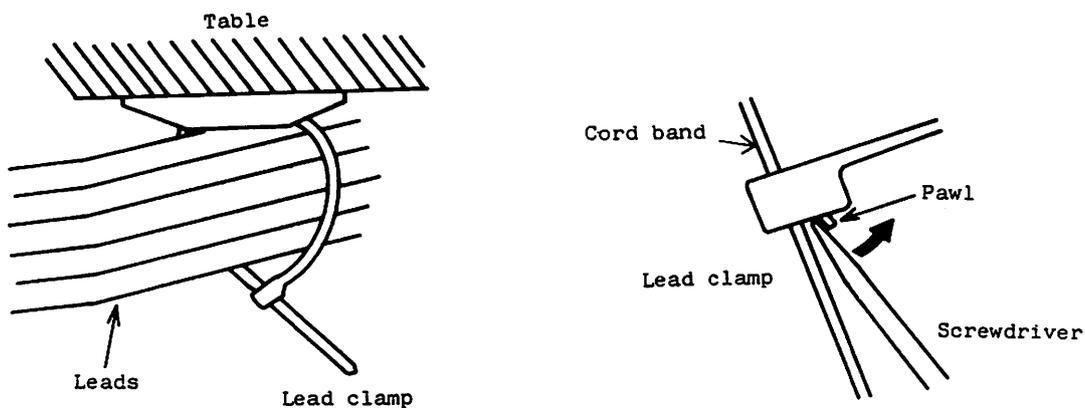


Fig. 4.6

Note: Two types of junction cord are used for connection of the control box to the stepping motors (one is for X-axis stepping motor, and the other is for Y-axis stepping motor). Since the X-axis cable may not be used for connection of Y-axis stepping motor, and vice versa, though the connectors of both the junction cords are of the same type, identify each cable before the connection.

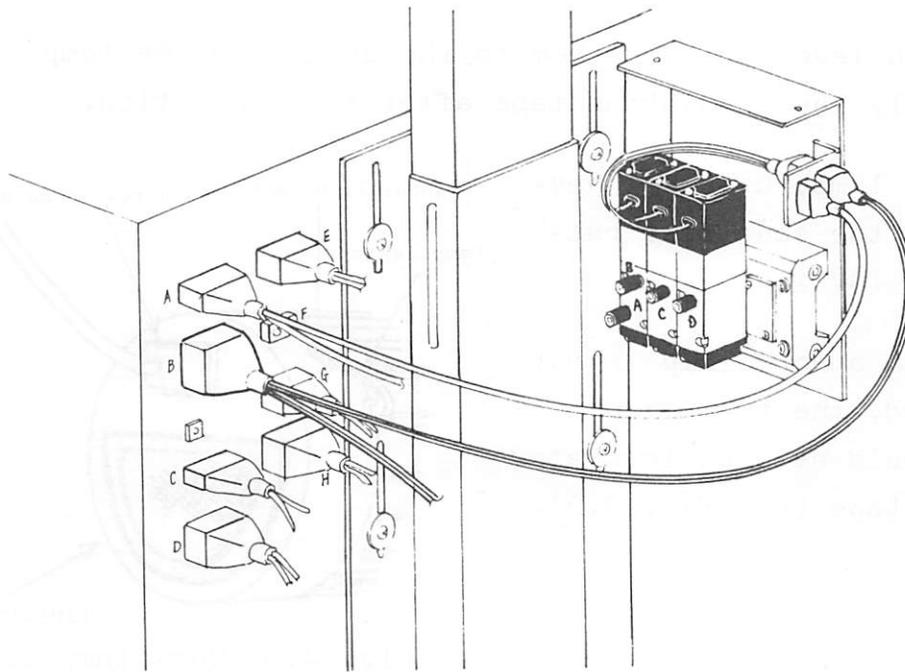


Fig. 4.7 Connection of machine head and control box

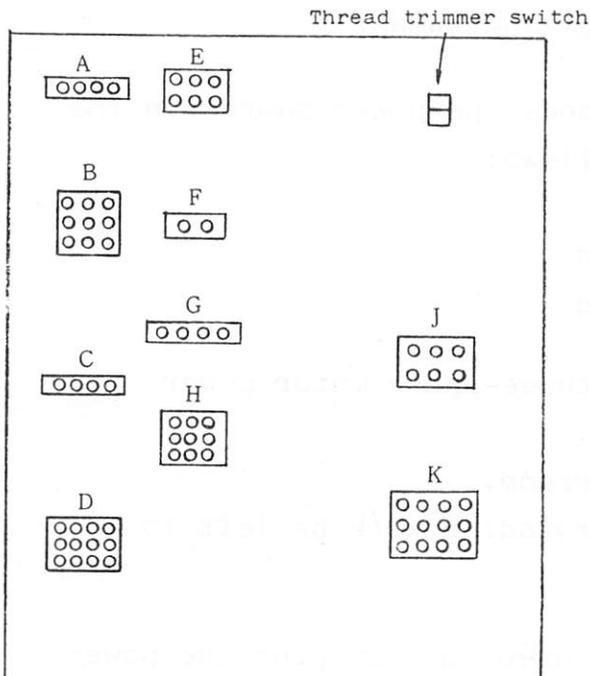


Fig. 4.8

- (A) : Thread release solenoid (double holding) connector
 - (B) : Thread trimmer, wiper, work holder and presser foot connector
 - C : Work holder and start switch connector
 - (D) : Stepping motor (X & Y) connector
 - (E) : Synchronizer connector
 - F : (Double-holding control switch ... option)
 - G : Clutch/brake connector
 - (H) : Home position detector connector
 - J : Power switch connector
 - K : Phase-reversing plug connector
- shows connector for lead from the machine head.

4.5 Work lamp leads

- (1) To install a work lamp, draw out the lamp leads found at the back of the motor, remove the insulation tape, strip

each lead and join them to the cord from the lamp. Apply the insulation tape after the connection.

- (2) For lamp, use that having the specified rating (6V 15W).
- (3) When a work lamp is not used, the two leads should be kept insulated by tape (see Fig. 4.9).

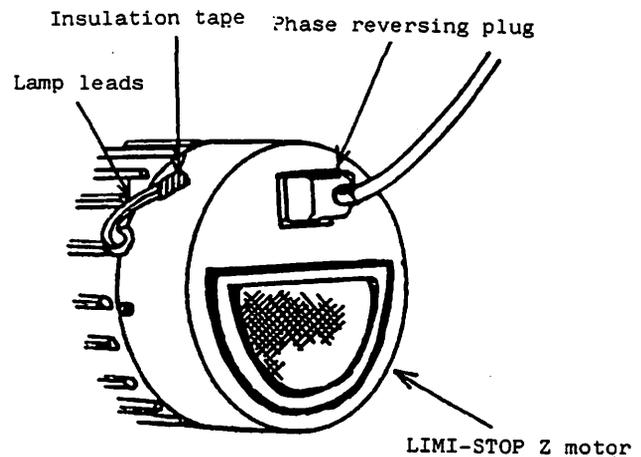


Fig. 4.9 Work lamp leads

4.6 Power cable connection

The power source capacity should be large enough for motor rating and the power cable should be selected with sufficient allowance to the power source requirement.

- (1) For a three-phase motor, connect the power source in the correct phase sequence as follows:
 - "U" phase Red lead
 - "V" phase White lead
 - "W" phase Black lead
- (2) Connect the green lead of a three-phase motor power cable to the ground terminal.
For safety, do not fail to ground.
It is recommended that the grounding work be left to a qualified electrician.
- (3) When a single-phase motor is used, do not plug the power cord to a branched socket, but plug to a wall outlet.

Notes: (1) All leads should be bundled and secured in position so that they cannot come into contact with the V-belts.

(2) Securely engage the plugs and connectors.

(3) Before starting connection of leads, unplug the power cable or cord.

4.7 Changing direction of rotation of motor

Direction of rotation of the motor can be changed (reversed) by removing, turning 180° and then setting the phase-reversing plug. When the plug is set, be sure to fully insert it into the socket (see Fig. 4.9).

For single-phase motor, it takes about 5 minutes for the motor to stop completely after the power is turned off. Do not turn on the power while the motor is running (otherwise direction of rotation does not change).

4.8 Installing the work holder pedal

To use the work holder pedal, remove the motor cover and install the chain as shown in Fig. 4.10, using care not to allow its contact with the leads.

CAUTION:

When the machine head is leaned, the chain should have been loosened by unhooking it. If the head is leaned without unhooking, the chain might be broken by tension.

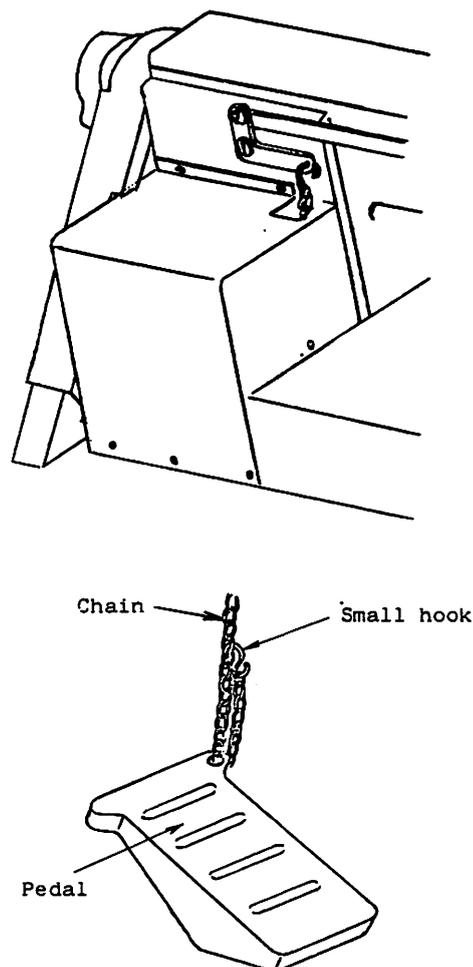


Fig. 4.10

5. PREPARATION AND CAUTIONS BEFORE OPERATION

- (1) Make sure the line voltage meets that specified for the sewing machine.
- (2) Make sure the PROM cassette has been put properly into the PROM cassette slot.
(The PROM cassette which is loaded by us at shipping has test pattern program.)
- (3) Move and locate the work holder by hand so that the needle is always located within the frame of work holder.
- (4) Make sure the needle comes at the center of the presser foot.
- (5) Make sure the air pressure is $4\text{kg}/\text{cm}^2$.
- (6) Check the rotational direction of the LIM1-STOP Z motor (for motor switches, refer to Fig. 1.1 and 6.1)

To check the direction of rotation, perform the following steps:

- 1) Press the POWER ON switch.
- 2) Set the RESET/HOME switch to RESET position and press the work holder switch to let down the work holder.
- 3) Set the STOP/MOVE switch to STOP position.
(For function of each switch, refer to Sec. 6.)
- 4) Press the START foot switch momentarily to see direction of rotation of the pulley (balance wheel).
The pulley should rotate clockwise as viewed from the sewing machine front (see Fig. 1.1).

The method of changing direction of rotation is described in 4.7.

- (7) Before unplugging the power cord, be sure to press the POWER OFF switch and make sure the red lamp at the end face of PROM-cassette does not light.

(8) Position of work holder

The home position (needle plate hole) is not at the center of the work holder, but deviates to the right from the center of the work holder by dimension equal to allowance for the presser foot, as shown in Fig. 5.1.

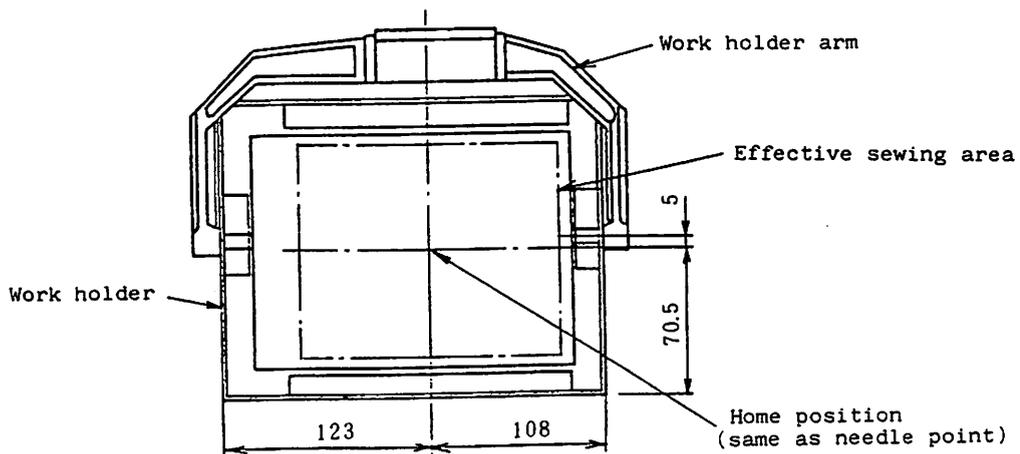


Fig. 5.1

6. NAME AND FUNCTIONS OF CONTROL SWITCHES

6.1 Switch panel

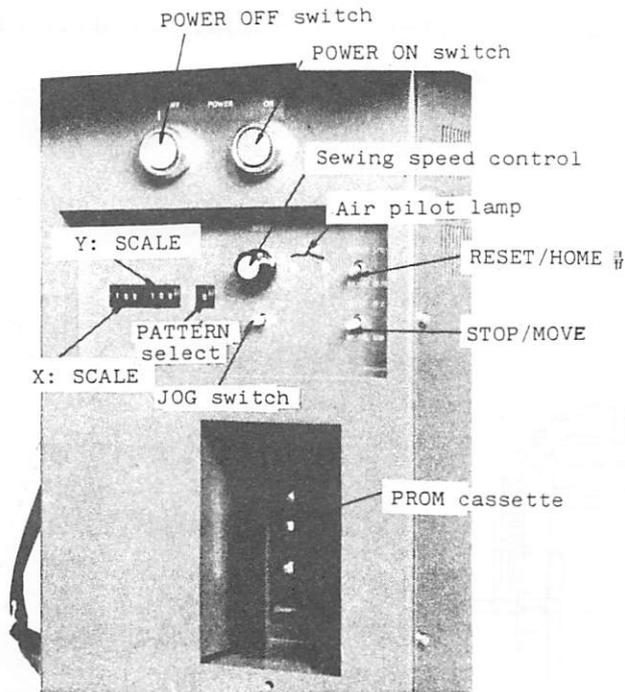


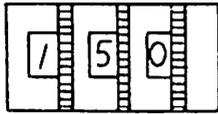
Fig. 6.1

6.2 POWER ON and OFF switches

- (1) When the POWER ON switch (green pushbutton) is pressed, the power supply is on and the red lamp at the end face of PROM-cassette lights.
- (2) When the POWER OFF switch (red pushbutton) is pressed, the red lamp goes out and the work holder lifts when it is at down position.

6.3 SCALE switch

- (1) Let sewing pattern stored in PROM be 100% in size, it can be enlarged or reduced within a range from 0% to 199% in X axis and Y axis independently (stitch length is enlarged or reduced correspondingly).
- (2) Pattern is enlarged or reduced in reference to the home position.



Switch setting should be within a range from "000" to "199" (%).
The third digit (hundred) is either "0" or "1".
150% (1.5 times)

Fig. 6.2 SCALE switch setting

NOTES: 1. Whenever pattern is enlarged, it should be verified that the enlarged pattern is within the range of sewing area (see para. 6.6.1).

2. The sewing speed may decrease when enlarged pattern is stitched (see para. 8 (4)).

6.4 PATTERN select switch

The PATTERN select switch is used to select the sewing pattern (patterns are stored in PROM).

6.5 SPEED setting dial

The SPEED setting dial is used to select the maximum sewing speed for each sewing pattern.

Speed cannot be changed in mid course of stitching.

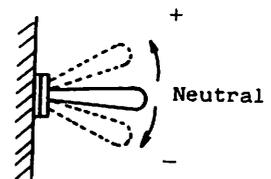
6.6 ±JOG switch

6.6.1 Test function

After the work holder is returned to the home position and lowered to the down position, proceed to the following steps:

- (1) Only the work holder moves forward along the pattern at constant speed while the JOG switch is held at (+) position.

To move the work holder backward along the pattern, set the JOG switch to (-) position.



- (2) When the work holder comes to the end of the

Fig. 6.3 JOG switch

pattern with the JOG switch set at (+) position, the work holder lifts and returns to the home position.

When the work holder comes to the home position, it stops there. Then the sewing operation can be started by pressing the START switch, or the test can be performed again by setting the JOG switch to (+) position.

(3) During test, the presser foot is at DOWN position for stitching test, and at UP position for feed motion test.

6.6.2 Stitching correct function

After suspension of sewing by operating the HALT switch (see Fig. 1.1), the work holder can be jogged forward and backward by the JOG switch. The movement of the work holder is the same as in the test, but the feed speed is slower than that in the test. This function is helpful for restarting the sewing after it is suspended due to thread breakage, etc.

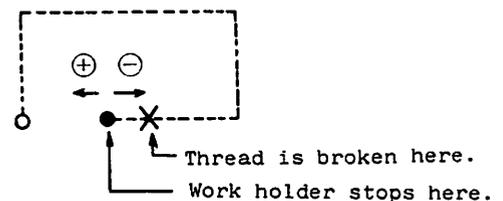


Fig. 6.4 Direction of jog motion

6.7 RESET/HOME switch

(1) RESET: When the switch is set to the up position, the machine operation is braked and all motions are reset.

CAUTION: Do not set this switch to RESET position while the sewing machine is in operation.

(2) HOME : When the switch is set to the down position, the work holder returns to the home position automatically.
(When the needle is not at the up position, the work holder returns to the home position after

the needle goes up).

The switch is usually to be set at the down (HOME) position.

6.8 STOP/MOVE switch

This switch is set at STOP position for bobbin winding, and for lowering the presser foot.

(1) Bobbin winding

When the START switch is pressed with the STOP/MOVE switch set at STOP position, and the work holder at DOWN position, the main motor rotates at approx. 600spm without motion of the work holder.

(2) Lowering the presser foot

When the STOP/MOVE switch is set to STOP position, the presser foot starts lowering. The switch is set to STOP position when the thread must be passed through the needle eye.

The switch is usually set at MOVE position.

6.9 ERROR indicators

Error indicator lights and the sewing machine stops with the needle at the UP position if error or failure occurs.

(1) ERROR 1

Green light: This indicator lights when sewing pattern data are not present, or not in good condition, for the selected pattern. Use correctly programmed PROM cassette.

Red light : This indicator lights when stitch length becomes more than 6.2mm due to excessive enlargement of the sewing pattern.

(2) ERROR 2

Red light : This indicator lights when the PROM cassette is not put into the PROM cassette slot correctly. Put the cassette into the slot

securely in correct manner.

Green light: This indicator lights when the work holder moves beyond the sewing area. Scale down the pattern.

(3) ERROR 1, ERROR 2

Two red lamps light at the same time: The needle is not at the UP position when the POWER ON switch is pressed. Operate the RESET/HOME switch to lift the needle and return the work holder to the home position.

Two red lamps flicker at the same time: The main motor is locked or the drive belt is out of pulley. Press the POWER OFF switch and, after the cause is removed, press the POWER ON switch.

Two green lamps light at the same time: Sewing pattern in use is changed while the second home position is used. Operate the RESET/HOME switch to return the work holder to the first home position to reset. After that, a newly selected pattern can be used.

ERROR 1 red and ERROR 2 green lamps light at the same time: (This error occurs only when "automatic home position return" (refer to 14.5) is used for turning on the power.)

The RESET/HOME switch is operated with the work holder at the UP position.

Lower the work holder and then operate the RESET/HOME switch.

6.10 Work holder lift switch

This foot switch (black) is pressed to lower the work holder. The work holder goes up when the switch is pressed again.

6.11 HALT switch

This switch is operated to suspend the sewing machine operation (if the thread is broken, for example). (See Fig. 1.1)

6.12 START switch

Sewing operation starts from the home position when this switch (red) is pressed. (See Fig. 1.1)

6.13 Work holder pedal (option)

To use this function, SW4 (A) on the CPU circuit board should be set to "ON" ("OFF" when the sewing machine is shipped). The left and right work holders can be turned on and off independently. The START switch is not operative if both the work holders are not at DOWN position.

When the automatic home position return function is used after suspension of sewing operation, the function does not start if both the work holders are not at DOWN position.

6.14 Thread trimmer switch

When this switch found on the side wall of control box is set at "ON" position, the thread trimmer and wiper operate in the previously set timing.

When the switch is at "OFF" position, the thread trimmer and wiper do not work.

For resetting of the thread trimmer after suspension of operation, refer to 14.4.

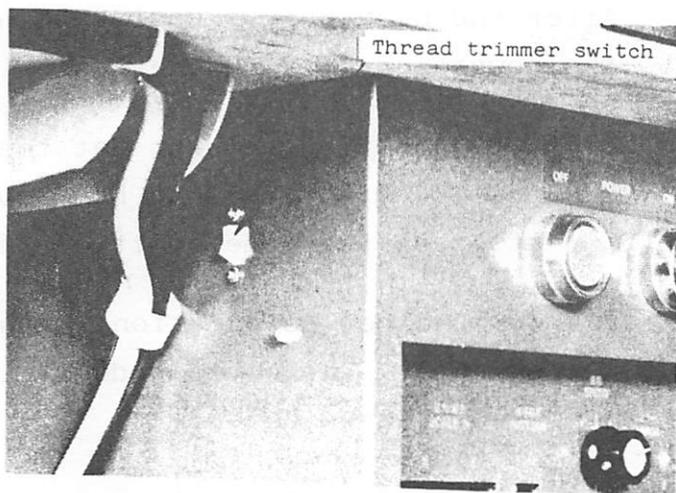


Fig. 6.5

7. OPERATION

7.1 Inserting the PROM cassette

Remove the cover on the cassette drive slot and insert the PROM cassette into the drive slot. Before the insertion, orient the cassette correctly.

To store sewing pattern(s) to the PROM, or erase sewing pattern(s) stored in the PROM, an optional device (PT-4000A or PTN-1000-OL ROM writer) is required.

For handling of the cassette, refer to section 13.

7.2 Setting the switches on the switch panel

Set each switch on the switch panel to check its function as follows:

- SCALE switch : 100 (for X and Y axes)
- PATTERN switch : 0 to 9, depending on selected pattern
- SPEED control dial : 4
- RESET/HOME switch : Set at DOWN position
- STOP/MOVE switch : Set at DOWN position

7.3 Checking each function

After the necessary preparation has been completed, turn on the power and perform the following check:

- (1) Home position return: Set the RESET/HOME switch to RESET position, and then to HOME position. The work holder stops at the home position (see 6.7).
- (2) Work holder down motion: Press the work holder lift switch. The work holder will go down (it will go up when pressed again).
- (3) Work holder movement: Set the JOG switch to (+) position and the work holder moves along the sewing pattern. The work holder lifts and returns to the home position when it traces the pattern completely. (If the JOG switch is returned to the neutral position during tracing, the work holder stops at DOWN position. (See 6.6)

During the check described above, the work holder moves but

stitching motion does not occur.

Also check pattern size and location of the work holder.

For stitching test, set the sewing speed to "low speed" and perform the test in accordance with para. 7.4.

7.4 Sewing operation

(1) Set each switch on the switch panel, referring to Fig. 6.1.

(2) Set up the fabric in the work holder and press the work holder lift switch to lower the work holder.

Press the START switch and the sewing machine starts stitching. Once the sewing machine starts stitching, it goes on stitching even when the START switch is released. When the stitching is completed and the threads are trimmed, the work holder automatically moves up to the UP position.

7.5 HALT switch operation

To stop the stitching, press the HALT switch (see Fig. 1.1). After thread trimming, the workholder stops at the DOWN position and the needle stops at the UP position.

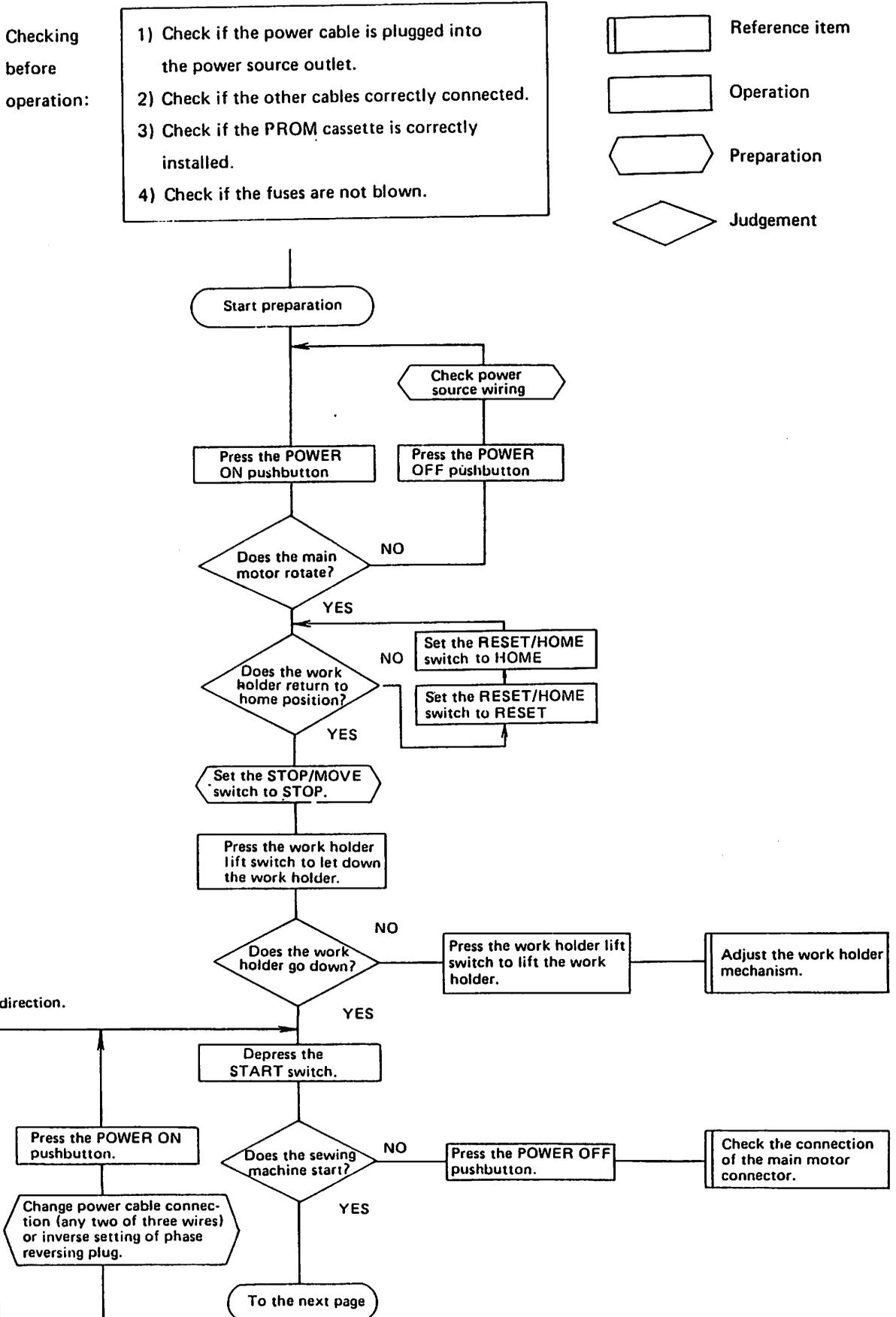
To resume the stitching, press the START switch after adjusting the restart position by operating the JOG switch. The sewing machine automatically stops when the remaining stitches are completed.

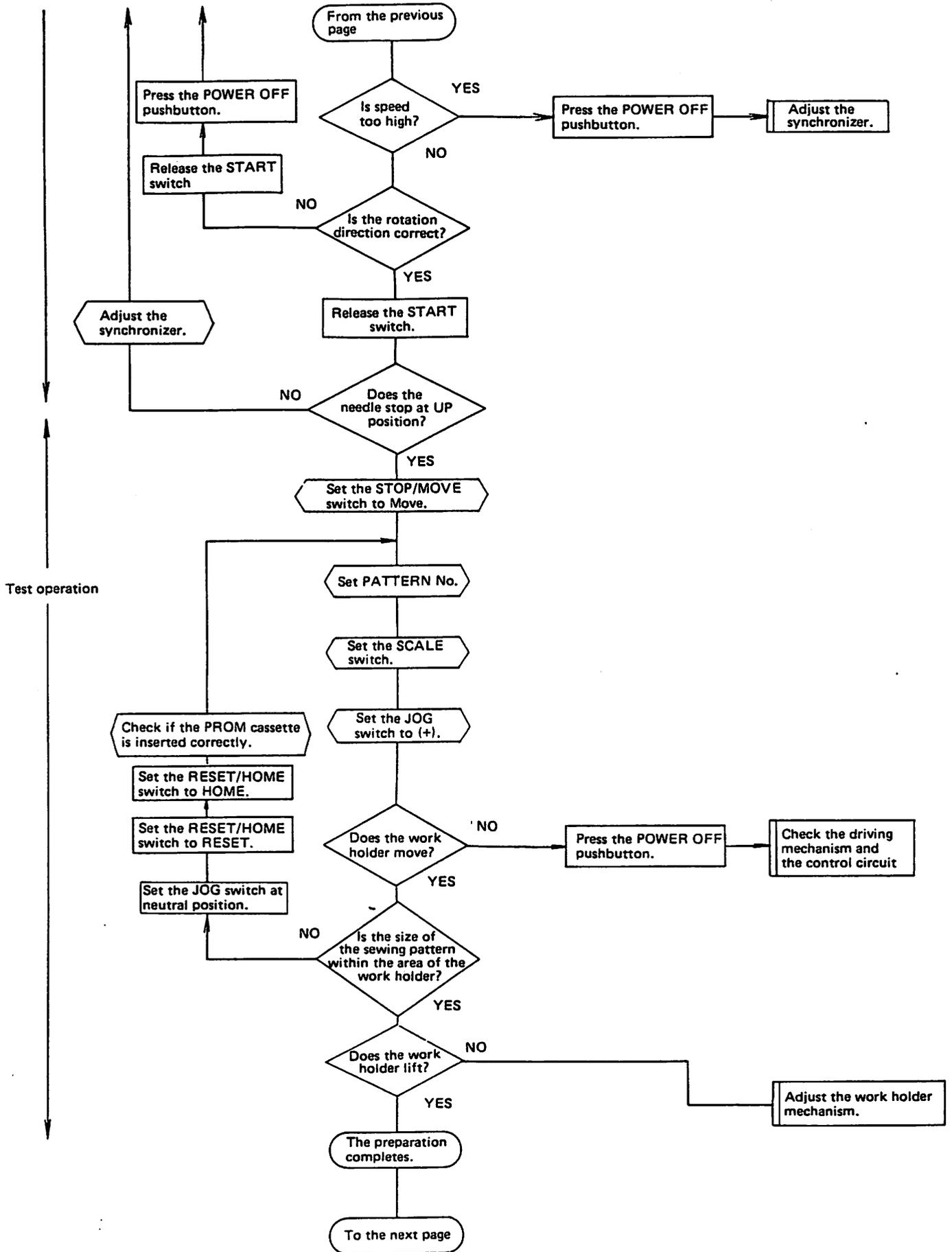
The work holder can be moved up and down by operating the work holder switch during HALT.

NOTE: Before starting sewing work, remove the needle and perform test operation in order to make yourself familiar with the sewing machine functions.

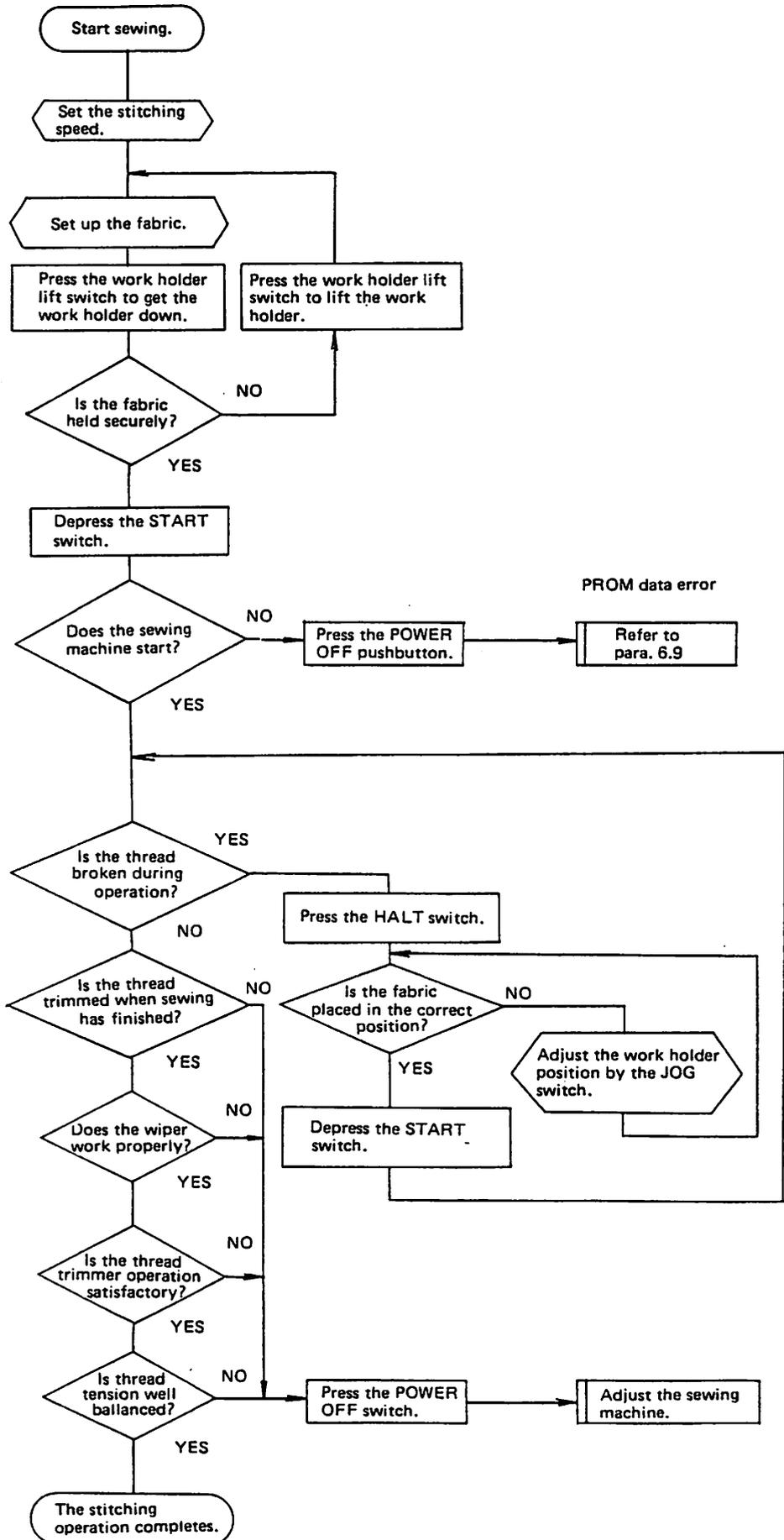
7.6 Operating procedure and checking

The sewing machine should be operated and checked in accordance with the following flow chart:





Automatic operation
(Sewing)



8. GENERAL INSTRUCTIONS

- (1) Before replacement of PROM in the PROM cassette, read the description in section 13.
Insert the PROM cassette into and remove from the cassette drive slot after turning off the power.
- (2) When any error lamp lights, check for cause referring to 6.9.
- (3) When a new sewing pattern is used or an enlarged pattern is used, check that the sewing pattern is within the sewing area confined by the work holder in test operation.
- (4) Maximum sewing speed differs depending on the stitch length as shown in Table 8.1 (see 6.5).

Table 8.1 Max. sewing speed for each stitch length

SW1 (B) set at "OFF"
(Setting at shipping)

Stitch length	Max. speed
5.4 - 6.2mm	850spm
4.8 - 5.2mm	1100spm
4.0 - 4.6mm	1300spm
3.2 - 3.8mm	1550spm
2.6 - 3.0mm	1800spm
2.4mm or less	2000spm

(Speed limit 1)

SW1 (B) set at "ON"

Stitch length	Max. speed
5.4 - 6.2mm	600spm
4.8 - 5.2mm	850spm
4.0 - 4.6mm	1100spm
3.4 - 3.8mm	1300spm
2.8 - 3.2mm	1550spm
2.2 - 2.6mm	1800spm
2mm or less	2000spm

(Speed limit 2)

- (5) Whenever the power is turned on and off, operator should keep his foot away from the pedal switches.
- (6) When the right side cover of control box is opened for adjustment or maintenance, the power should have been off.
- (7) Avoid applying a multimeter to the internal control circuits to check. Otherwise, voltage from the multimeter may be applied to semiconductors and cause damage to the circuits.

- (8) The pulley cannot be turned by hand if the presser foot is not at the DOWN position.

While the power is on, operate the STOP/MOVE switch to STOP position and lower the presser foot (see 6.8).

Since the presser foot is the DOWN position while the power is off, the pulley can be turned by hand freely.

- (9) Since water is accumulated in the pneumatic system due to moisture involved in air, press the drain knob from time to time to remove the water (see Fig. 4.1).

9. HANDLING THE SEWING MACHINE HEAD

9.1 Lubrication

(1) Supplying the lubricant

Before starting daily operation, supply a few drops of lubricant to the points indicated by arrow in Fig. 9.1 and 9.2.

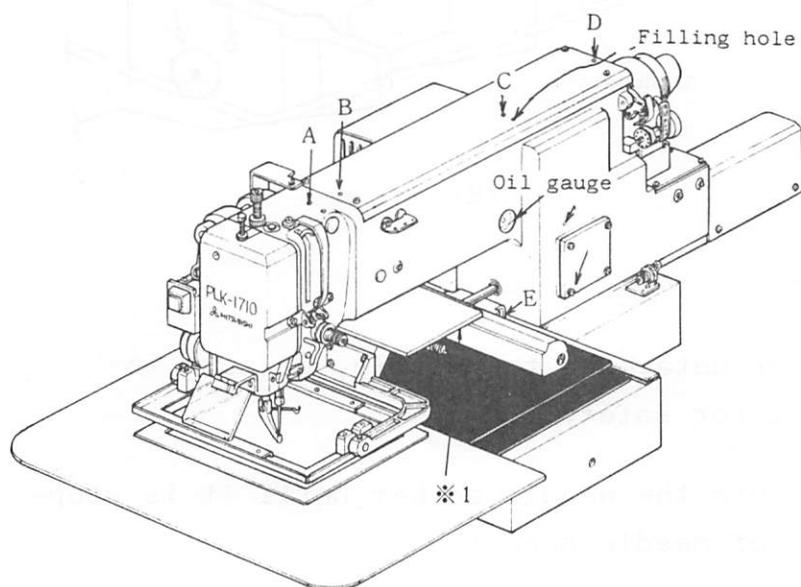


Fig. 9.1

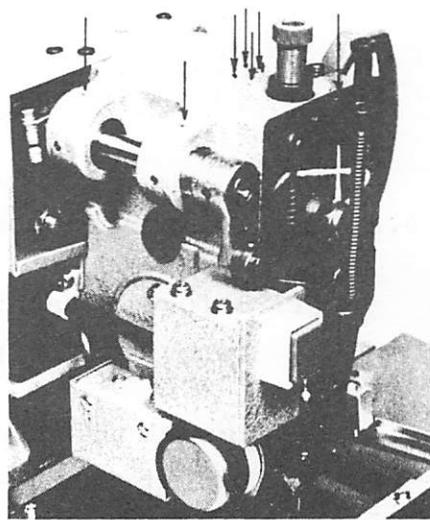


Fig. 9.2

Before starting the initial operation after the installation of the sewing machine, pour a suitable amount of lubricant through holes A, B, C, D and E (during regular operation, lubricant is given automatically and therefore not necessary to add).

*For hole E, turn the power and fully push the clamp bracket in the direction of arrow. The filling hole will appear (for lower horizontal shaft bearings).

*For *1, apply lubricant to the reverse surface of the presser plate.

(2) Filling the oil tank with lubricant (on arm side and bed side)

Fill the oil tank with lubricant until lubricant level reaches the center mark of oil gauge.

The oiling rate is factory-adjusted. When readjustment is necessary, refer to 10.3.

NOTE: For lubricant, use white spindle oil #2.

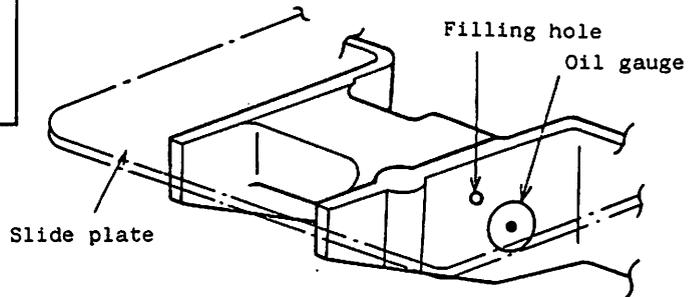


Fig. 9.3

9.2 Installing the needle

- (1) Before attaching or detaching the needle, be sure to turn off the power for safety.
- (2) Insert the needle into the needle socket until it is stopped at the bottom of needle socket.
- (3) Secure the needle screw with the prime groove of needle facing front.
- (4) For better stitching, it is usually recommended to set the needle turned about 10° in the direction of arrow shown in Fig. 9.4.

Put needle into the socket until it stops and tighten the set screw with the needle prime groove oriented front.

Needle not inserted fully

Needle oriented improperly.

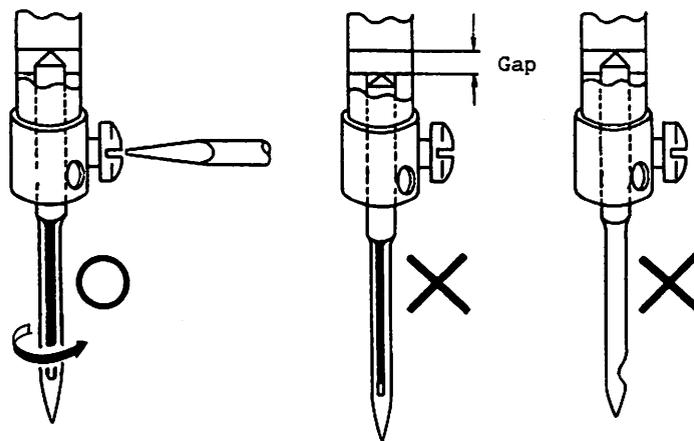


Fig. 9.4

9.3 Threading the needle thread

Pass the needle thread as shown in Fig. 9.5 and 9.6.

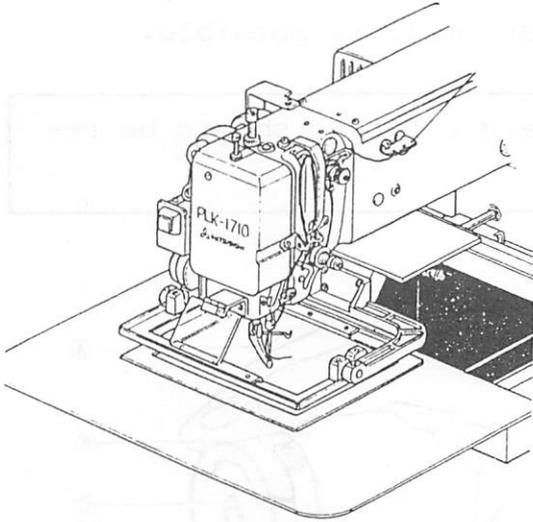


Fig. 9.5

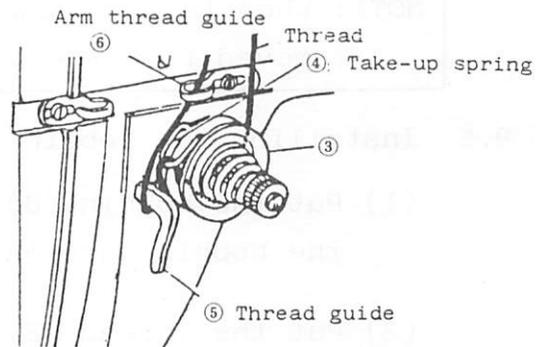


Fig. 9.6

9.4 Winding the bobbin thread

- (1) Wind the end of the thread, led from the cotton stand via the tension thread guide, around the bobbin several turns as shown in Fig. 9.7.
- (2) Press the work holder lift switch to lower the work holder.
- (3) Set the STOP/MOVE switch on the switch panel to STOP position and press the START switch (see 6.8).

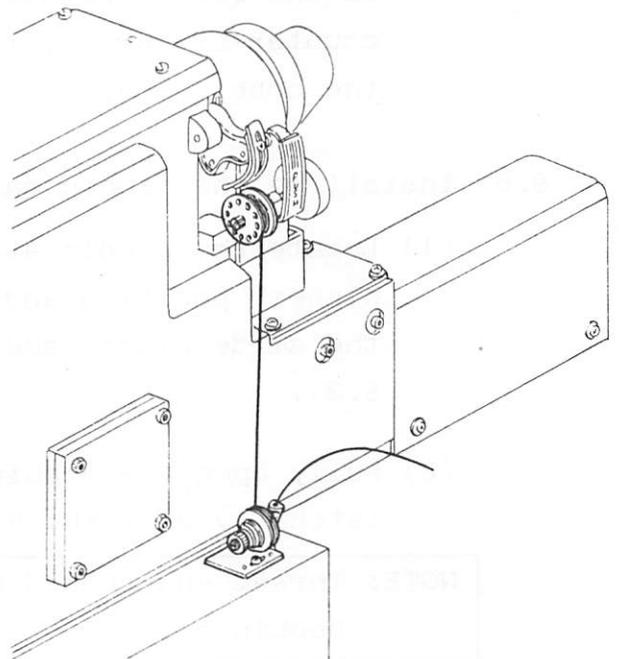


Fig. 9.7

- (4) When the thread has been wound, set the STOP/MOVE switch to MOVE position.

- (5) If the thread is wound unevenly (conically), move the tension thread guide so that the thread can be wound evenly on the bobbin.
- (6) When polyester or nylon thread is used, wind the thread on the bobbin with a tension as small as possible.

NOTE: When thread is wound, the needle thread should be removed from the needle.

9.5 Installing the bobbin

- (1) Put the bobbin (B) into the bobbin case (A).
- (2) Put the thread (E) into the slit (C) and lead it into groove (C) and hole (D).
- (3) Pull the thread (E) to make sure the bobbin (B) rotates clockwise.
If the bobbin rotates counter-clockwise, reverse the bobbin (B).

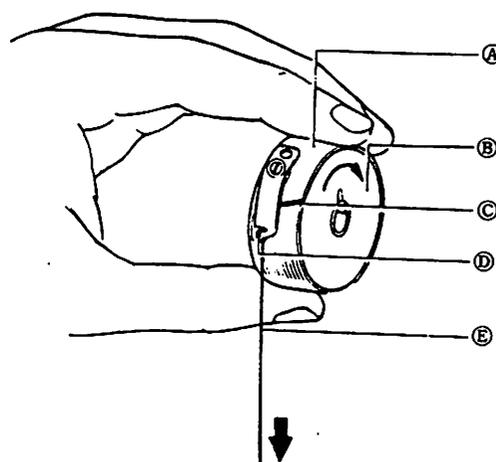


Fig. 9.8

9.6 Installing the bobbin case

- (1) Locate the needle at the highest position and open the slide plate (see Fig. 9.3).
- (2) Fully open the bobbin case latch (A) and, while holding the latch, put it into (B).

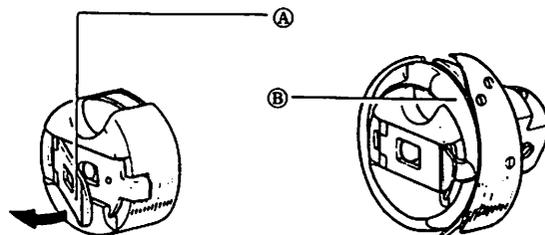


Fig. 9.9

NOTE: Thread end should be extended about 100mm from the bobbin case.

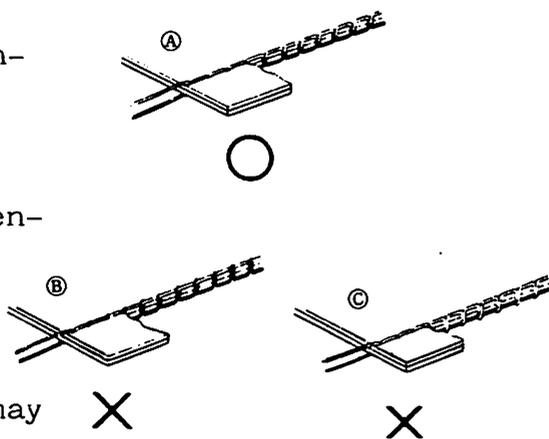
9.7 Thread tensions

When the needle thread tension is well balanced with the bobbin thread tension, the needle thread is interlocked with

the bobbin thread along the center line of fabric layers as shown in Fig. 9.10 (A)

Fig. (B): Tight needle thread tension or loose bobbin thread

Fig. (C): Loosen needle thread tension or tight bobbin thread



NOTE: Too tight thread tension may result in puckering and/or thread breakage.

Fig. 9.10

(1) Needle thread tension

Needle thread tension can be adjusted by turning the thread tension regulating thumb nut (A).

Tension increases when the thumb nut is turned clockwise.

Tension decreases when the thumb nut is turned counter-clockwise.

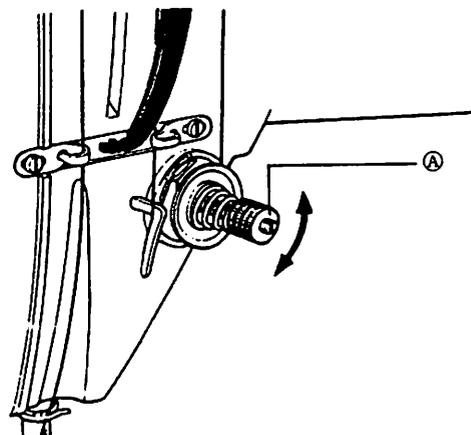


Fig. 9.11

(2) Bobbin thread tension

Bobbin thread tension can be adjusted by turning the thread tension adjusting screw (A).

Tension increases when the screw is turned clockwise.

Tension decreases when the thumb nut is turned counter-clockwise.

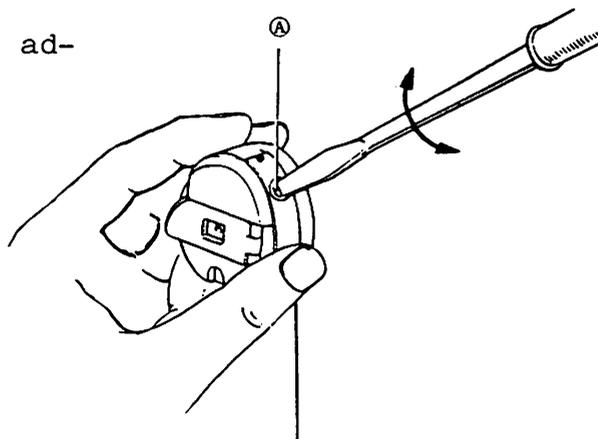


Fig. 9.12

9.8 Adjusting the work holder

9.8.1 Work holder pressure adjustment

Work holder pressure is given by the pneumatic system, and can be adjusted by operating the air pressure regulator knob (see Fig. 4.5). Increase air pressure for larger work holder pressure and decrease for smaller pressure. (The standard air pressure is 4kg/cm².)

9.8.2 Adjusting the work holder lift

Work holder lift increases when the slider is turned clockwise and decreases when turned counter-clockwise, after the work holder arm adjusting nut is loosened with a furnished spanner.

Note that too large lift may cause the work holder to hit against the wiper, presser foot, etc. The standard lift is 20mm.

After the adjustment, do not fail to fully tighten the adjusting nut.

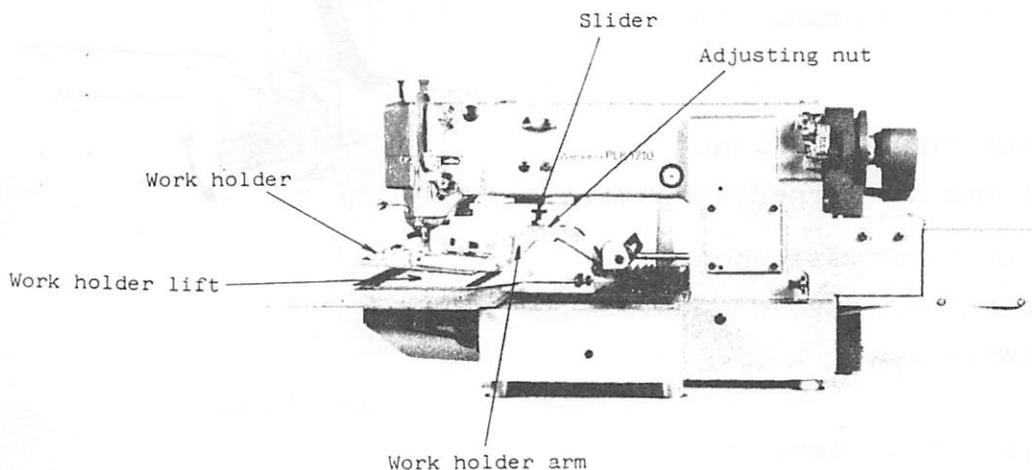


Fig. 9.13

9.8.3 Replacing the work holder

(1) The work holder can be replaced immediately and easily.

To remove the work holder, push the work holder down from the work holder arm pin.

(2) To install a work holder, engage the U-groove of work holder with the work holder arm pin.

After the engagement, check if play exists in the direction indicated by arrow in Fig. 9.14. Note that play, if exists, may cause deviation of stitches.

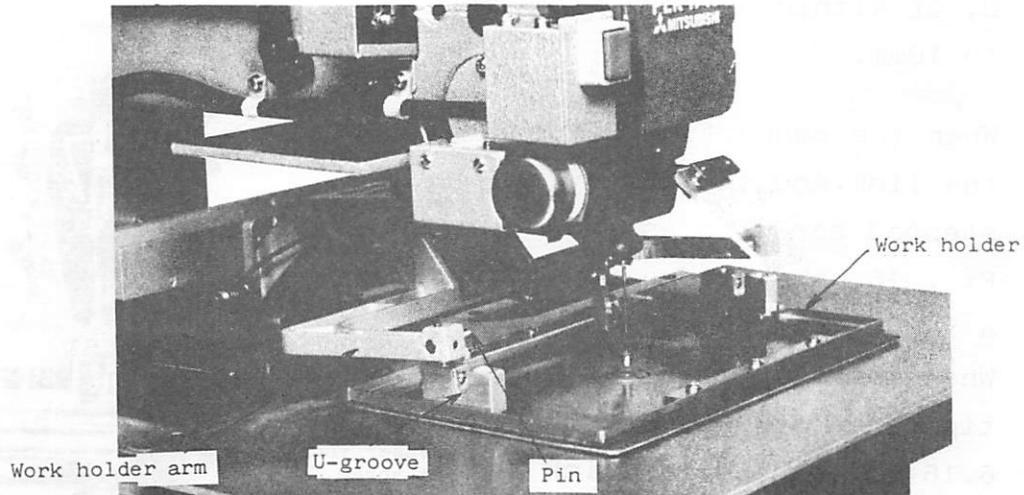


Fig. 9.14

9.9 Adjusting the presser foot

9.9.1 Adjusting the presser foot height

Adjust height of the presser foot so that the bottom surface of presser foot comes into slight contact with fabric (0 - 0.5mm above fabric) when the presser foot is located at its lowest position. (see Fig. 9.15).

To adjust, loosen the presser foot set screw or presser bar set screw shown in Fig. 9.16. Note that the presser foot adjusted too high or low may cause stitching trouble.

After the adjustment, make sure the needle is at the center of the presser foot.

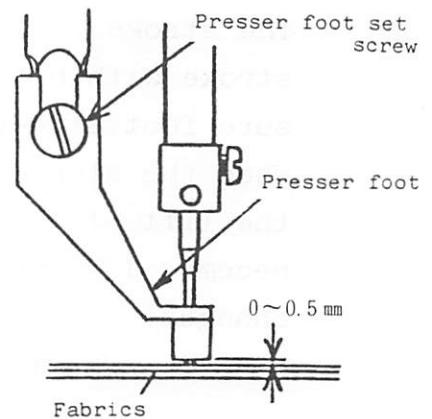


Fig. 9.15

NOTE: Height of the presser foot should be changed in accordance with thickness of fabric.

9.9.2 Adjusting the presser foot stroke

Vertical stroke of the presser foot can be adjusted to 0, or within a range from 2mm to 10mm.

When the connection between the link and the arm by the stepped screw is as shown in Fig. 16, the stroke is within a range from 4mm to 10mm.

When the stepped screw is tightened at hole "A" in Fig. 6.16 to connect the link to the arm, the stroke is within a range from 2mm to 5mm.

The stroke is zero when the stepped screw is tightened at hole "B".

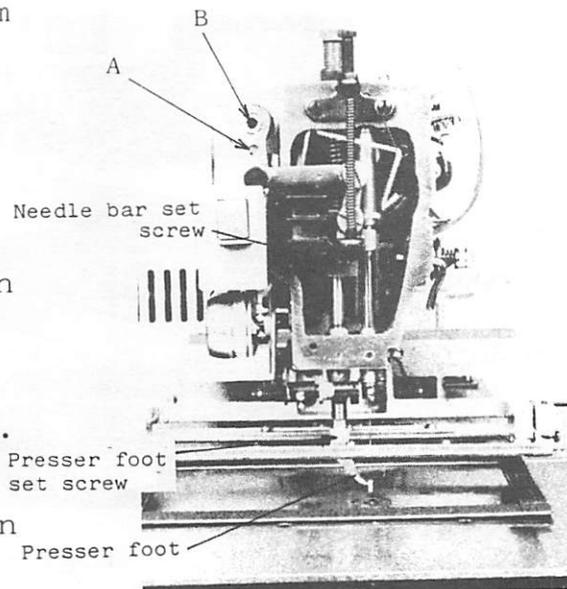


Fig. 9.16

The stroke is factory-adjusted to 4mm. Adjustment of the stroke within each range can be made by loosening the presser foot stroke adjusting bolt.

When the stepped screw is tightened at hole "A" or "B", the lift of the presser foot at stop of presser foot motion becomes 1 - 2mm larger and the height of the presser foot changes. Therefore, after adjustment of presser foot height, adjust the height of the presser foot bar.

9.9.3 Adjusting the presser foot pressure

Pressure of the presser foot can be adjusted by turning the presser foot pressure adjusting screw after loosening the thumb screw (larger) shown in Fig. 9.17.

Pressure increases when the adjusting screw is turned clockwise, and decreases when turned counter-clockwise.

The standard setting is shown in Fig. 9.17.

Do not change the setting of the smaller thumb screw.

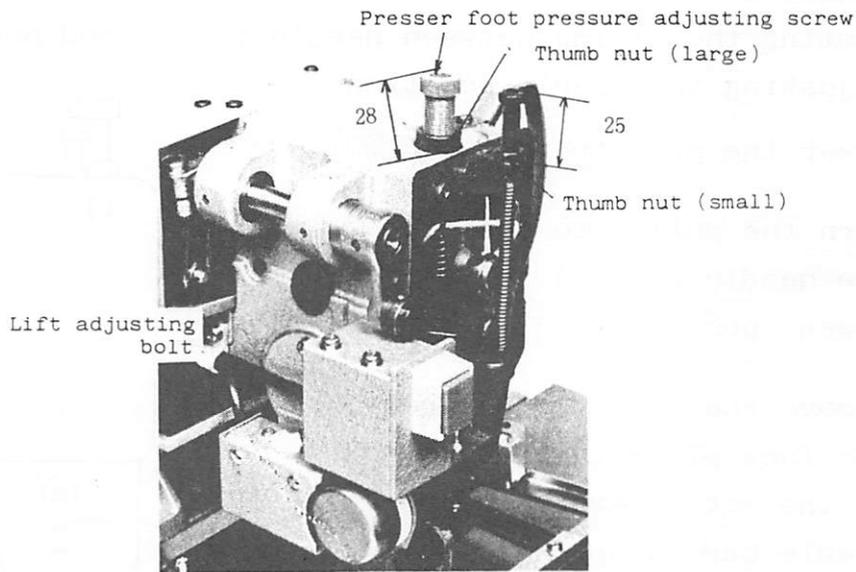


Fig. 9.17

9.9.4 Adjusting the timing of presser foot motion

For adjusting the timing of presser foot motion, refer to 10.6.

9.10 Replacing the lower clamp frame (see Fig. 6.18)

- (1) To replace the lower clamp frame, remove the lower clamp frame mounting screw (screw "A" in Fig. 9.18).
- (2) The guide plate is provided for position adjustment of the lower clamp frame.
If the lower clamp frame is not aligned with the work holder, loosen screws "A" and "B" and adjust.

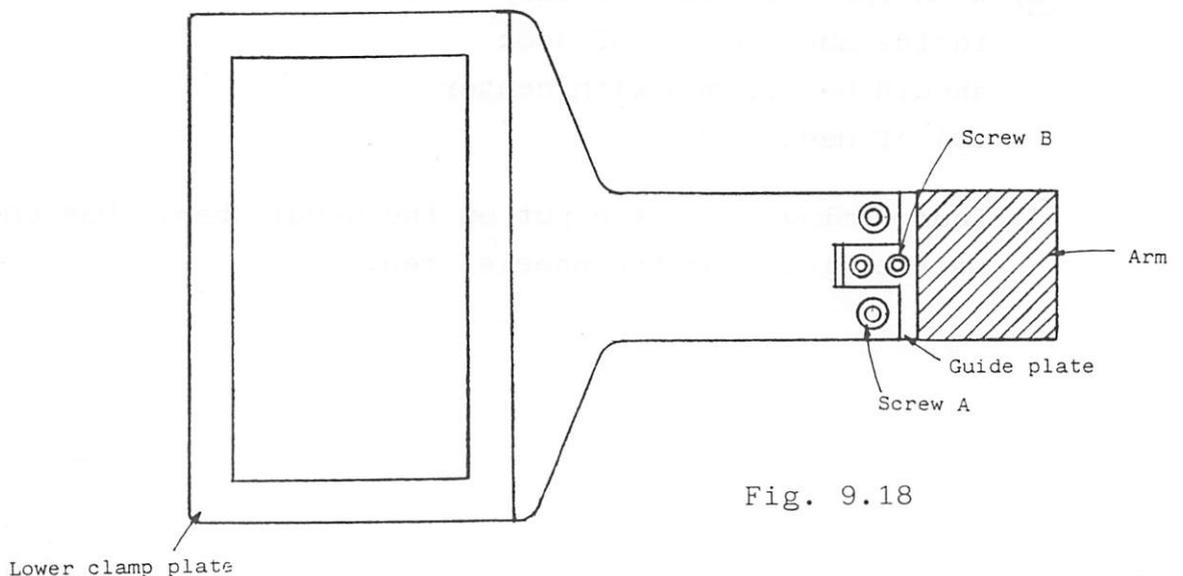


Fig. 9.18

10. ADJUSTMENT AND MAINTENANCE

10.1 Adjusting the timing between needle motion and hook motion

10.1.1 Adjusting the needle position

- (1) Lower the presser foot.
- (2) Turn the pulley to position the needle bar (C) to its lowest position.
- (3) Remove the rubber plug from the face plate (A) and loosen the set screw (B) of needle bar clamp.
- (4) Vertically move and position the needle bar (C) to adjust timing of needle bar motion and then tighten the set screw (B).

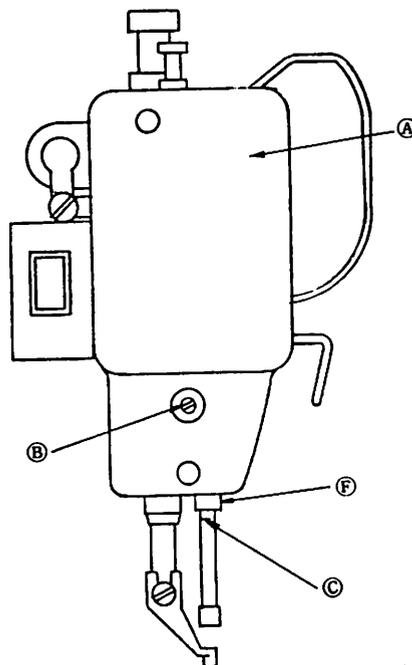


Fig. 10.1

*Timing of needle bar motion

- ① When the needle bar (C) is at its lowest position, needle bar timing mark (K) or (J) must be in line with the bottom edge of the needle bar bushing (F).
- ② With the alignment at step (1), inside surface (E) of hook should be aligned with center (D) of needle eye.
- ③ Four timing marks are put on the needle bar. Use one pair of them for the needle used.

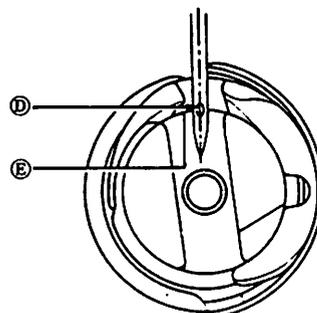


Fig. 10.2

10.1.2 Adjusting the hook position

- (1) Remove the slide plate (see Fig. 1.1).
- (2) Loosen the hook set screw (A), turn and position the hook (B) to adjust timing* of motion of the hook point (C).
- (3) Gap between the needle (D) and the hook point (C) should be about 0.05mm.

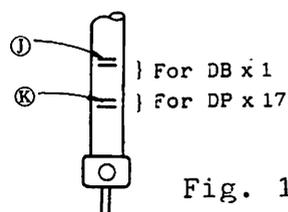


Fig. 10.3

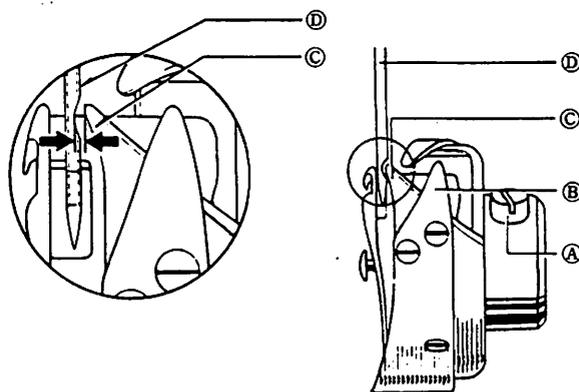


Fig. 10.4

NOTE: When the slide plate is installed, adjust its position relative to the needle position and then tighten the slide plate screws.

*Timing of hook point motion

The standard timing is as follows:

When the needle bar (B) is lifted 2.2mm from its lowest position (refer to timing mark (A) put on the needle bar),

- (1) the hook point (D) should meet the center (C) of needle, and
- (2) the gap between the needle eye upper edge (E) and the hook point (D) should be 1.0mm - 1.5mm.

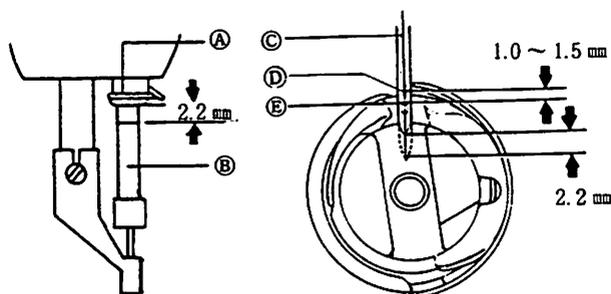


Fig. 10.5

10.1.3 Position of hook positioner

The hook positioner (A) should be adjusted so that the side surface of needle (B) is aligned with the point of hook positioner (A) as shown in Fig. 10.6.

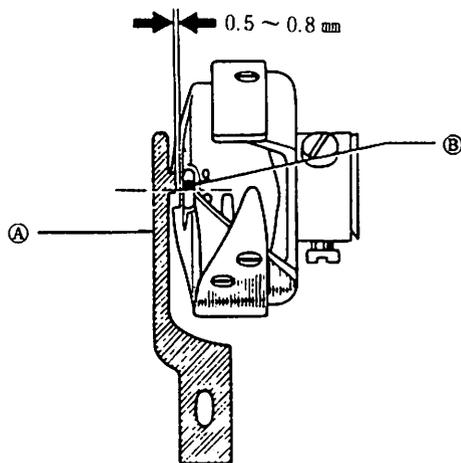


Fig. 10.6

10.2 Thread tensions

Needle thread tension should be adjusted in reference to bobbin thread tension as follows:

- (1) Bobbin thread tension can be adjusted by changing intensity of the bobbin case thread tension spring.
- (2) Needle thread tension can be adjusted by changing
 - (1) intensity of thread take-up spring (B) of needle thread tension regulator, or
 - (2) stroke (A) of the thread take-up spring, or
 - (3) pressure of the tension discs (C).

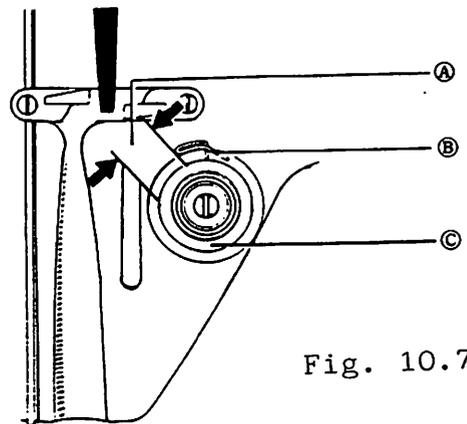


Fig. 10.7

10.2.1 Adjusting the bobbin thread tension

- (1) Put the bobbin with polyester thread #30 into the bobbin case (A) and lead out thread (C) through slit (B).

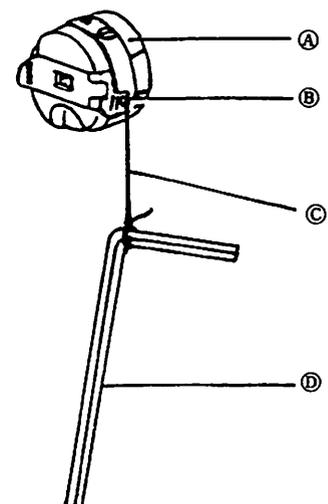


Fig. 10.8

- (2) Tie a hexagon key wrench (D) (furnished) to the thread (C) to hang the key wrench, as shown in Fig. 10.8. The standard bobbin thread tension is that the thread is gradually unwound when the bobbin case is vertically swung.

Standard bobbin thread tension: 10 - 15g

NOTE: The thread tension can be adjusted by turning screw (B) of bobbin case thread tension spring (A).

Thread tension increases when the screw is turned clockwise, and decreases when turned counter-clockwise.

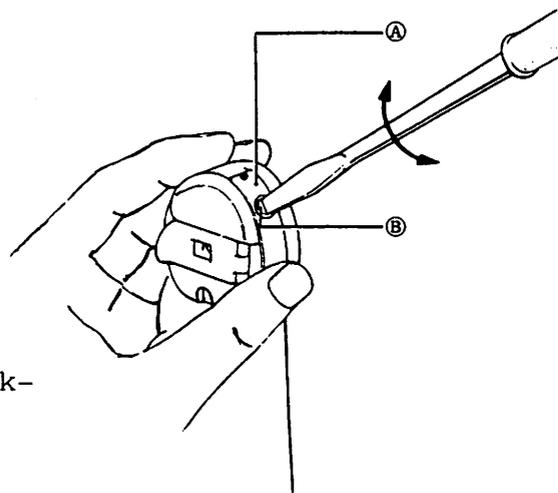


Fig. 10.9

10.2.2 Adjusting the needle thread tension

- (a) Adjusting the intensity of thread take-up spring

- (1) Loosen the tension stud set screw and turn the tension stud (B) counter-clockwise until intensity of the thread take-up spring (A) reaches zero.

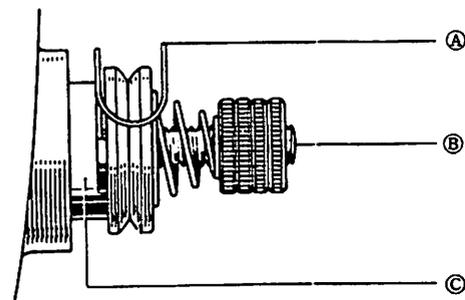


Fig. 10.10

- (2) Turn the thread stud (B) clockwise until the take-up spring (A) comes into contact with the spring stopper and then further turn tension stud (B) about 1/2 turn.

The needle thread tension will be adjusted to about 30 - 40g.

Standard needle thread tension: 30 - 40g

(b) Adjusting the intensity of thread take-up spring

- (1) Loosen the tension stud set screw (A).
- (2) Turn clockwise or counter-clockwise the tension stud (B) to adjust intensity of the spring. After the adjustment, tighten the set screw (A)

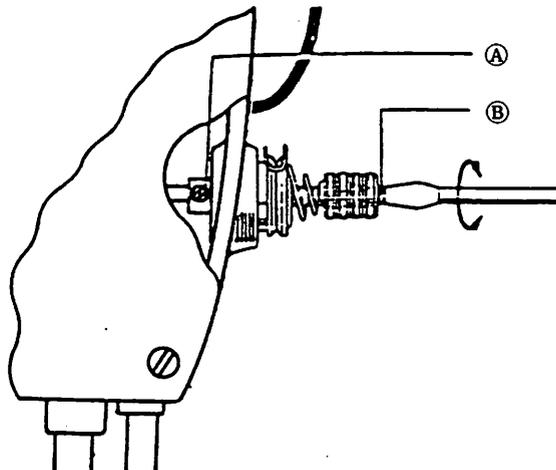


Fig. 10.11

Thread take-up spring intensity increases when the tension stud is turned clockwise, and decreases when turned counter-clockwise.

(c) Adjusting the stroke of take-up spring

- (1) Loosen the needle thread tension stud set screw (B).
- (2) Turn the tension regulating thumb nut (C) clockwise or counter-clockwise to adjust the stroke of take-up spring*.

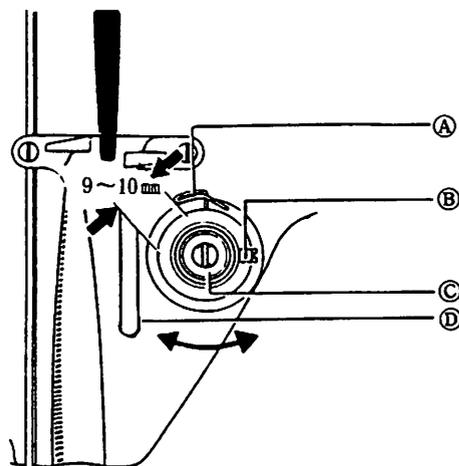


Fig. 10.12

The stroke increases when the thumb nut is turned clockwise, and decreases when turned counter-clockwise.

NOTE*: The standard stroke of take-up spring (gap between take-up spring (A) and thread guide (D)) ranges from 9mm to 10mm.

(d) Adjusting the thread tension discs

(1) Lift the presser foot and loosen the thread tension regulator set screw.

(2) Move the tension regulator bushing (B) in the direction indicated by arrow in Fig. 10.13, so that the gap between tension discs (A) is within a range from 0.8mm to 10.mm.

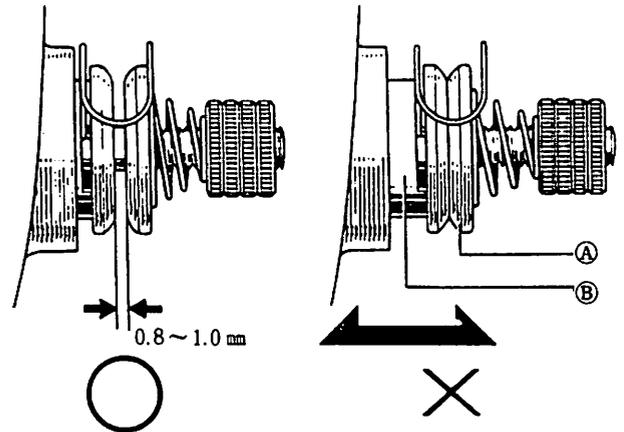


Fig. 10.13

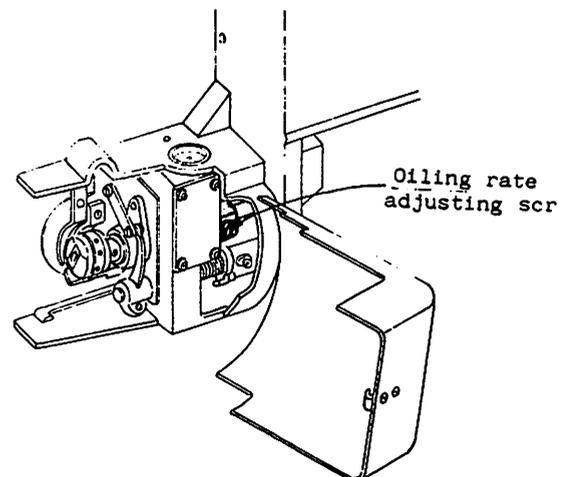
After the adjustment*, tighten the set screw.

NOTE*: Whenever the needle thread tension regulator set screw is loosened, make sure the gap between the tension disks (A) is within a range from 0.8mm to 1.0mm.

NOTE: The tension discs work only when the presser foot is lifted and when thread is trimmed.

10.3 Adjusting the lubrication to hook

- (1) Tighten the oiling rate adjusting screw by fingers or with small screwdriver until it stops.
- (2) Loosen one turn or less the adjusting screw to adjust



View with machine head laid down

oiling rate.

- (3) Oiling rate can be checked by observing the oil trace, splashed from the hook on to a test paper.

NOTE: Do not tighten the oiling rate adjusting screw with excessively large force.

Screw fully tightend

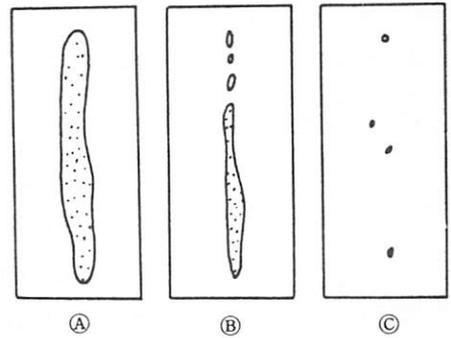
Fig. (A) Max. oiling rate
(about 250mg/min)

Screw loosened by about 3/4 turn

Fig. (B) Standard oiling rate

Screw loosened by one turn

Fig. (C) Min. oiling rate



Oil splashed from hook (for 10 sec.)

Fig. 10.15

10.4 Adjusting the bobbin winder

The contact pressure of the bobbin winder rubber wheel to the pulley can be adjusted by moving the bobbin winder assembly around the pivot pin after loosening one set screw of bobbin winder (see Fig. 10.16).

10.5 Adjusting the needle stop UP position

After the completion of stitching, the machine should stop with the timing mark (A) on the arm positioned in line with the first timing mark (B) on the pulley.

If the marks deviate

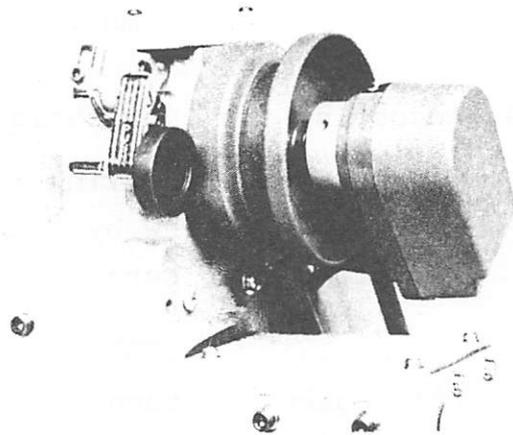


Fig. 10.16

more than 3mm from each other, loosen the set screws of synchronizer coupling and, holding the coupling with one hand, move the pulley to adjust the needle stop position.

NOTE: Although the DOWN position of the needle bar is not usually required to be adjusted, the following check should be performed.

- (1) Remove the synchronizer cover by pulling it toward the cable side (see Fig. 10.17).
- (2) The first synchronizer disc (red) is for DOWN position detection, and the second (black) is for UP position detection.
- (3) The matching mark on the first disc (red) should be at 115° on the scale of second disc (black). If the first disc is not at 115° , turn the first disc to set to 115° (see Fig. 10.18).

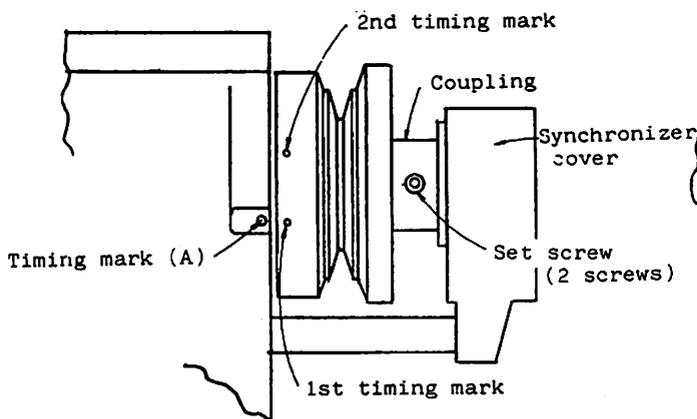


Fig. 10.17

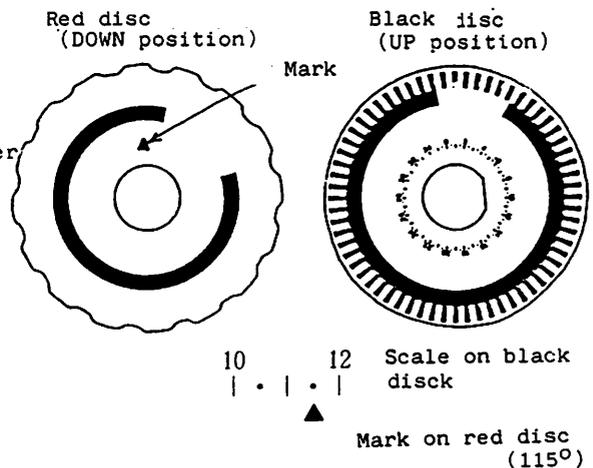


Fig. 10.18

10.6 Adjusting the timing of presser foot motion

To adjust timing of presser foot vertical motion, remove the cover on the back of arm to make accessible to the inside through the opening.

- (1) Loosen the eccentric ring set screw (C).
- (2) Turn the pulley and stop it when the needle bar reaches its lowest position.

The eccentric ring set screw (A) will come to the front

(standard position).

(3) Loosen the eccentric ring set screw (A).

(4) Secure the eccentric ring (B) in position.

Carefully turn the pulley to position the eccentric ring (B).

(5) Timing becomes earlier when the pulley is turned in the direction of arrow (D).

(6) After the adjustment, while pressing the eccentric ring (B) in the direction of arrow (E), tighten the set screws (A) and (C) in this order.

(7) Position and secure the upper vertical feed crank with its clamping screw, so that the vertical center line of the bell crank is in parallel with the presser foot bar when the take-up lever is at the highest position.

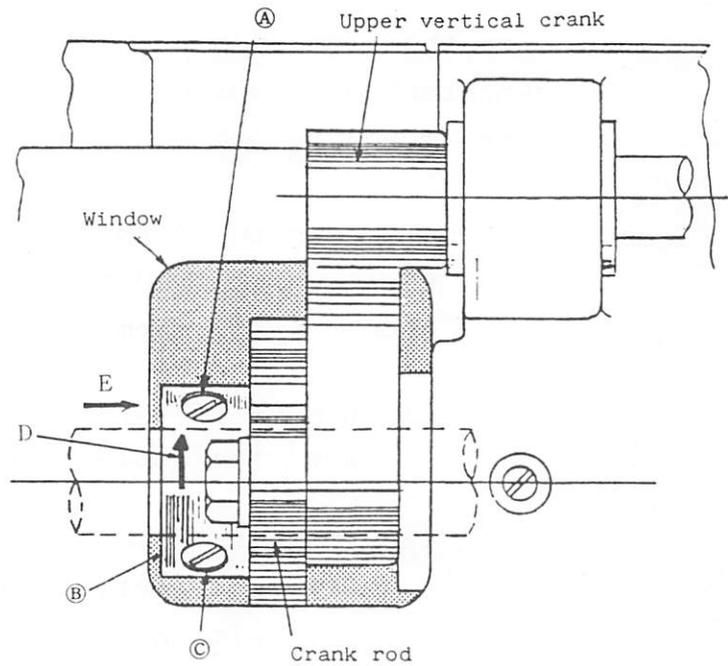


Fig. 10.19

NOTE: For adjustment of presser foot height, vertical stroke and pressure, refer to 9.9.

10.7 Air piping to cylinders for work holder, presser foot and thread trimmer

Fig. 10.20 shows the diagram of air piping to each cylinder.

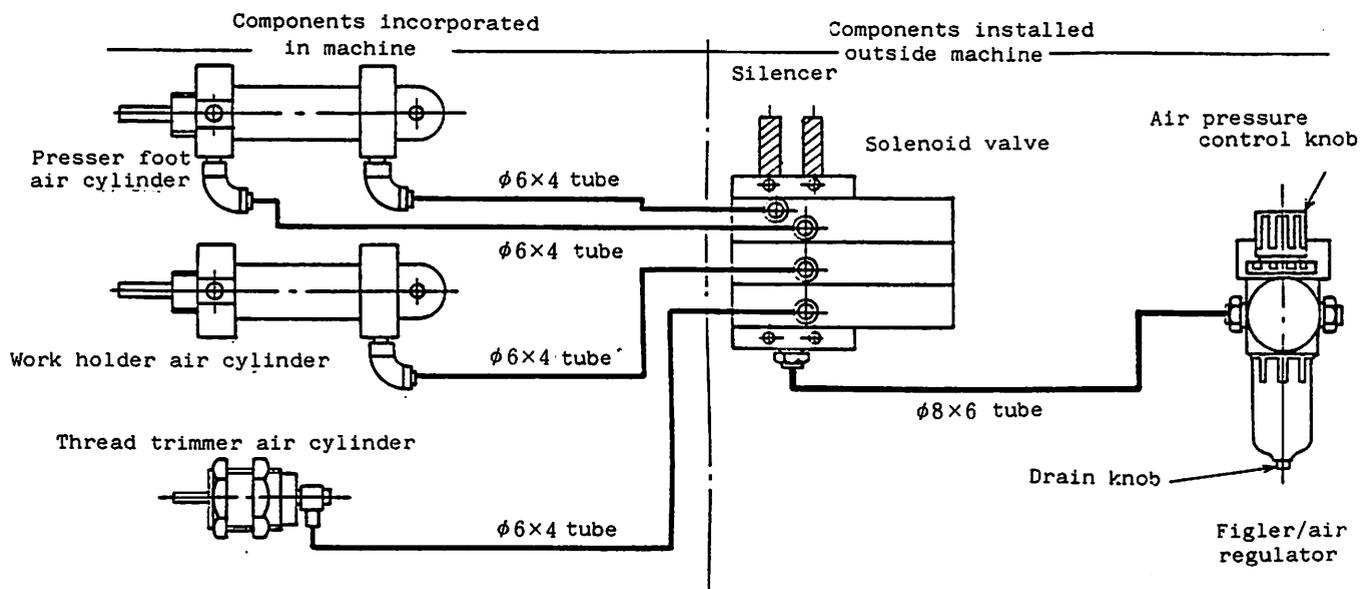


Fig. 10.20

10.8 Adjusting the wiper

10.8.1 Adjusting the height of wiper

- (1) When the wiper is not used, set the wiper release switch shown in Fig. 10.23 to "OFF".
- (2) Set the STOP/MOVE switch to STOP position when the sewing machine stops (take-up lever located at its highest position) to lower the presser foot. Loosen the wiper set screw and adjust height of the wiper so that the top of wiper is 1.0mm above the top surface of presser foot. If the distance between the needle point and the wiper top is less than 5mm, the wiper should not be used (the wiper may hit against the needle) (see Fig. 10.22).

CAUTION: When height or lift of the presser foot is changed, height of the wiper should be changed correspondingly.

10.8.2 Adjusting the wiper drive mechanism

- (1) Loosen the set screw for rotary solenoid drive crank.
- (2) Adjust position of the stopper so that gap between the bent part of stopper and the washer (clamped by the right stopper screw in Fig. 10.21) is about 4mm, as shown in Fig. 10.21, and secure it in that position.
- (3) Locate the wiper drive crank so that the driven crank pin is at the center of the slotted hole of drive crank, as shown in Fig. 10.21.
- (4) Adjust position of the driven crank so that the wiper top is positioned as shown in Fig. 10.23 when the wiper drive crank is brought into contact with the stopper.
- (5) Rotate the rotary solenoid by hand (push the drive crank) to make sure it can move smoothly.

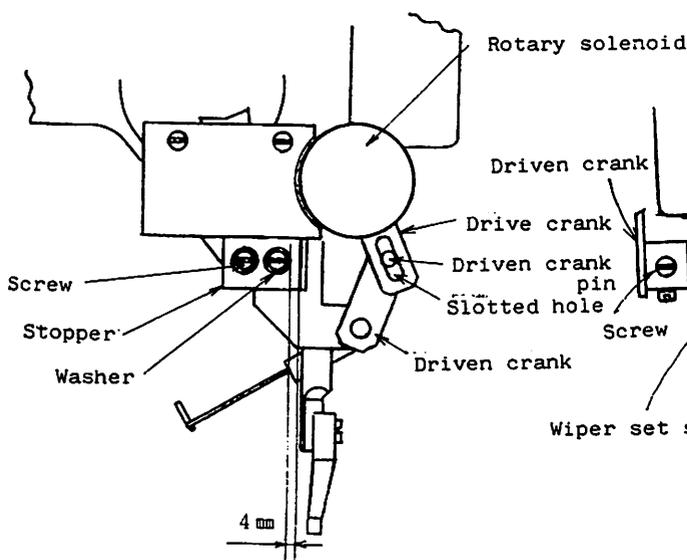


Fig. 10.21

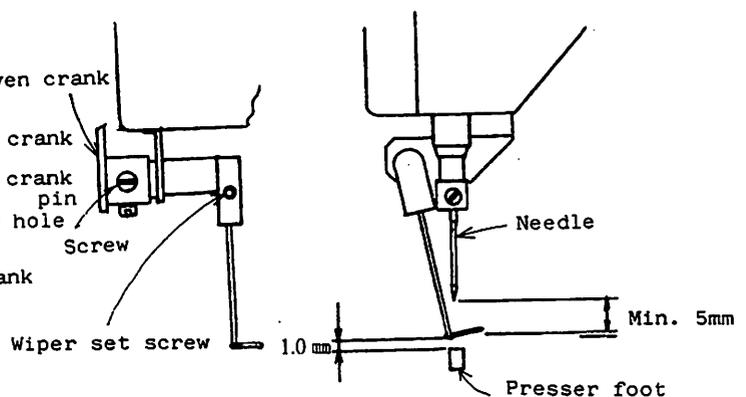


Fig. 10.22

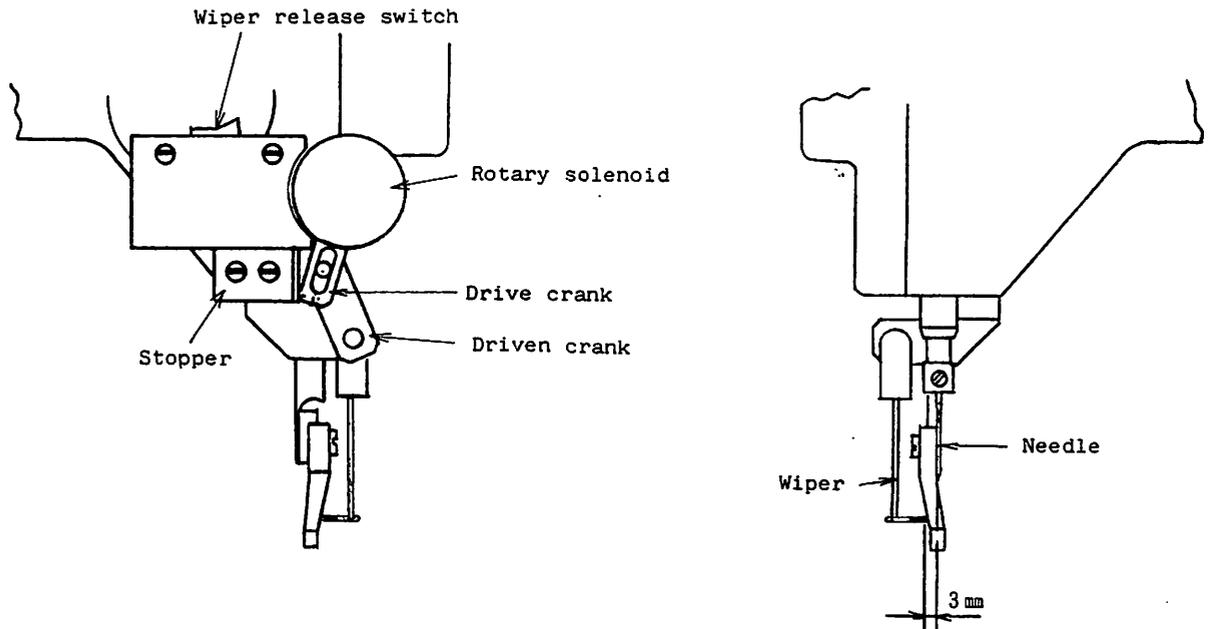


Fig. 10.23

10.9 Home position adjustment

When the sewing machine is shipped, the home position is fixed to the center of the effective sewing area. The home position can be changed within the range shown below.

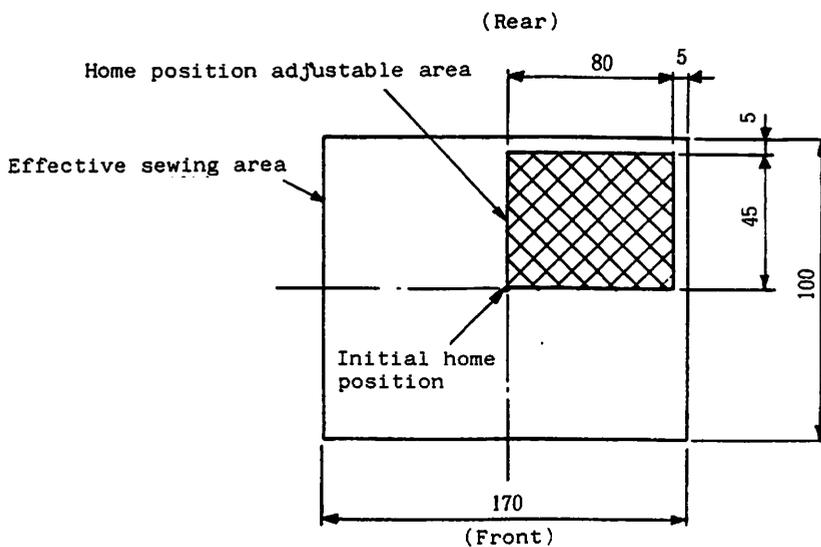


Fig. 10.24

10.9.1 Preparation for home position adjustment

- (1) Set SW1 (C) switch in the control box to "ON" position (refer to 14.3).

If this switch is "OFF", the effective sewing area becomes narrower when home position is changed.

Ex.: When home position is moved 60mm in the X direction, and 40mm in Y direction with SW1 (C) switch set at "OFF", stitching is impossible in the shaded area shown below.

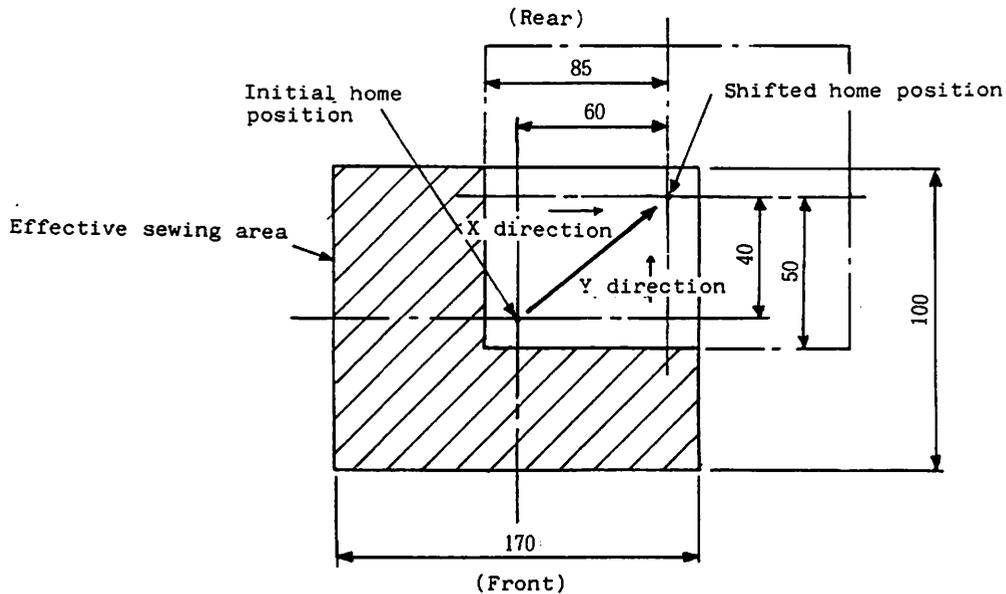


Fig. 10.25

- (2) Home position adjustment can be facilitated when it is made as follows:

Plot the original home position and the desired new home position on a paper and put the paper on the lower clamp frame.

After the RESET/HOME switch is set to RESET and then HOME, locate the original home position plotted on the paper to the needle position and secure the paper in that position. Then perform the following home position adjustment:

10.9.2 Home position adjustment in X direction

- (1) Remove the X-Y cover (upper) clamping screws, and the X-Y cover (upper). (see Fig. 10.26).

- (2) Remove two cover guide (left) clamping screws.
Remove the X-Y (lower) cover and the cover plate as shown in Fig. 10.27. (removal on the right side is not required).

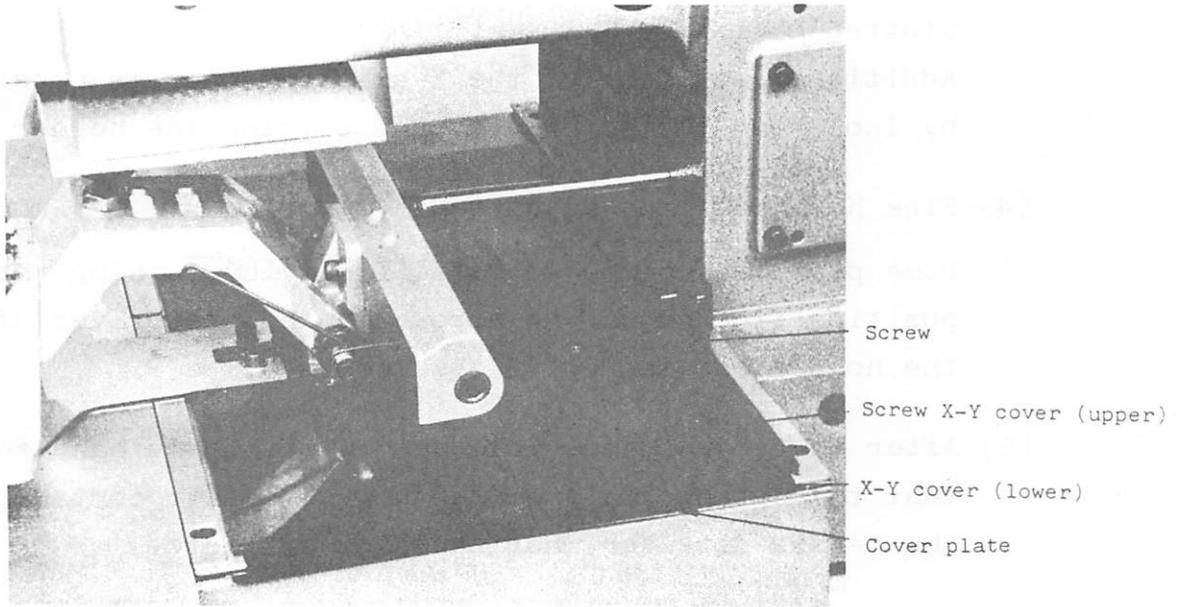


Fig. 10.26

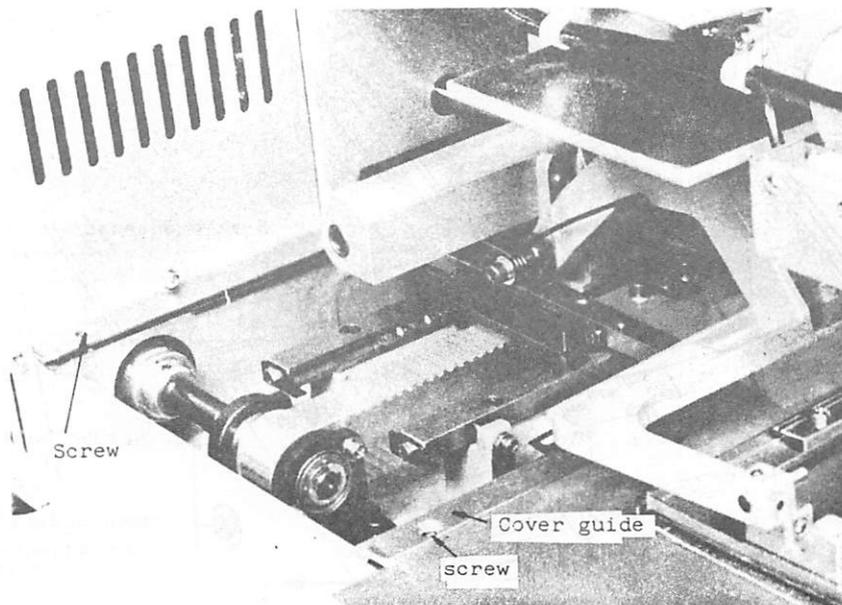


Fig. 10.27

(3) Home position can be shifted to the right by moving the X-axis detector in the direction of arrow C, and the detector plate in the direction of arrow D.

The detector plate can be moved within the length of its slotted hole.

Additional movement of the X-axis detector is possible by loosening the screws (A) and sliding the holder base.

(4) Fine home position adjustment

Home position can be adjusted finely by turning the home position fine adjusting screw with a screwdriver after the holder base screw (B) is loosened.

(5) After the adjustment, move the X-Y table by hand to check that the detector plate does not come into contact with the X-axis detector, horizontal shaft, etc.

(6) Operate the RESET/HOME switch to make sure home position has been shifted as intended.

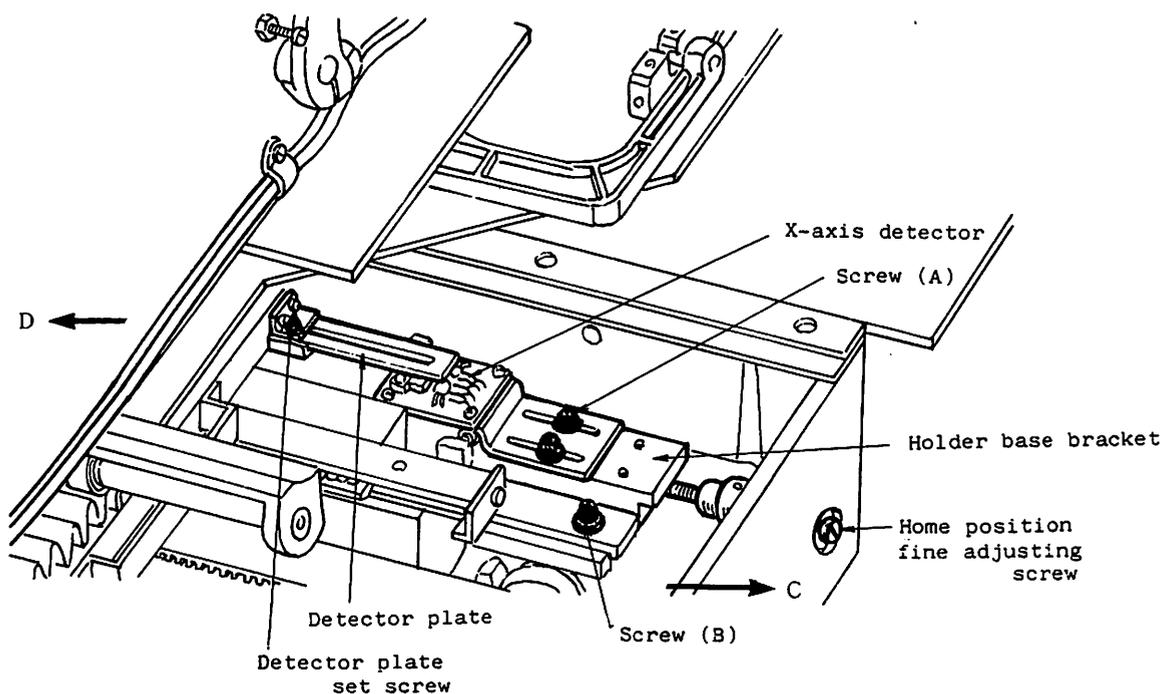


Fig. 10.28

10.9.3 Home position adjustment in Y direction

- (1) Remove the detector cover.
- (2) Home position can be shifted backward by moving the Y-axis detector in the direction of arrow (A) after the detector clamping screws are loosened.
- (3) To move the Y-axis detector for long distance, remove the screw (B) and tighten it in an appropriate screw hole.
- (4) Home position can be adjusted finely by turning the home position fine adjusting screw after the set screw (A) is loosened (adjustable distance: 3mm).
- (5) After the adjustment, check that the detector plate can pass through the space between the two detector elements without contact.
- (6) Operate the RESET/SET switch to make sure home position has been shifted as intended.

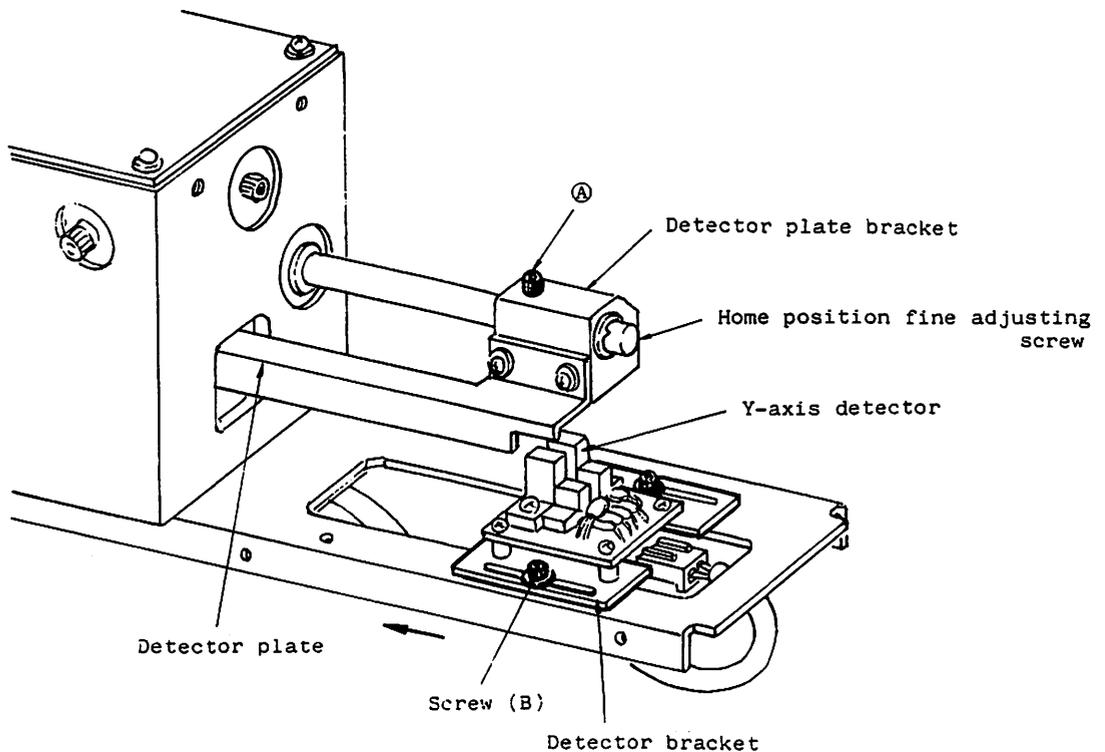


Fig. 10.29

10.10 Adjusting the X-Y table

10.10.1 Checking the X-Y table motion and movable range

- (1) After stitching of small patterns is repeated for long and the power is turned off, the work holder may not be moved by hand throughout the entire sewing area. This is caused by displacement of the X-Y table retainer. In this case, retainer position can be corrected by letting the table strike against the X and Y stoppers several times.
- (2) Long use may result in heavy movement of the X-Y table due to dust deposited on races. In this case, remove the X-Y cover (upper), X-Y cover (lower) and cover plate (see Fig. 10.26 and 10.27), oil and clean the races.
- (3) When the movable race is shifted, the moving distance of retainer is reduced to half of race moving distance.

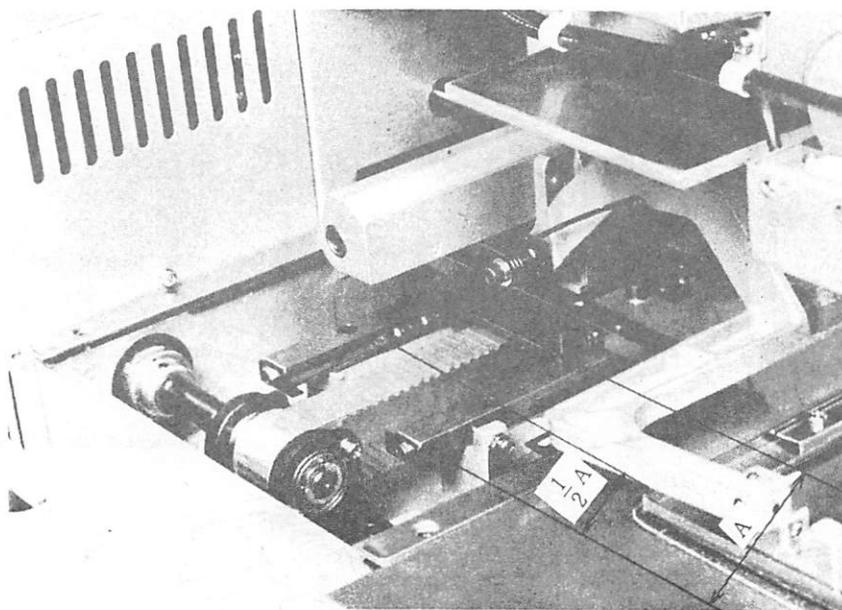
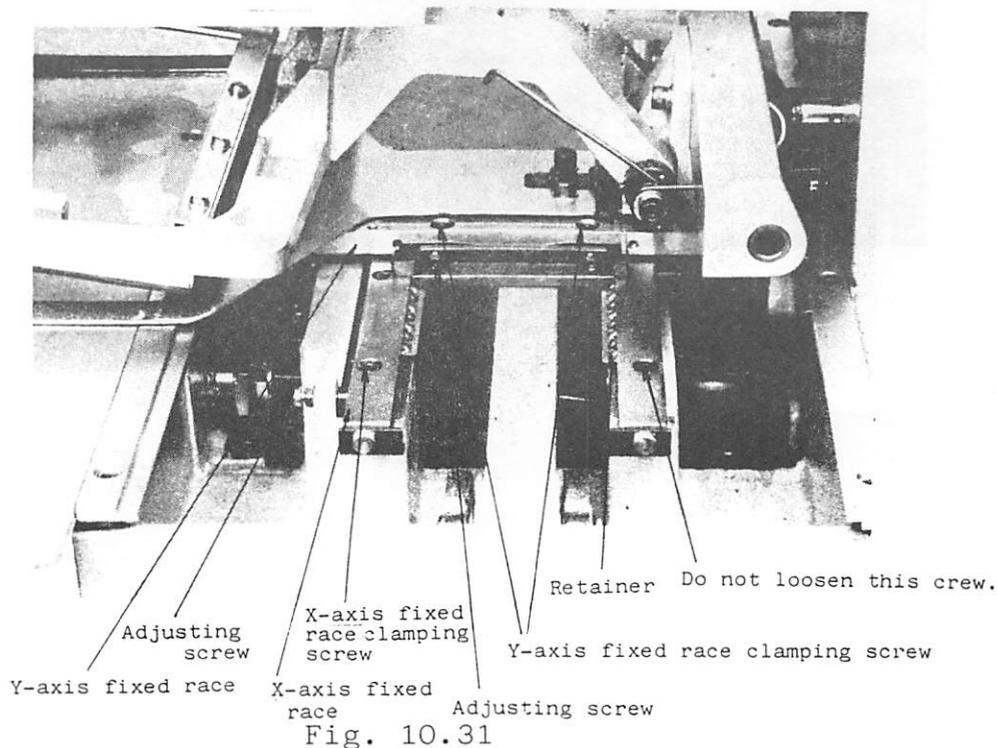


Fig. 10.30

10.10.2 Adjusting the X-Y table contact pressure

- (1) To adjust contact pressure of the X-Y table, remove the X-Y covers (upper and lower), cover plate, bellows and lower clamp plate (when contract pressure is adjusted only in the X axis, removal of the bellows and lower clamp plate is not required).
- (2) Loosen the X-axis fixed race clamping screws (only front 3 screws).
While pressing a fixed race (X) against mated fixed race (X), tighten the clamping screws.
- (3) Smaller contact pressure which does not cause play is recommended.
Adjust the pressure so that the work holder can move with roller slipping when it is moved with one retainer held in position by a finger, and that good balance is retained when located to the left and right extremities.
- (4) Adjust the contact pressure in the Y-axis direction in the same manner as above.



10.11 Adjusting the X-Y table belt tension

10.11.1 Adjusting the X-axis belt tension

- (1) Loosen four bracket clamping screws and turn the belt tension adjusting screw to adjust belt tension.
- (2) To increase X-axis belt tension, tighten the X-axis belt tension adjusting screw at the side of bed.

The recommended belt tension is that no slack is developed when the belt is lightly depressed at its center of span by finger.

This tension will be achieved by tightening the adjusting screw about 90° from nearly screwed up position.

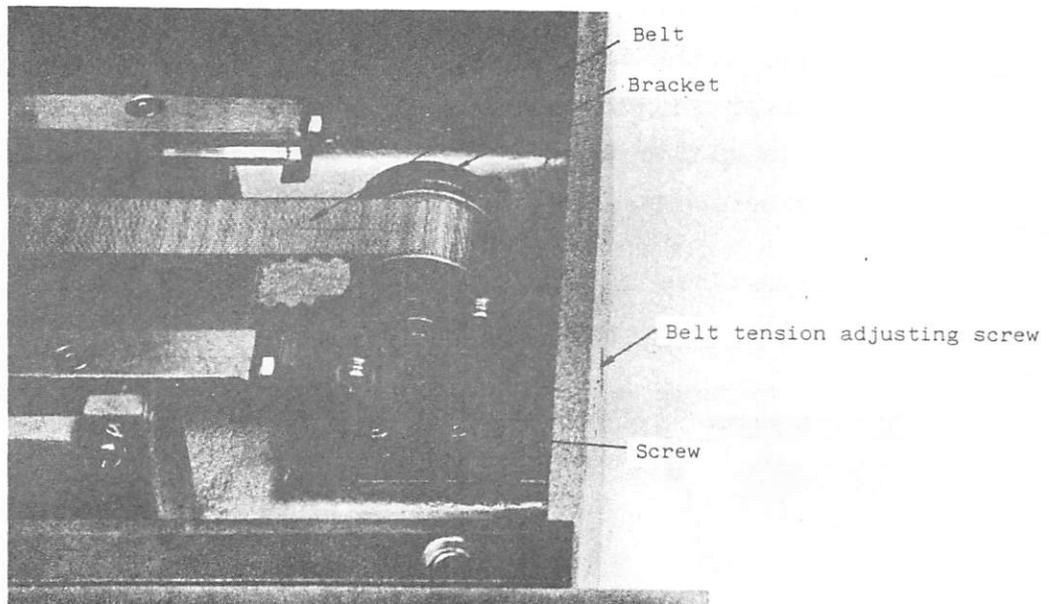


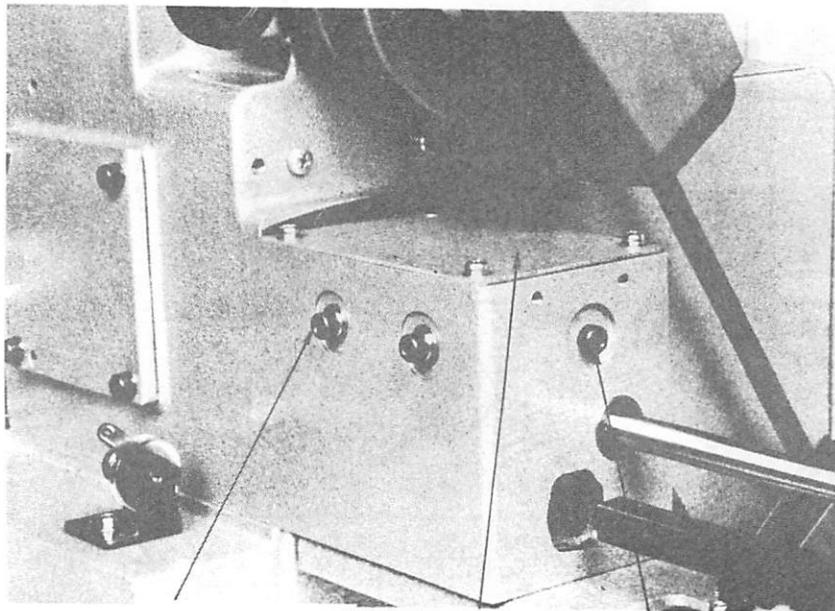
Fig. 10.32

10.11.2 Adjusting the Y-axis belt tension

- (1) Loosen the bracket clamping screws to such an extent that the bracket can move slightly.
- (2) To increase Y-axis belt tension, tighten the belt tension adjusting screw (Y).

The recommended belt tension is that no slack is developed when the belt is slightly depressed at its center of span by finger.

This tension will be achieved by tightening the adjusting screw about 90° from nearly screwed up position.



Bracket clamping bolt Cover plate Y-axis belt tension adjusting screw

Fig. 10.33

10.12 Adjusting the LIMI-STOP Z motor belt tension

- (1) Remove the belt cover.
- (2) Loosen two nuts shown below.
- (3) Adjust motor position by the upper nut so that appropriate tension is given to the belt by the gravity of the motor. After the adjustment, tighten the lower nut.

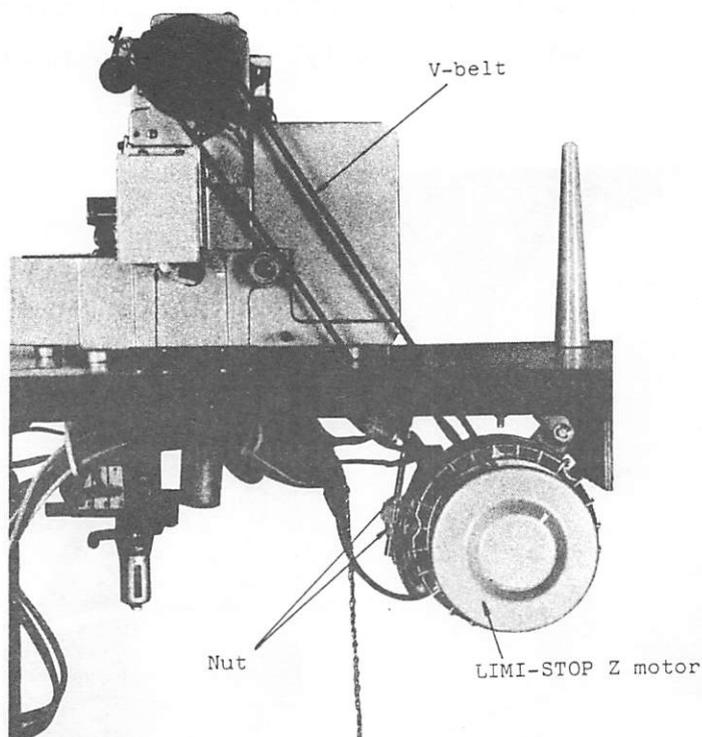


Fig. 10.34

11. ADJUSTMENT OF THREAD TRIMMER

11.1 Construction of thread trimmer mechanism

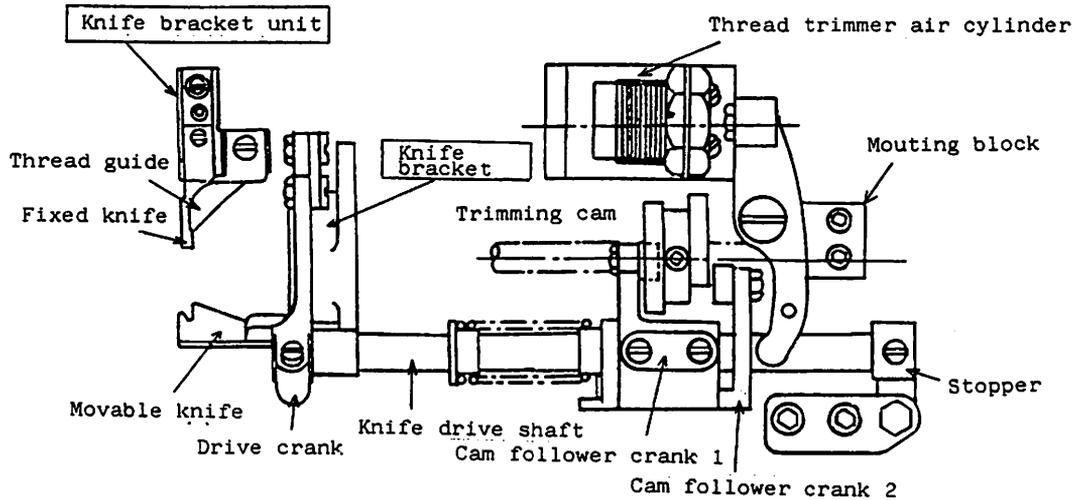


Fig. 11.1

11.2 Caution

A hook shaft cam drive system is employed in the trimmer. When the machine is adjusted, if the machine pulley is rotated with the trimmer air cylinder in actuation (that is, the cam follower (2) is engaged with the trimming cam), the movable knife comes into contact with the needle, and damaged. Therefore, the trimmer air cylinder should not be actuated during adjustment or maintenance of the machine.

11.3 Installation of knife bracket and knife bracket unit

11.3.1 Knife bracket unit

- (1) Secure the knife bracket unit to the hook shaft bushing (left) with screw (A).

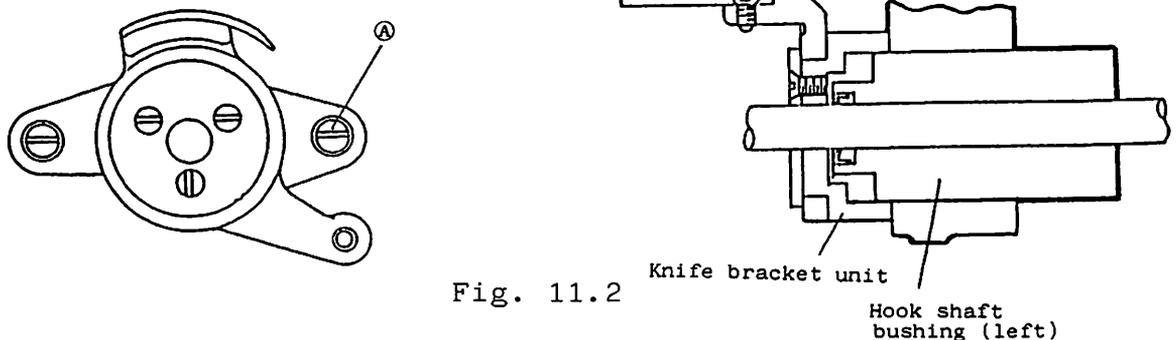


Fig. 11.2

11.3.2 Knife bracket unit

Secure the knife bracket unit to the bed with screw (A) as shown in Fig. 11.3

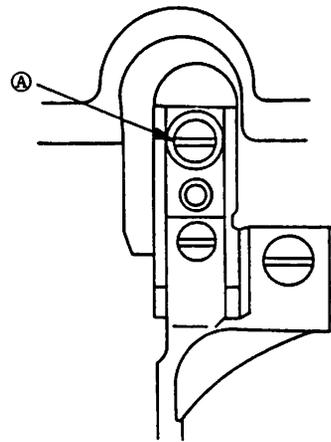


Fig. 11.3

11.3.3 Relative location of fixed knife and movable knife

(1) The standard installation of the fixed knife and movable knife is shown in Fig. 11.4.

(2) If dimension of 0.3mm shown in Fig. 11.4 is too large, the needle thread may leave the needle eye after thread trimming.

On the other hand, if the dimension is too small, thread trimming failure may occur.

(3) The dimension (0.3mm) should be adjusted when the knife bracket unit or the fixed knife is installed.

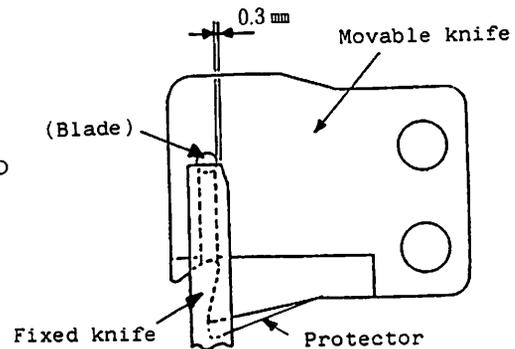


Fig. 11.4

11.4 Connection of knife bracket to drive crank

Connect the knife bracket to the drive crank as shown in Fig. 11.5. Pay attention to position of the link.

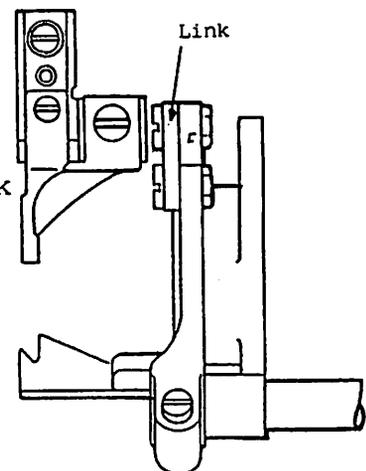


Fig. 11.5

11.5 Knife drive shaft

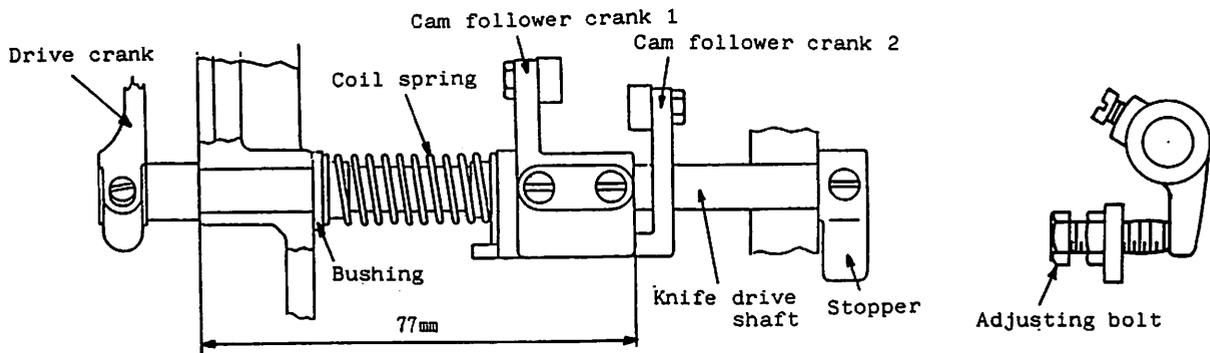


Fig. 11.6

- (1) The standard installation of the knife drive mechanism is shown in Fig. 11.6.
- (2) When the knife drive mechanism is assembled, pass the knife drive shaft through the drive crank first.
- (3) Secure the cam follower crank (1) to the knife drive shaft in position shown in Fig. 11.6.
- (4) Secure the stopper so that the knife drive shaft has no play in the axial direction, and can rotate smoothly.

11.6 Installation of trimmer air cylinder

- (1) Installation of trimmer air cylinder unit

- ① The unit is installed by screws (C) shown in Fig. 11.7.

When the trimmer air cylinder is in release condition, a gap of about 1mm should be developed. To adjust this gap, loosen screws (C) and adjust position of the bracket.

- ② When the trimmer air cylinder

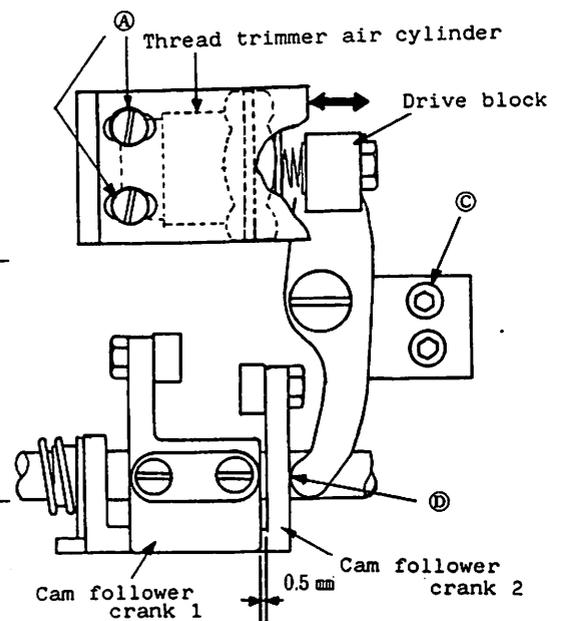


Fig. 11.7

der is actuated, a gap of 0.5mm is developed between the cam follower arms (1) and (2) as shown in Fig. 11.7 (under the standard installation).

To adjust the gap to 0.5mm, loosen screws (A) and move the air cylinder in the direction of arrow in Fig. 11.7.

11.7 Installation of trimming cam

- (1) Align the second timing mark (A) on the pulley with the timing mark on the arm, as shown in Fig. 11.8 (a).
- (2) Actuate the trimmer air cylinder to rotate the trimming cam clockwise as shown in Fig. 11.8 (b) and secure the trimming cam in position when the cam comes into contact with the roller.
- (3) Release the trimmer air cylinder. When the cam follower arm (2) is returned, the gap between the cam and the roller should be 0.5mm - 1.0mm as shown in Fig. 11.8 (c).

NOTE: The standard position of the cam follower (2) before it is actuated is shown in Fig. 11.9.
If the position of the cam follower (2) is shifted, when the stopper plate is removed, for example, it should be adjusted by the adjusting bolt shown in Fig. 11.6 and then the steps (1) - (3) should be accomplished.

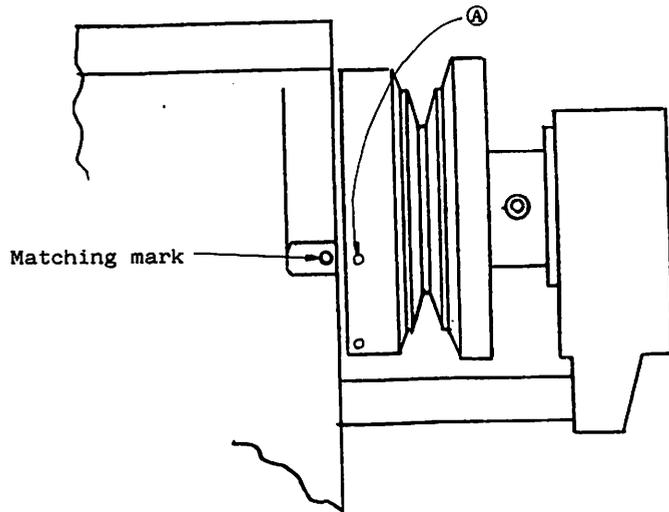


Fig. 11.8 (a)

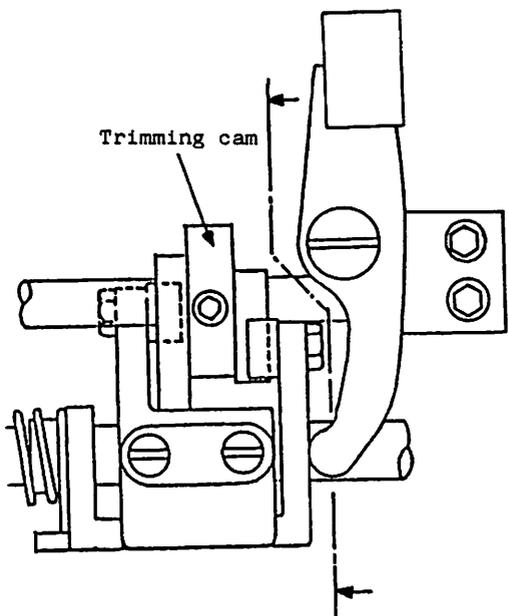


Fig. 11.8 (b)

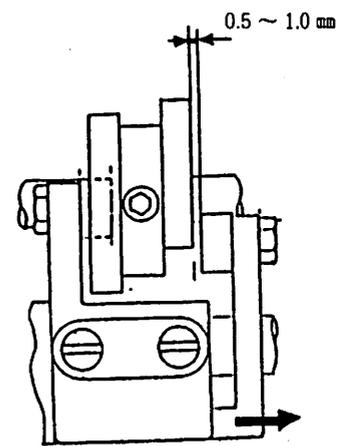
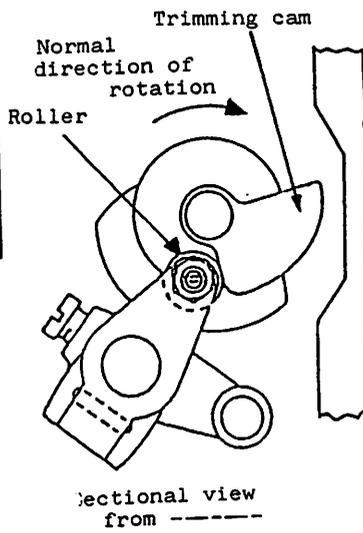


Fig. 11.8 (c)

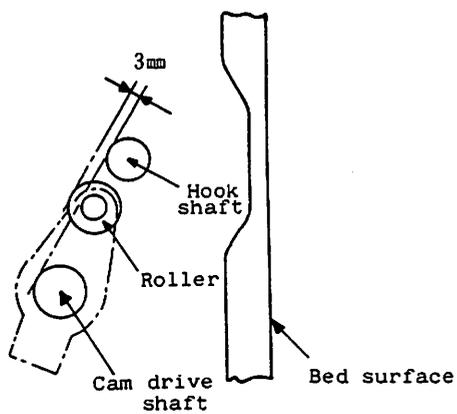


Fig. 11.9

11.8 Adjusting the knife engagement

(1) Relative positions of movable knife and fixed knife

The movable knife and the fixed knife should be located as shown in Fig. 11.10 (standard positions).

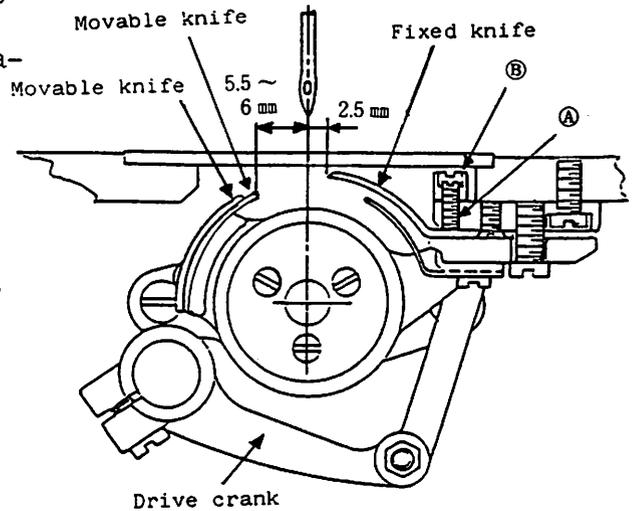


Fig. 11.10

(2) Adjusting the knife engagement

- ① When the trimmer air cylinder is actuated and the sewing machine is run, the trimming cam rotates the movable knife.

When the movable knife advances fully, knife engagement should be 1.5mm - 2.0mm as shown in Fig. 11.11.

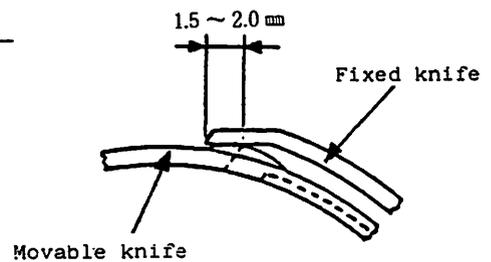


Fig. 11.11

- ② To adjust knife engagement, change position of the drive crank.

(3) Adjusting the knife engagement pressure

- ① The standard knife engagement is that the movable knife starts engaging with the fixed knife when they are positioned as shown in Fig. 11.12 (1).

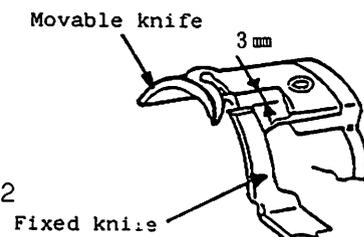


Fig. 11.12(1)

- ② If thread cannot be trimmed easily, increase knife engagement pressure.

- ③ To adjust knife engagement pressure, loosen the lock nut (B) shown in Fig. 11.10 and turn the adjusting screw (A).

(4) Installing the knife protector

Put the protector under the movable knife and secure it in position together with the movable knife, as shown in Fig. 11.12(2).

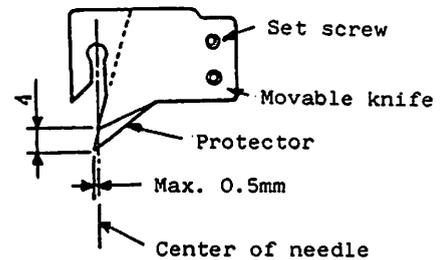


Fig. 11.12(2)

11.9 Adjusting the needle thread tension release

- (1) When the tension release solenoid is actuated, the tension discs should open about 1.0mm as shown in Fig. 11.13.

- (2) To adjust, loosen the nut (C) shown in Fig. 11.14 and move the wire tube.

Opening of the tension discs increases when the wire tube is moved to the left.

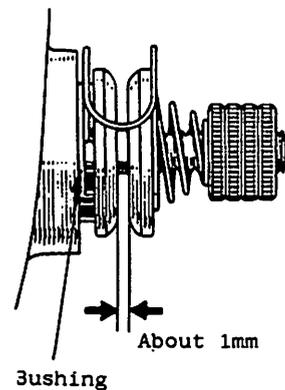


Fig. 11.13

NOTE: If opening of the tension discs is too small, the needle thread may be broken due to excessive tension to the needle thread. Too loose tension discs, however, may cause loose stitch.

- (3) If opening cannot be adjusted by moving the wire tube, loosen the screw (A) and pull the wire to adjust.

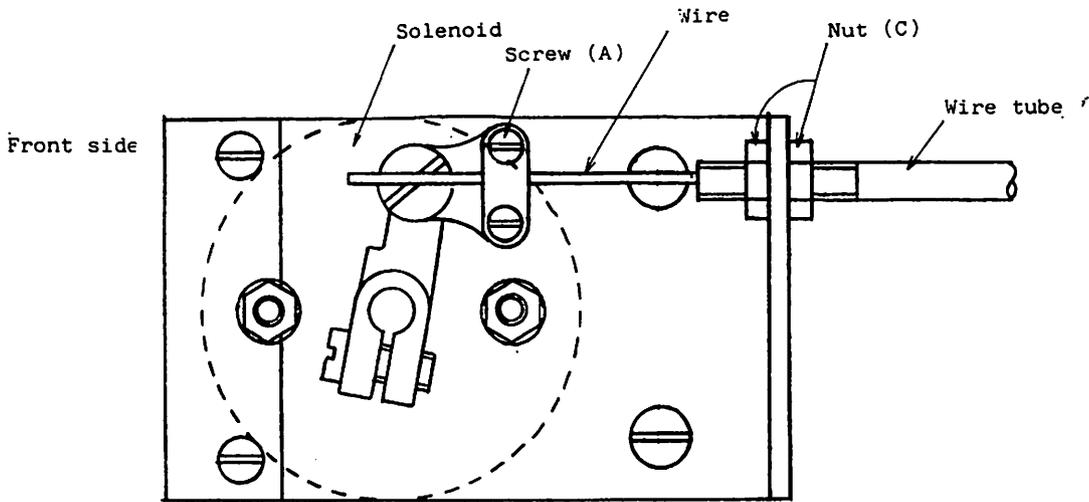


Fig. 11.14

(4) Thread release timing can be adjusted on the synchronizer located by the balance wheel (pulley).

To adjust, set the marking on the blue ring in the synchronizer to 295° on the scale of black ring.

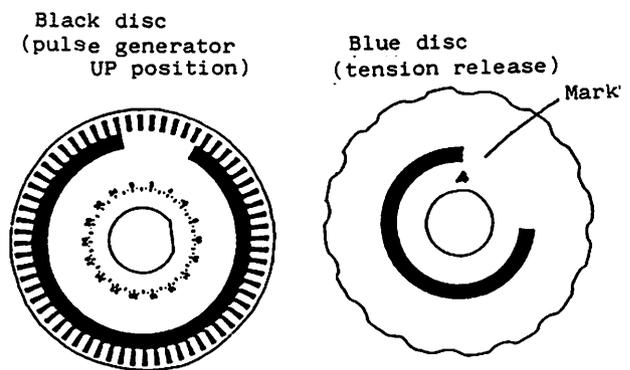


Fig. 11.15

Thread release becomes faster if the blue ring is set to smaller angle, and becomes slower if set to larger angle.

NOTE: Faster thread release may cause unstable thread trimming, and slower thread release may cause shorter length of trimmed needle thread end.

11.10 Adjusting the length of thrimmed needle thread end

This adjustment can be made by turning the pretension nut (A).

- o Turning the nut clockwise
Length of remaining thread end becomes short.
- o Turning the nut counter-clockwise
Length of remaining thread end becomes long.

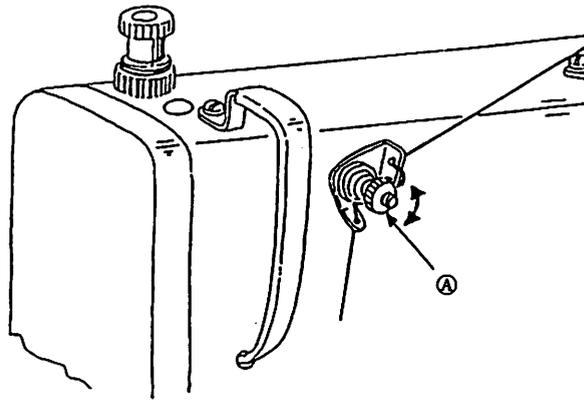


Fig. 11.16

11.11 Hook, bobbin case and bobbin

- (1) Use a hook for thread trimmer application, having bobbin thread guide slit (A), as shown in Fig. 11.16.

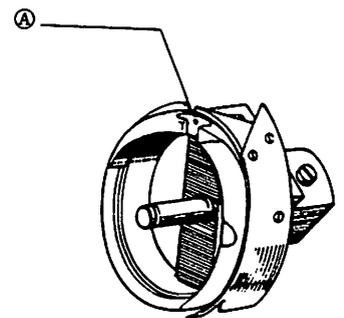


Fig. 11.17

- (2) The bobbin case should have a spring (A) for prevention of racing.

NOTE: When bobbin thread tension is adjusted by the bobbin case, adjust the tension a little smaller than that required in ordinary single-needle lockstitch machine in view of pressure of the spring for prevention of racing.

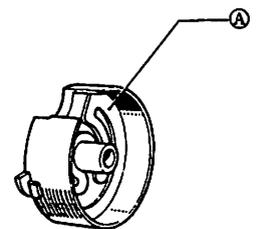


Fig. 11.18

- (3) Use a furnished bobbin, or equivalent. When an aluminum bobbin is used, wind the thread on the bobbin under a tension adjusted as small as possible to prevent deformation of the bobbin due to wound thread tension.

12. CONTROL SYSTEM

12.1 LIMI-STOP Z motor

12.1.1 Filter

Periodically clean the air filters installed at the motor end cover and on the pulley side. Note that air filter heavily clogged with dust might cause overheat to the motor.

12.1.2 Motor

Overhaul is not required for the motor used under the normal operating conditions. If long use makes stop position inaccurate, or running speed becomes unstable, or unusual sound occurs when the motor is braked, however, check the motor as follows:

- (1) Turn off the power source to stop the motor. (It will take 2 minutes until the motor completely stops after the power is turned off.)
- (2) Remove the belt and motor pulley.
- (3) Unplug the case (for brake) connected to the control box from the bracket.
- (4) Remove the three bracket mounting screws.
- (5) Remove the bracket.
- (6) Check the brake lining and the brake disc for condition. If the brake lining is found excessively worn, causing contact of metallic parts, replace it.
- (7) Hold the clutch shaft by hand and carefully draw it out. The driven member (cup-shaped part) and the brake lining can be removed.
If they cannot be taken out, set two screws (M5 x 0.8 with thread length of 45mm or longer) into the tapped holes provided in the aluminum boss and tighten the screws alternately to release the drive member and the brake lining.

- (8) To release the brake lining, remove the bearing on the pulley side and replace the brake lining together with the bearing.

When a new brake lining is installed, care should be taken to let the tapped holes, mentioned at step (7), meet holes of the brake lining (once dismantled bearing should be replaced with a new one).

- (9) Assemble the brake in the steps reverse to the disassembling.

If the clutch shaft cannot be inserted by hand, lightly tap the clutch shaft end with a mallet (do not forcefully tap).

- (10) When the brake lining is replaced, turn the clutch shaft by hand after the completion of the assembling to make sure the shaft can rotate smoothly and then perform test operation by turning on the motor.

CAUTION:

- o Carefully handle the driven member to avoid deformation.
- o Since a special bearing is used, order a new bearing from us when it must be replaced.

12.2 Grounding for prevention of noise-induced malfunction

(1) Malfunction caused by noises may be eliminated to a certain extent by grounding the control box, synchronizer and machine head.

(For power source of voltage higher than AC150V, grounding is indispensable. The grounding should be made by authorized electrician.)

(2) Do not locate the sewing machine near a machine or equipment that generates intense electric noises, such as high-frequency welder.

12.3 Fuses and magnetic contactor

(1) Use two glass-tube fuses of 10A rating ($\phi 6.4\text{mm} \times 30\text{mm}$). For location of fuses, refer to Fig. 12.1.

(2) Magnetic contactor

The thermal setting of magnetic contactor is,

200V - 50/60Hz 2.6A

220V - 50/60Hz 2.6A

12.4 Cooling fan

The control box is equipped with a cooling fan located on the bottom of control box.

If the cooling fan does not work, electronic components in the control box might be damaged.

To prevent such a trouble, remove the filter from the cooling fan and clean it monthly.

CAUTION: 1. If the filter is pushed with an excessively large force when it is attached to the cooling fan, the fan blades might be locked by the filter. The filter should be attached after the frame is removed.

2. Before removing the filter, turn off the power and make sure the fan stops completely.

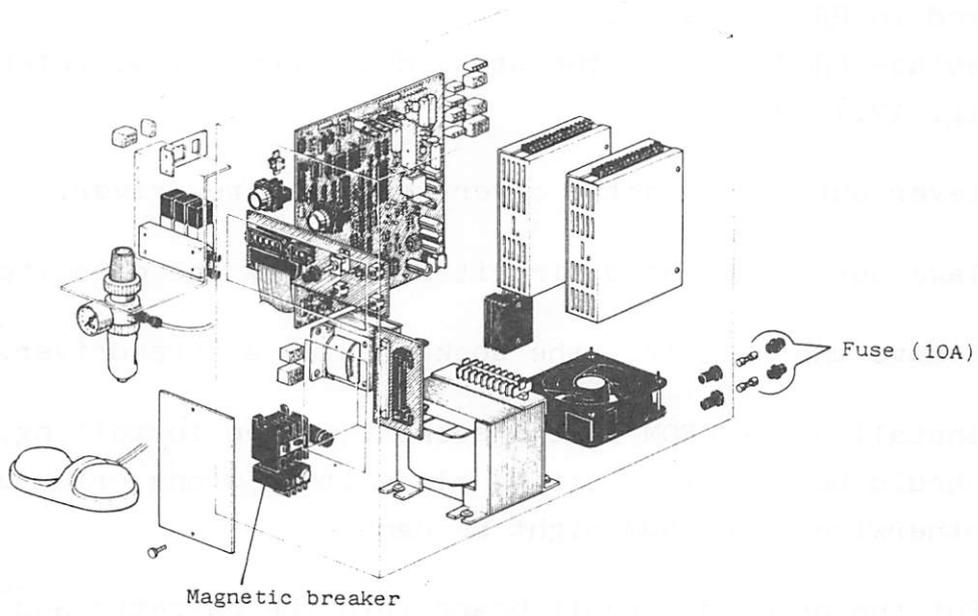


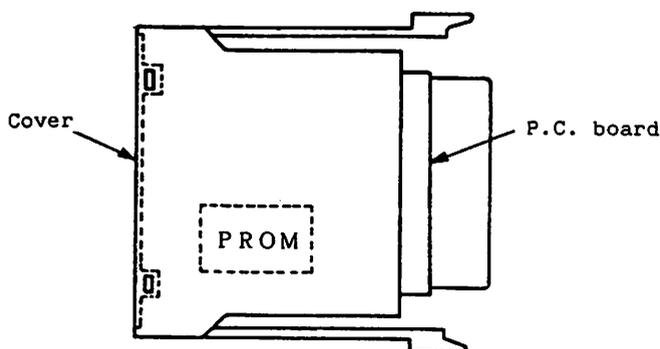
Fig. 12.1

13. REPLACEMENT OF PROM

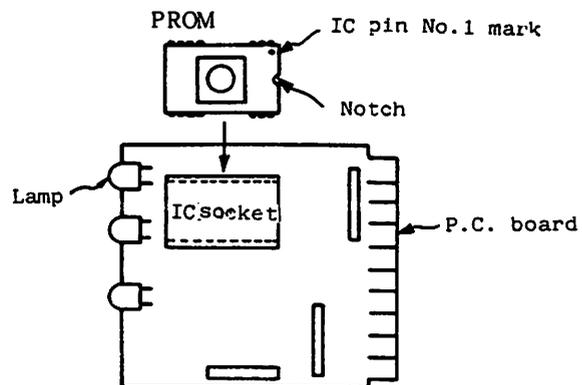
PROM is installed in the socket on the printed circuit board encased in PROM cassette.

To replace PROM, follow the steps described below, referring to Fig. 13.1 and 13.2.

- (1) Lever out the cassette cover using a screwdriver.
- (2) Take out the printed circuit board from the cassette.
- (3) Remove the PROM from the socket using a screwdriver.
- (4) Install a new PROM in the socket. When installing, care should be exercised not to place it in wrong orientation, otherwise, the PROM might be damaged.
- (5) Put the printed circuit board into the cassette and install the cassette cover.
- (6) Use care not to directly touch the printed circuit board terminals with fingers.
- (7) When removing the PROM with a screwdriver, use care not to damage the circuit patterns.
It is recommended to use an IC remover (Type P-63, TAKARA TOOL S/S, for example).
- (8) Do not place the printed circuit board and PROM on statically charged cloth or plastic, but place on a metallic sheet.



PROM cassette
Fig. 13.1



Notch of PROM should come to P.C. board terminal side.

Printed circuit board
Fig. 13.2

(9) Optionally available PROM cassette (for expansion of stitch data storage capacity) should be installed as shown below.

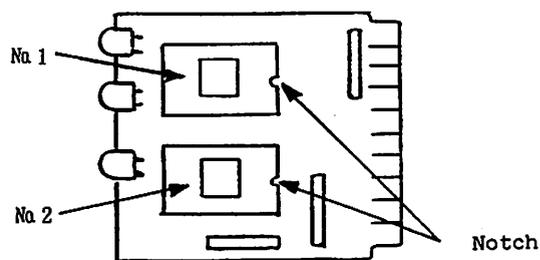


Fig. 13.3

14. AUXILIARY FUNCTIONS

The DIP switches SW1, SW2 and SW4 on the CPU board in the control box have the following functions:

(The switches are protected with transparent covers. After the completion of setting, be sure to attach each cover.)

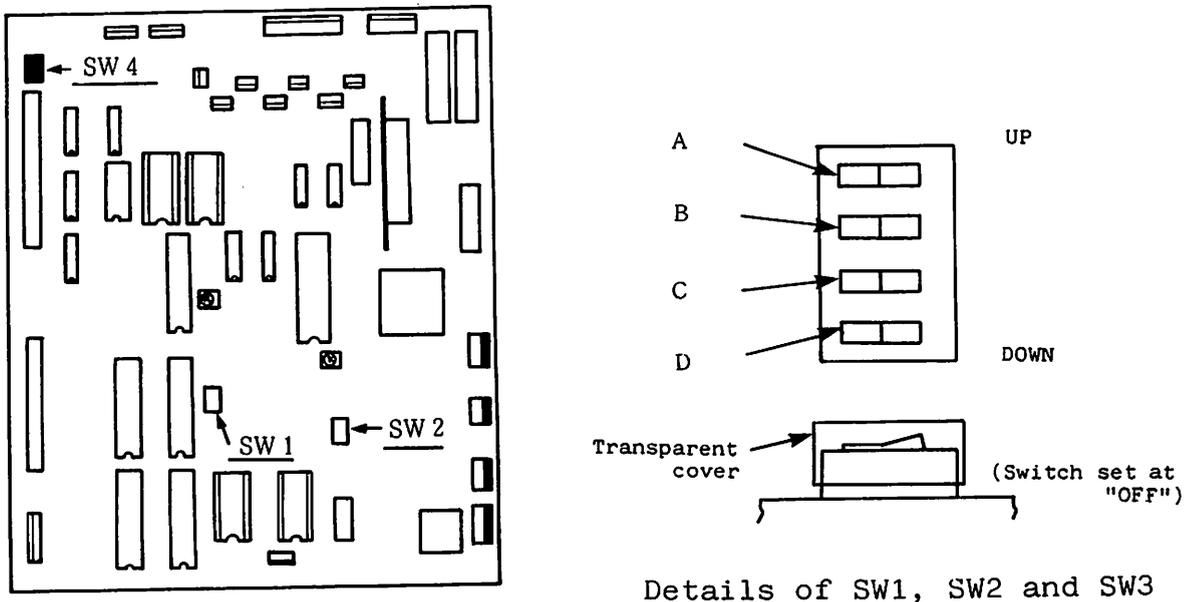


Fig. 14.1

14.1 Repeat function

With SW1 (A) switch set at "OFF" position (initial setting), the pattern is stitched only once and the work holder rises upon completion of stitching even if the START switch is held pressed. When this switch (A) is at "ON", the work holder lifts, as usual, when the power is turned on, or the RESET/HOME switch is set to RESET position, or when the work holder lift switch is pressed, but it remains lowered after the completion of stitching, thus permitting immediate resumption of stitching operation (stitching starts again when the START switch is pressed).

Therefore, stitching of the same pattern can be repeated.

This function is very helpful when a part (piece) is held in the lower clamp frame, instead of the work holder, for stitching embroidery on that part, for example.

14.2 Speed limit select function

When SW1 (B) switch is set at "OFF" (initial setting), sewing speed is restricted to "Speed Limit 1" shown in Table 8.1.

When the switch (B) is at "ON", sewing speed is restricted to "Speed Limit 2" in Table 8.1.

"Speed Limit 2" should be selected when a heavy fabric is sewn (when the work holder and fabric are heavy).

14.3 Sewing area limit release function

When SW1 (C) switch is at "OFF" (initial setting), movement of the work holder is limited to prevent overrun resulting from excess pattern enlargement or reduction (when SCALE function is used), or from stitching data input error.

This limit can be removed when this switch (C) is set to "ON".

The function is used to expand the sewing area when the home position is shifted (see 10.9).

14.4 Thread trimming release function

When SW1 (D) switch is at "OFF" (initial setting), depression of the HALT switch causes thread trimming and stop of the work holder at its DOWN position.

When HALT signal is given from an external signal source with the switch (D) set at "OFF", thread trimming does not occur and the work holder stops at the UP position.

When thread trimming signal and HALT signal are given at the same time, thread is trimmed and the work holder stops at the UP position.

On the contrary, when the HALT switch is pressed with this switch (D) set at "ON", thread trimming does not occur and the work holder stops at the DOWN position.

When HALT signal is given from an external signal source with the switch (D) set at "ON", thread trimming does not occur and the work holder stops at the DOWN position.

When thread trimming signal and HALT signal are given at the same time from external signal sources with the switch (D) set at "ON", thread trimming occurs and the work holder stops at the DOWN position.

Sewing operation can be resumed by pressing the START switch with the work holder at the DOWN position.

14.5 Adjusting the fabric feed timing

Fabric feed timing can be changed by changing settings of SW2 switches.

In Table 14.1, the initial switch settings are listed.

When the switch settings are as shown in Table 14.1, fabric feed starts when rotation of the arm shaft for 8 pulses (arm shaft rotates 5.6° per pulse) is completed after needle DOWN position is detected by the synchronizer.

If the switch (C) is set at "OFF", for example, fabric feed starts after the arm shaft rotates for 10 pulses (i.e., $8 + 2$ pulses).

Fabric feed timing can be checked as follows:

- (1) With the needle at the UP position, turn on the power.
- (2) Press the work holder lift switch to lower the work holder.

Switch	Timing
(A) OFF	8 pulses
(B) ON	4 pulses
(C) ON	2 pulses
(D) ON	1 pulse

Table 14.1

- (3) Start the sewing machine and press the HALT switch after fabric feed starts.
- (4) While the operation is in suspension (HALT condition), remove the rear cover (Fig. 4.2) and the V-belt.
- (5) With the V-belt removed, press the START switch.
- (6) Turn the pulley (balance wheel) by hand and the presser foot will be driven by the stepping motor.

(7) The presser foot motion corresponds to the fabric feed timing. Visually check the timing in reference to height of the needle.

(8) In several seconds after the START switch is pressed, error lamp will light (indicating that the V-belt is out of position) and the LIM1-STOP Z motor clutch will be disengaged.

Under these conditions, the pulley can be turned by hand.

14.6 2-stage work holder function

The initial setting of SW4 (A) switch is "OFF".

When 2-stage work holder is used, the switch (4) should be set to "ON".

14.7 Automatic home position return function

When SW4 (D) switch is set at "ON" (initial setting), the lifted work holder returns automatically to the home position when the power is turned on.

When the RESET/HOME switch is operated, the work holder goes up and returns to the home position.

When the switch (D) is at "OFF", the work holder can be returned to the home position by pressing the work holder lift switch to lower the work holder and by operating the RESET/HOME switch (for prevention of collision of work holder).

It should be noted that the sewing machine does not work (RESET/HOME is impossible) when the work holder is at the DOWN position. Before operation, lower the work holder to the DOWN position.

14.8 Remarks

SW4 (B) and (C) switches are set at "OFF". Do not change settings of these switches.

15. WIRING DIAGRAMS
 15.1 General wiring diagram

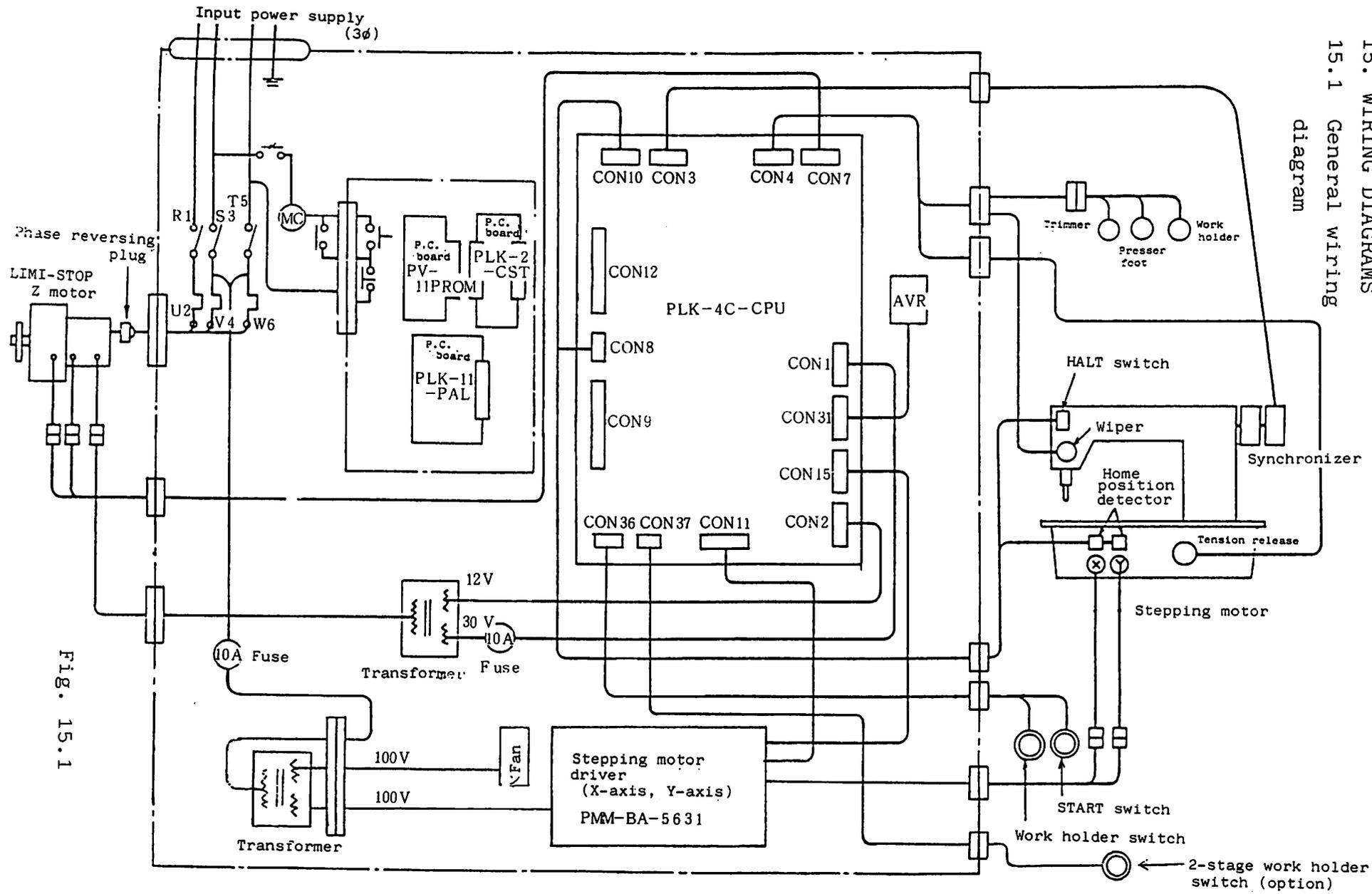


Fig. 15.1

15.2 Connector pin arrangement

Fig. 15.2 and Table 15.1 show the location and application of each connector respectively.

The pin No. and signal names for each connector are listed in Table 15.2, and connection and signal names for flot cables are listed in Table 15.3 and 15.4.

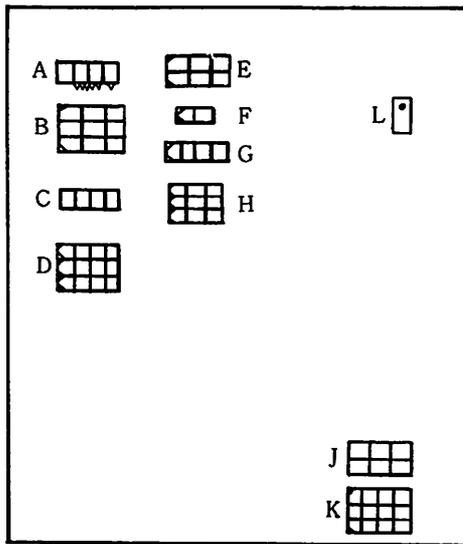


Fig. 15.2

Connector	Application
A	Thread tension release (2-stage work holder)
B	Thread trimmer, wiper and work holder (presser foot)
C	Work holder and START switch
D	Stepping motor (X, Y)
E	Synchronizer
F	2-stage work holder switch
G	Clutch, brake
H	Home position detector
J	POWER switch
K	Motor phase reversing plug
L	thread trimmer switch

Table 15.1

Control box side wall

Table 15.2

A connector 3191-04P

Pin No.	Signal	CPU board
1	WHL D5	CON4-9
2	+30V	" -5
3	+30V	" -5
4	WHL D4	" -10

B connector 1991-09R

Pin No.	Signal	CPU board
1	+30V	CON4-1
2	TRM	" -2
3	WHL D3	" -7
4	WHL D2	" -4
5	+30V	" -1
6	WIP	" -6
7	+30V	" -3
8	WHL D1	" -8
9	アース	-

C connector 1490R

Pin No.	Signal	CPU board
1	S10	CON36-1
2	GND	" -3
3	GND	" -3
4	S11	" -2

D connector 1360R

Pin No.	Signal	Motor
1	-	
2	BLACK	X axis
3	RED	"
4	ORANGE	"
5	YELLOW	"
6	BLUE	"
7	-	
8	BLACK	Y axis
9	RED	"
10	ORANGE	"
11	YELLOW	"
12	BLUE	"

F connector 1545R

Pin No.	Signal	CPU board
1	GND	CON37-2
2	S12	" -1

E connector 1991-06R

Pin No.	Signal	CPU board
1	GND	CON3-1
2	PG	" -2
3	TM (RO)	" -3
4	UP	" -4
5	DN	" -5
6	+12V	" -6

G connector 1991-04R

Pin No.	Signal	CPU board
1	CL	CON7-1
2	+30V	" -2
3	+30V	" -3
4	BK	" -4

H connector 1292-R1

Pin No.	Signal	CPU board
1	+12V	CON8-1
2	X-HOME	" -2
3	Y-HOME	" -3
4	X-LIMIT	" -4
5	Y-LIMIT	" -5
6	GND	" -6
7	GND	"
8	GND	"
9	STOP	CON10-6

K connector 1991-12R J connector 3191-06P

Pin No.	Signal	
	3 ϕ	1 ϕ
1	U phase	
2		U phase
3	W phase	V phase
4	GND	GND
5		
6		
7		
8		
9		
10	V phase	
11		W phase
12		V phase

Pin No.	Signal 号		
	3 ϕ 200V/1 ϕ 100V, 200V	3 ϕ 220V/1 ϕ 110, 120, 200, 240 V	3 ϕ 380 ~ 440 V
1	105 V (Wh1)	110 V (Ylw 1)	170 V (Wh1)
2	0 V (Blk 1)	0 V (Blk 1)	0 V (Ylw)
3			210 V (Pnk)
4	105 V (白 2)	110 V (Ylw 2)	210 V (Bwn)
5	0 V (Blk 2)	0 V (Blk 2)	0 V (Blk)
6	GND	GND	GND

Table 15.2

Connection of flat cables

PLK-4C-CPU ↔ PLK-2-CST
50-circuit connector

Table 15.3

CPU	Signal	CST
1 A	GND	1 A
2 A		2 A
3 A	D 4	3 A
4 A	D 3	4 A
5 A	D 5	5 A
6 A	D 2	6 A
7 A	D 6	7 A
8 A	D 1	8 A
9 A	D 7	9 A
10 A	D 0	10 A
11 A	A 1	11 A
12 A	A 2	12 A
13 A	A 10	13 A
14 A	A 3	14 A
15 A	CST - CHECK	15 A
16 A	A 4	16 A
17 A	A 5	17 A
18 A	A 9	18 A
19 A	A 6	19 A
20 A	A 8	20 A
21 A	A 7	21 A
22 A	CS 1	22 A
23 A		23 A
24 A	CS 2	24 A
25 A	+ 5 V	25 A

CPU	Signal	CST
1 B	GND	1 B
2 B	CS 0	2 B
3 B	CS 3	3 B
4 B	CS 4	4 B
5 B	CS 5	5 B
6 B	CS 6	6 B
7 B	CS 7	7 B
8 B	WR	8 B
9 B		9 B
10 B		10 B
11 B	A 0	11 B
12 B	.RD	12 B
13 B	I O / M	13 B
14 B	A 1 2	14 B
15 B		15 B
16 B	A 1 1	16 B
17 B		17 B
18 B		18 B
19 B		19 B
20 B		20 B
21 B		21 B
22 B		22 B
23 B		23 B
24 B		24 B
25 B	+ 5 V	25 B

PLK-4C-CPU ↔ PLK-11PAL

Table 15.4

CPU	Signal	PAL
1 A	GND	1 A
2 A	ERR 4	2 A
3 A	ERR 2	3 A
4 A	JOG (-)	4 A
5 A		5 A
6 A	X SCLS	6 A
7 A	Y SCLS	7 A
8 A		8 A
9 A	Y SCALE 8	9 A
10 A	" 4	10 A
11 A	" 2	11 A
12 A	" 1	12 A
13 A	" 10	13 A
14 A	" 20	14 A
15 A	" 40	15 A
16 A	" 80	16 A
17 A	X SCALE 8	17 A
18 A	" 4	18 A
19 A	" 2	19 A
20 A	X SCALE 1	20 A

CPU	Signal	CST
1 B	GND	1 B
2 B	ERR 3	2 B
3 B	ERR 1	3 B
4 B	JOG (+)	4 B
5 B		5 B
6 B	RESET / HOME	6 B
7 B		7 B
8 B	STOP / MOVE	8 B
9 B	PSE 1	9 B
10 B	" 2	10 B
11 B	" 4	11 B
12 B	" 8	12 B
13 B	S P M A X 1	13 B
14 B	" 2	14 B
15 B	" 4	15 B
16 B	" 8	16 B
17 B	X S C A L E 80	17 B
18 B	" 40	18 B
19 B	" 20	19 B
20 B	X S C A L E 10	20 B

15.3 Detailed connector wiring diagrams

(1) LIMI-STOP Z motor

① Motor (200V, 220V)

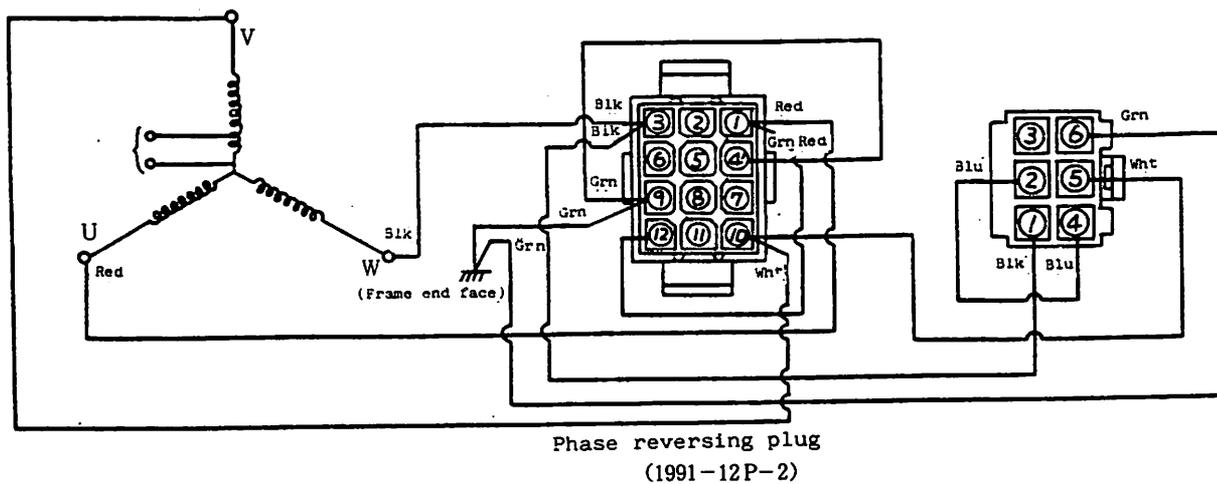


Fig. 15.3

② Clutch & brak

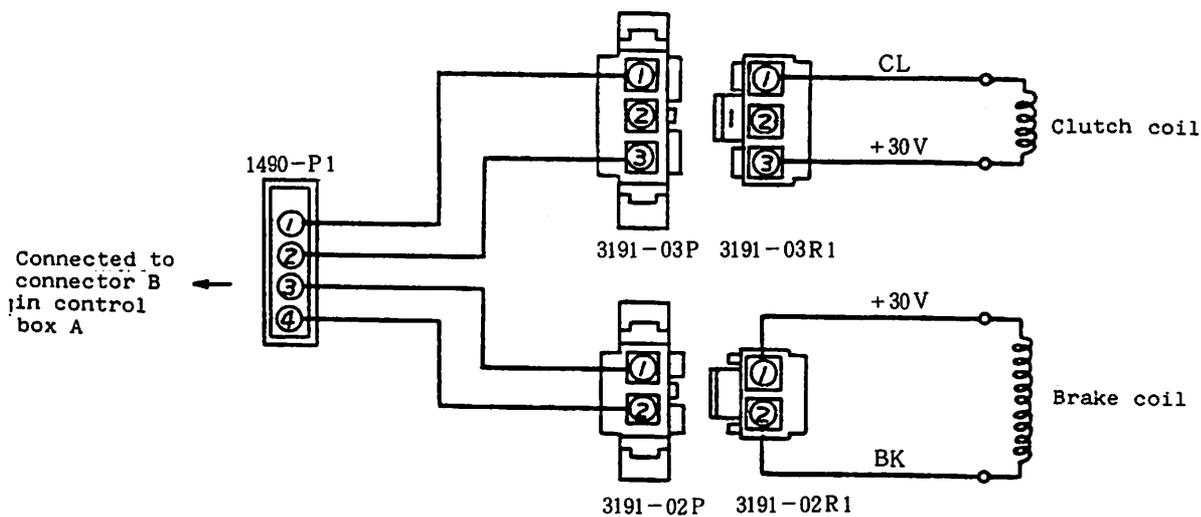


Fig. 15.4

③ Phase reversing plug cord

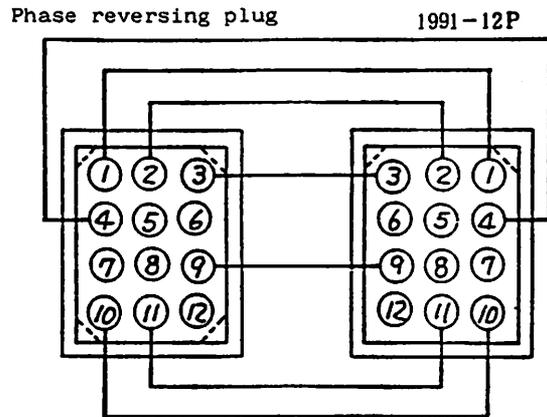


Fig. 15.5

(2) Stepping motor

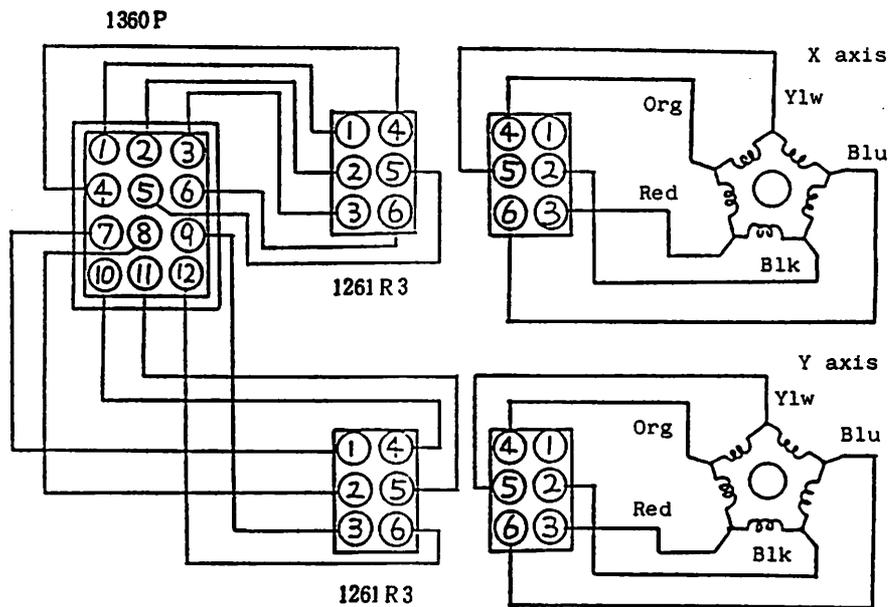


Fig. 15.6

(3) Stepping motor position detector

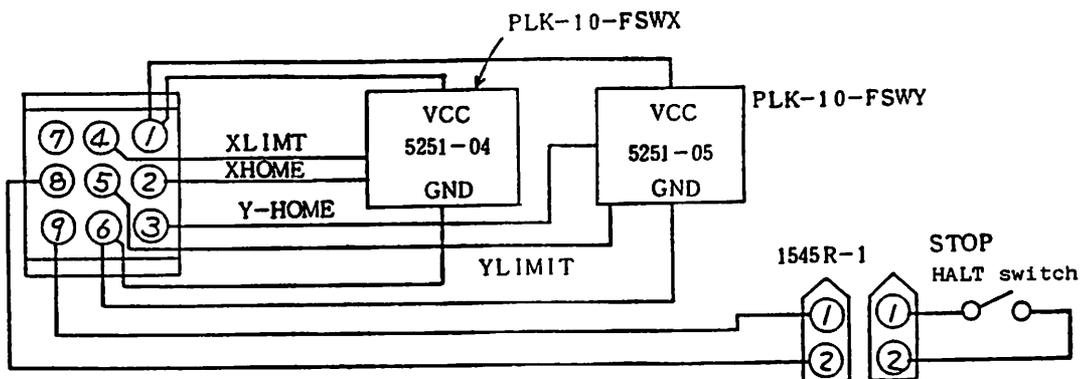


Fig. 15.7

(4) Transformer

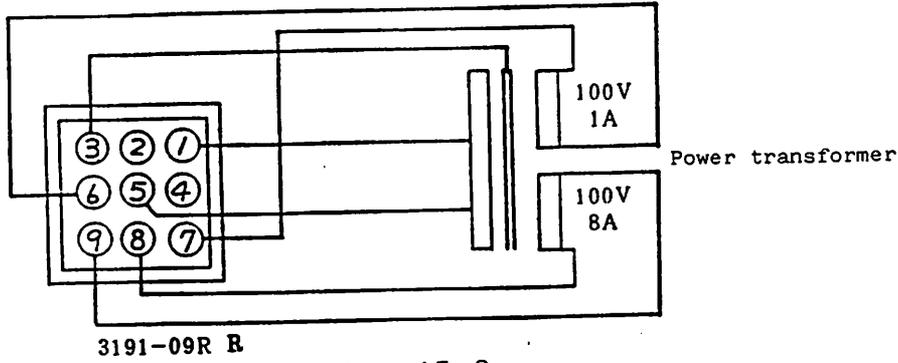


Fig. 15.8

(5) START switch work holder lift switch

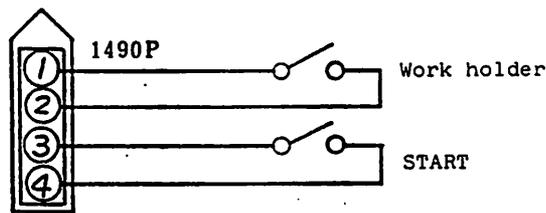


Fig. 15.9

(6) Synchronizer

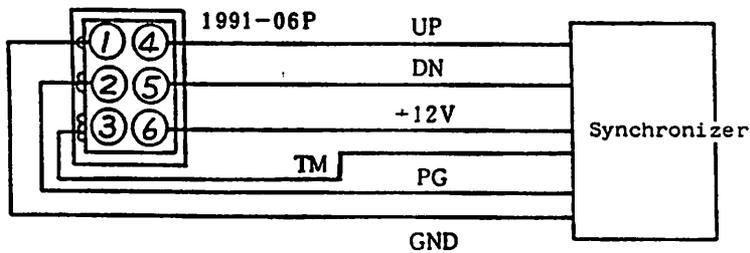


Fig. 15.10

(7) Solenoid connection

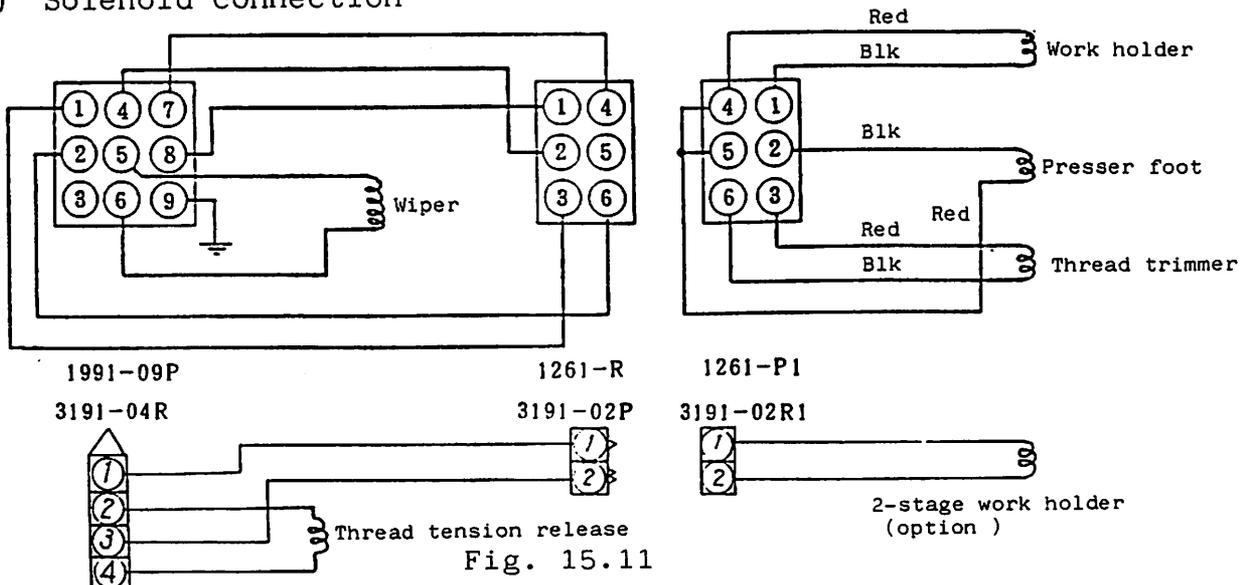


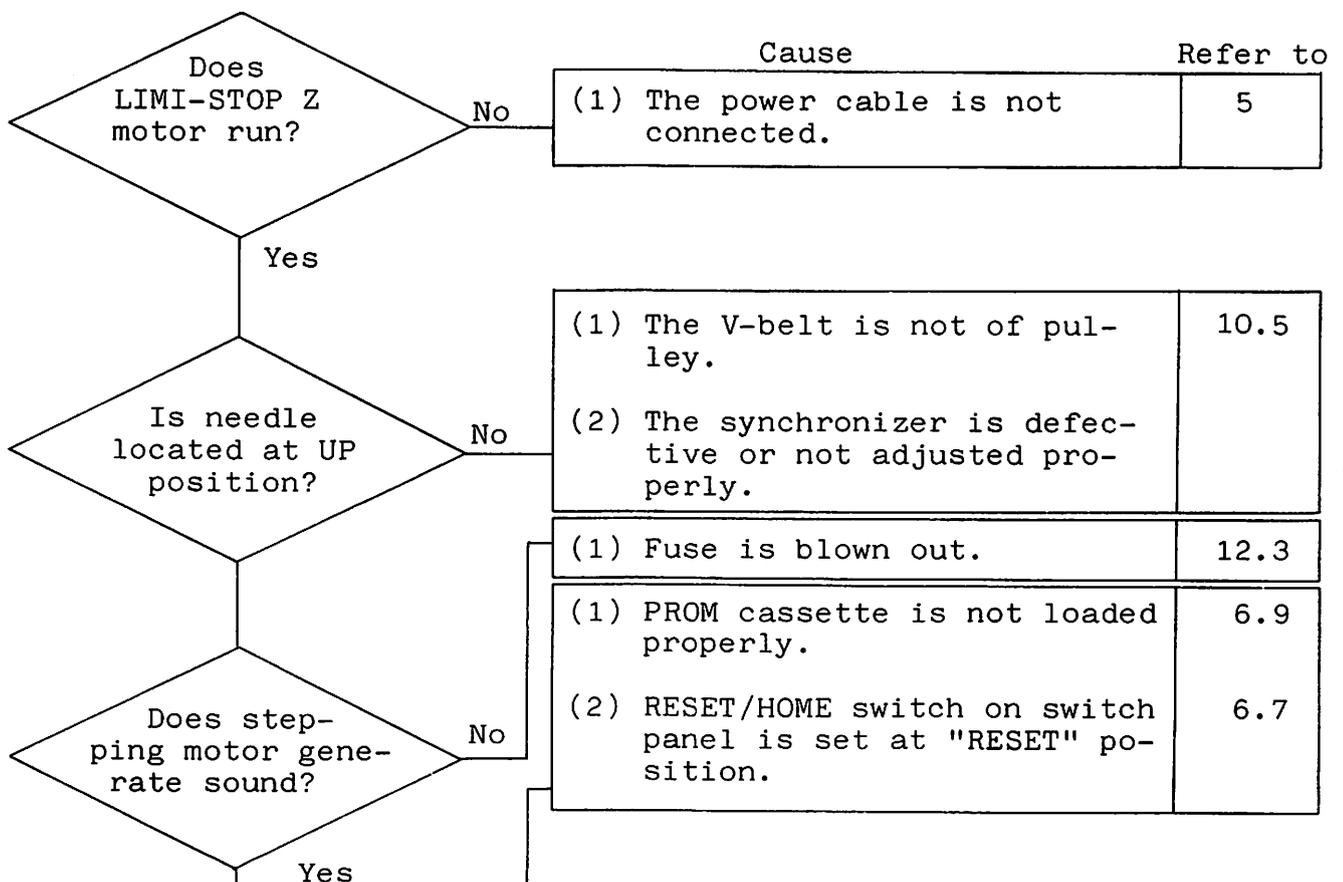
Fig. 15.11

16. TROUBLESHOOTING

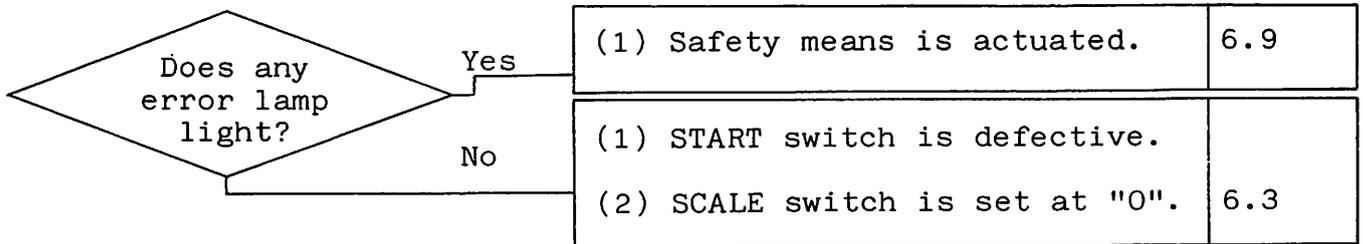
If any trouble occurs with the sewing machine, perform the following check before starting detailed troubleshooting.

- (1) Is the power source at the specified voltage?
Are all connectors, phase reversing plug and switches set properly?
- (2) Are the connectors in the control box engaged properly?
- (3) Is the PROM cassette loaded properly?
(See the power pilot lamp on the cassette to check.)
- (4) Does any error lamp on the front panel light?
(If yes, determine the cause and remedy.)
- (5) Is fuse not blown out (two fuses)?
Is the rating of each fuse correct (10A)?

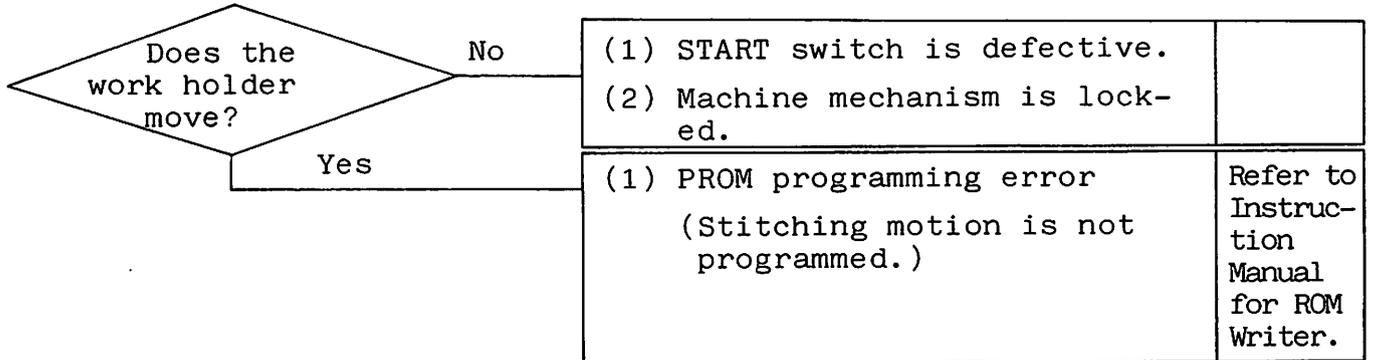
16.1 The work holder does not return to the home position when the power is turned on ...



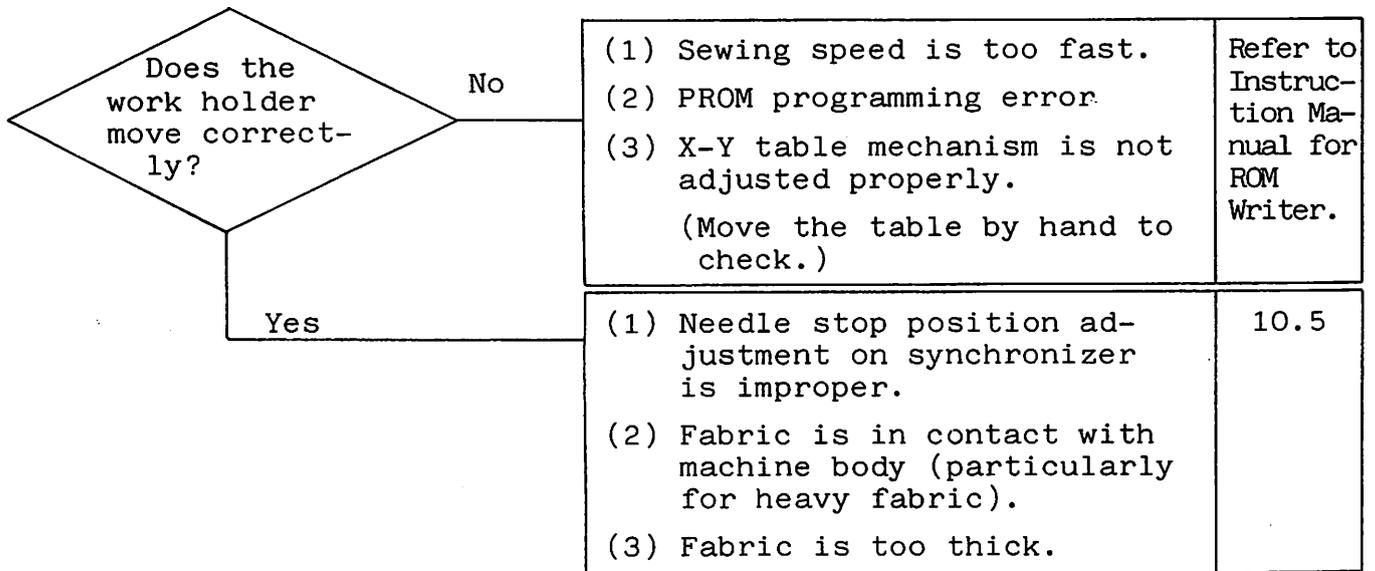
16.2 The work holder does not move at all when the START switch is pressed



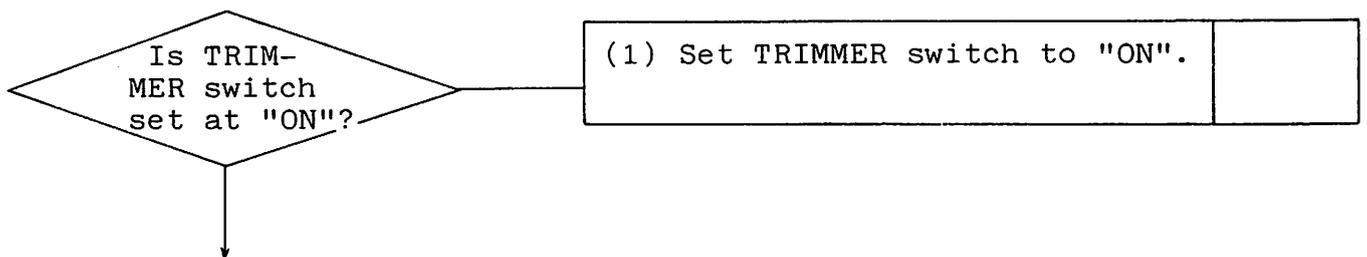
16.3 Stitching motion does not start

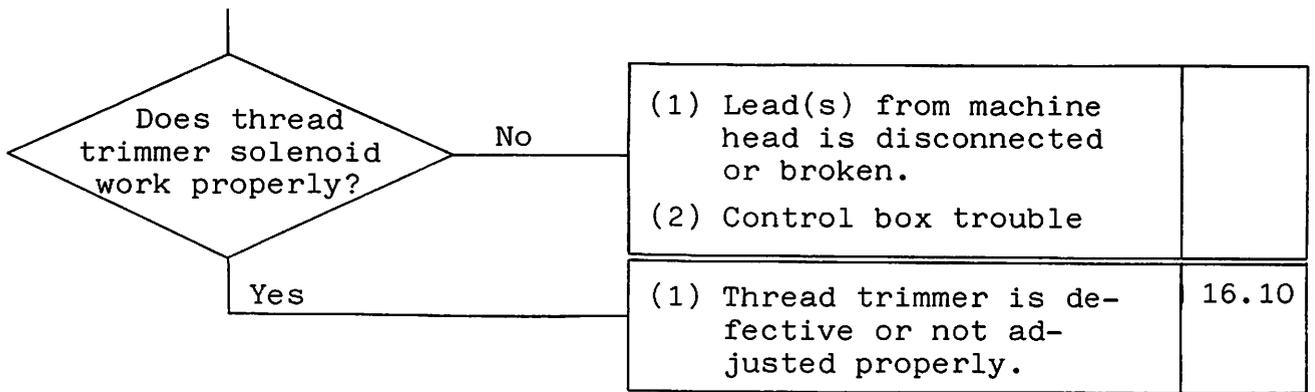


16.4 Stitching line deviates from previously determined pattern



16.5 Thread cannot be trimmed successfully (the same is applied to the wiper)





16.6 HALT (stitching suspension) is impossible

(1) HALT switch is defective. (2) HALT switch lead is disconnected or broken. (3) Control box trouble	
---	--

16.7 Sewing speed is extremely low

(1) Torque required to drive stitching mechanism is extremely large, due to distortion of mechanism. (2) Synchronizer is defective or not adjusted properly.	10.5
---	------

16.8 Sewing speed is extremely high

(1) Synchronizer pulse generator is disconnected. (2) Synchronizer is defective or not adjusted properly.	10.5
--	------

16.9 Checking the machine head connector

Measure resistance across the following connector pins to check.

Solenoid	Resistance	Connector CONB (9-circuit connector)
Wiper	12 ohm	Across pins (5) and (6)

NOTE: Resistance shown above is that measured at 20°C.

Table 16.1

16.10 Troubleshooting (sewing machine mechanisms)

Trouble	Cause	Remedy	Refer to
Thread cannot be trimmed.	Fixed knife is not properly engaged with movable knife.	Adjust knife engagement.	11.8
	Knife engagement is loose.	Adjust knife engagement pressure.	11.8
	Knife blade is damaged, or worn.	Replace damaged knife.	
	Needle stops too early.	Adjust needle stop position.	10.5
	Fixed knife is not positioned properly.	Adjust position of fixed knife.	11.8
	Movable knife motion too fast and thread cannot be trimmed properly.	Adjust position of thread trimming cam.	11.7
Needle thread comes off needle eye after thread trimming.	Tension discs do not open when thread is trimmed.	Adjust the needle thread release.	11.9
	Timing of thread trimming is not proper.	Adjust position of thread trimming cam.	11.7
	Thread is trimmed by fixed knife before scissoring.	Adjust position of fixed knife.	11.8
	Needle is too thick for thread used.		
	Pretension discs are too tight.	Adjust pretension discs.	11.10
	Thread tension is too faint.	Adjust thread tension.	
	Protector is located improperly.	Locate protector properly.	11.8

Trouble	Cause	Remedy	Refer to
Stitches are not inter-locked at start of sewing.	Bobbin thread extending from bobbin case becomes short due to racing of bobbin.	Use a bobbin case having spring for prevention of racing.	11.11
	Bobbin thread tension is too high.	Adjust bobbin thread tension.	10.2
	Length of trimmed end thread (needle thread) is too short after thread trimming.	1. Adjust pretension discs. 2. Check thread trimming cam for installation. 3. Check threading.	11.10 11.7
Trimmer end thread (needle thread) is too long.	Pretension discs are too faint.	Adjust pretension discs.	11.10
	Thread trimming delays.	Adjust position of thread trimming cam.	11.7
	Thread often leaves hook.	Adjust hook gap.	10.12



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