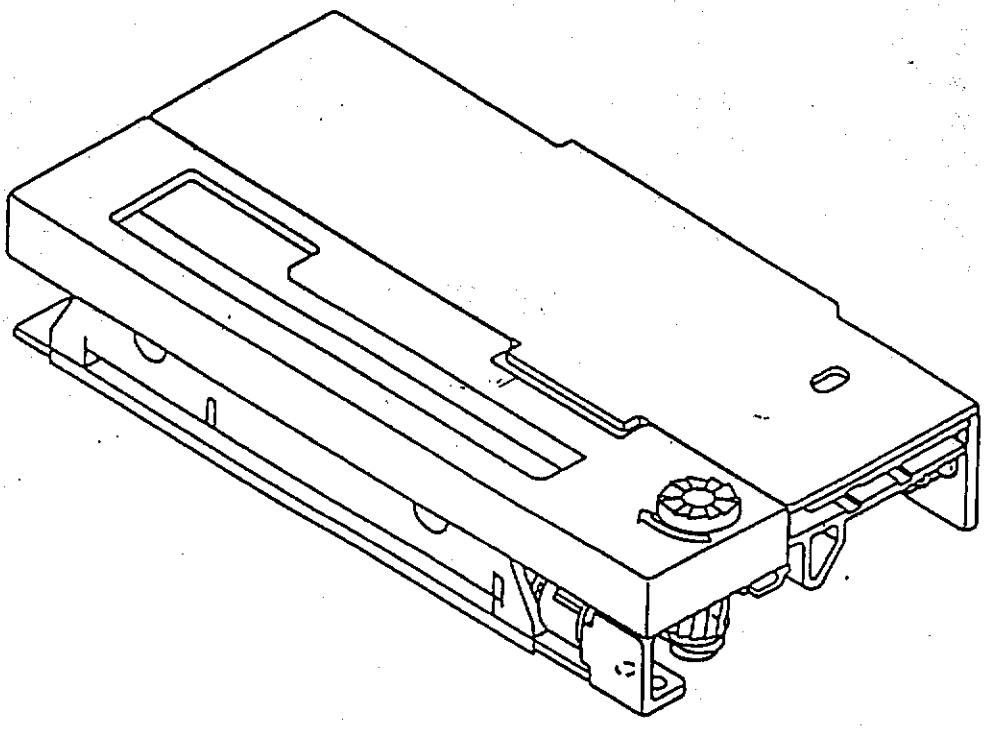
Home

MD910 series
Technical Manual



Compact dot printer

CITIZEN

Foreword

This technical manual describes the operating principles, maintenance and other required items for CITIZEN compact dot printer MD910 series for technical service engineers in the field.

Features

The MD910 series is a dot matrix compact printer that uses two serial print heads. This printer has been developed as an output terminal for various applications such as POS terminals, measuring/analyzing equipment, medical equipment and communication data equipment, and has been designed to be as compact as possible.

- Compact and lightweight
- High-speed printing of up to 2.5 lines/sec (for MD910) or 1.8 line/sec (for MD911)
- Clear printout with high resolution of 8 dots/mm
- Paper width of 57.5 mm
- Longer life of print head
- Simple mechanism for high-reliability

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1 Printer Usage and Care

(1) Use recommended register paper. Otherwise, printing quality and the life of the print head will not be guaranteed. The width of paper must meet the specifications.

(2) Never allow a mechanical impact (including the entry of foreign matter) to the print head surface.

(3) Any dust on the print head surface must be wiped off by an applicator soaked in ethanol or the equivalent.

(4) The dedicated ribbon cartridge should be taken off when the printer is carried or not used for a long period.

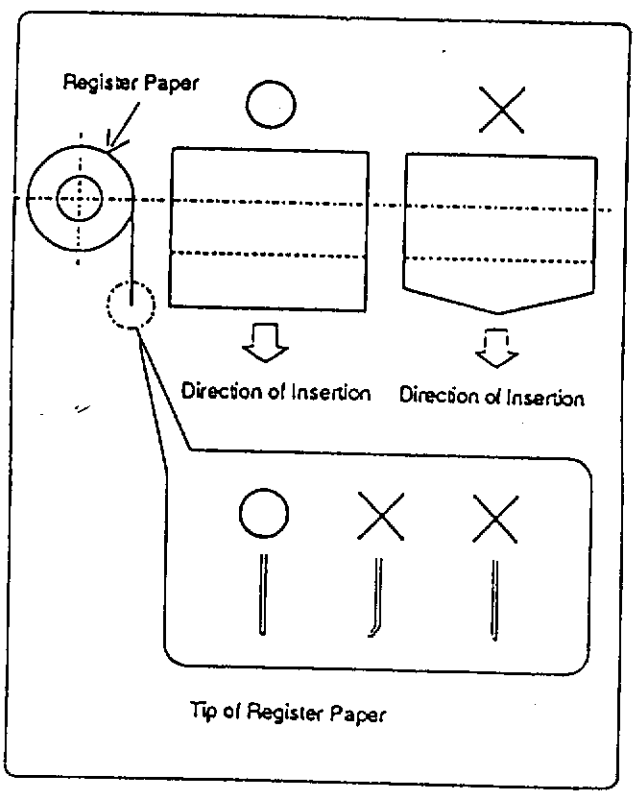
(5) Do not feed current to the print head if it is wet or moist. If current is fed, the print head may be damaged. If the print head is wet or moist, dry it fully and then start printing.

(6) Inserting register paper

- Cut the top end of the register paper straight (it should never be fluffed or bent) and insert it.
- When the top end of the register paper comes out of the print head, check that it is set straight and then pull it.

(7) Removing register paper

- Before removing the register paper, be sure to stop feeding current to the print head.
- Pull out paper straight in the direction of paper exit.



2 Specifications/Operating Principles

2-1 Specifications

Item		Specifications
Printing method		Dot matrix system
Printing direction		Unidirectional printing
Printing speed		2.5 lines/sec ± 20%; DC 5.0 V, 25°C in continuous printing
Printing format	Number of dots	144 dots/line
	Character configuration	(5 + 1) x 8
	Number of columns	24
Paper feeding	Paper feeding pitch	3.52 mm (10 dots/line)
	Rapid feed rate	5 lines/sec ± 20%; DC 5.0 V, 25°C in continuous printing
Inking		Dedicated cartridge (black or purple)
Detection	Dot pulse	Photointerrupter
	Reset pulse	Leaf switch detector
Paper feeding solenoid	Drive voltage	DC 5.0 V
	Resistance	7 Ω ± 3 (temperature: 25°C)
Printing solenoid	Drive voltage	DC 5.0 V
	Resistance	1.7 Ω ± 0.3 (temperature: 25°C)
Motor	Type	DC brush motor
	Drive voltage	DC 5.0 V
	Max. current	Approx. 1 A
	Average current	0.3 A or less; DC 5.0 V, 25°C in continuous printing
Paper	Type	Plane or recommended paper
	Paper width	57.5 mm
	Cut sheet	45 to 55 kg (thickness: 0.06 to 0.085 mm)
	Copies	Original paper (34 kg) + single copy (34 kg) (Total thickness: 0.13 mm or less) Non-carbon paper
Life of print head		1,500,000 lines
Exterior dimensions		90 (w) x 45.5 (d) x 15.8 (h) ± 0.5 mm (excluding paper feeding nob and feet)
Weight		105 g ± 10%

2-2 Outline of mechanism

This printer mechanism is divided roughly into the following seven blocks:

- Power transmission
- Sensor
- Print head
- Paper feed
- Ribbon cartridge drive
- Frame
- Motor

For external control circuits attached to this printer, please see the appropriate operating manuals.

2-3 Mechanism and operation principles

The mechanism and operating principles are described for five blocks out of seven (i.e., excluding the frame and motor).

2-3-1 Power transmission mechanism

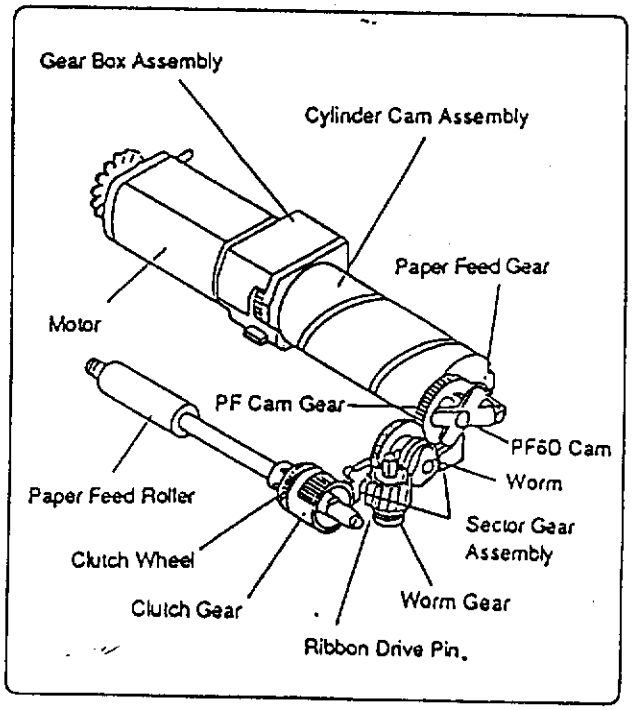
This mechanism transmits a motor driving force to the head assembly, paper feed roller and ribbon cartridge.

The head assembly is driven by the cylinder cam assembly connected to the gear box assembly which encloses the motor.

The driving force transmitted to the cylinder cam assembly is sent to the PF cam gear and PF6D cam through the paper feed gear. Either the driving force transmitted to the PF cam gear or the driving force transmitted the PF6D cam can be selected, depending on the operation status, and is sent to the clutch gear through the sector gear assembly.

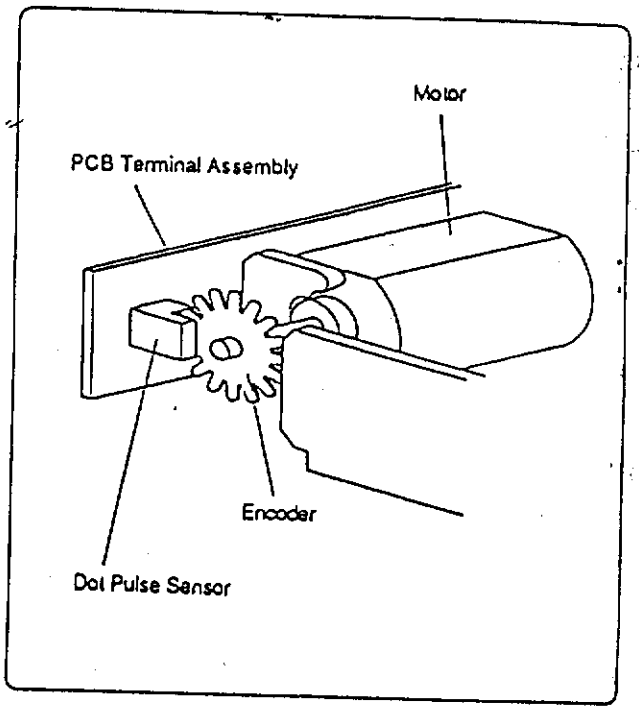
The driving force of the clutch gear is transmitted to the clutch wheel connected to the paper feed roller, driving the paper feed roller.

The driving force of the PF cam gear is transmitted to the worm, worm gear and ribbon drive pin respectively, so that the ribbon cartridge is driven by the ribbon drive pin.



2-3-2 Sensor mechanisms

This mechanism has two sensors for detection, a dot pulse sensor and a reset pulse sensor.



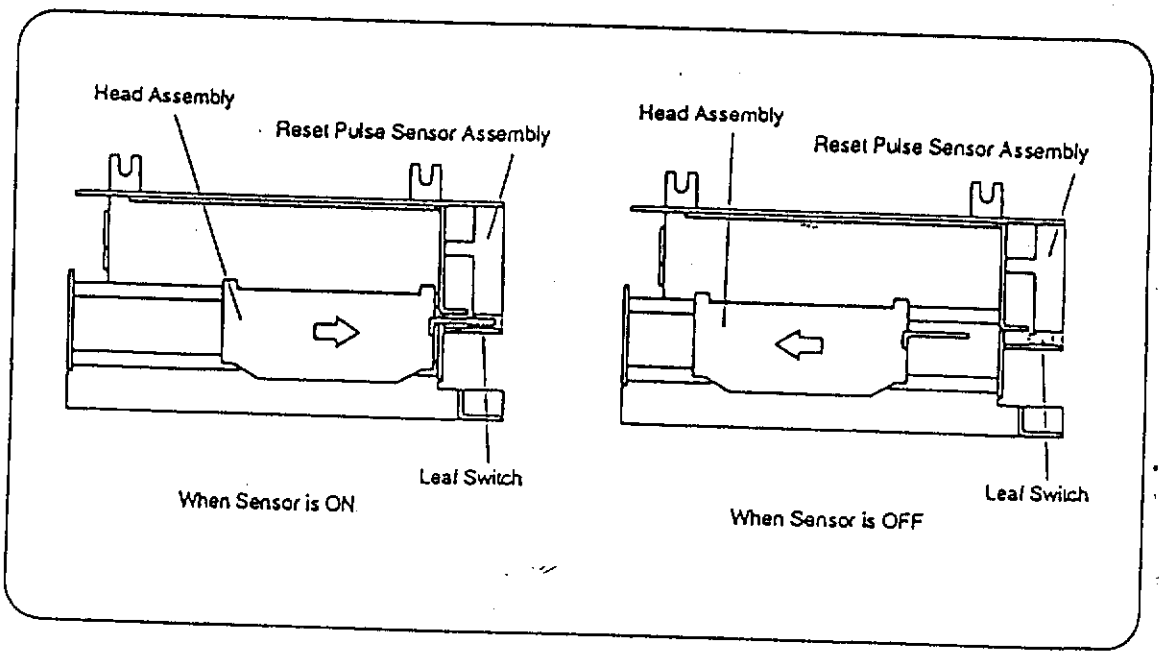
(1) Dot pulse sensor

The dot pulse sensor consists of an encoder (slit disk) directly connected to the motor and a photointerrupter reading the rotation. The rotation read (number of slits counted) is treated as the DP signal that is the core of the printing control.

(2) Reset pulse sensor

The reset pulse sensor uses a leaf switch which turns ON/OFF according to the head assembly position.

This sensor detection signal represents the RP signal that specifies the print head home position and printing start base position.



2-3-3 Print head mechanism

This printer has two print heads arranged at intervals on the left and right, so that the left half and the right half of the register paper can be printed simultaneously as it is moved from left to right.

One movement causes the upper part of one line to be printed and the next movement causes the lower part of the line to be printed. Therefore, two print head movements complete printing of one line. The print heads, however, print the register paper only when they move from left to right.

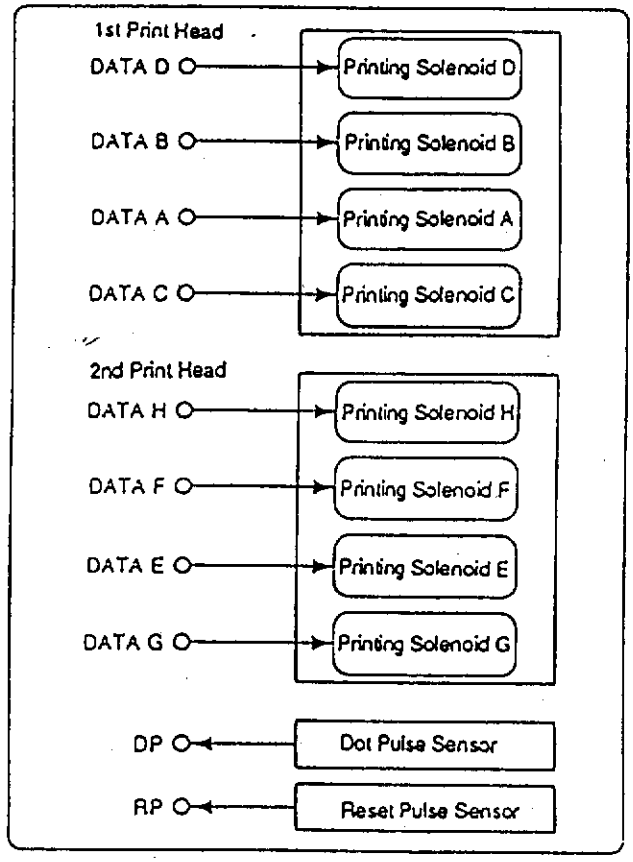
(1) Printing control

Each print head has four printing solenoids and each solenoid is turned ON/OFF according to the printing data and the corresponding printing pins are activated to form character dots.

This printer, however, does not have a serial/parallel conversion circuit.

Therefore, ON (L level)/OFF (H level) signals are directly provided to the eight data lines for each printing solenoid.

Printing timing is controlled by the DP signal which is detected by the dot pulse sensor and is treated as a clock pulse and the RP signal which is detected by the reset pulse sensor and is treated as a starting point.



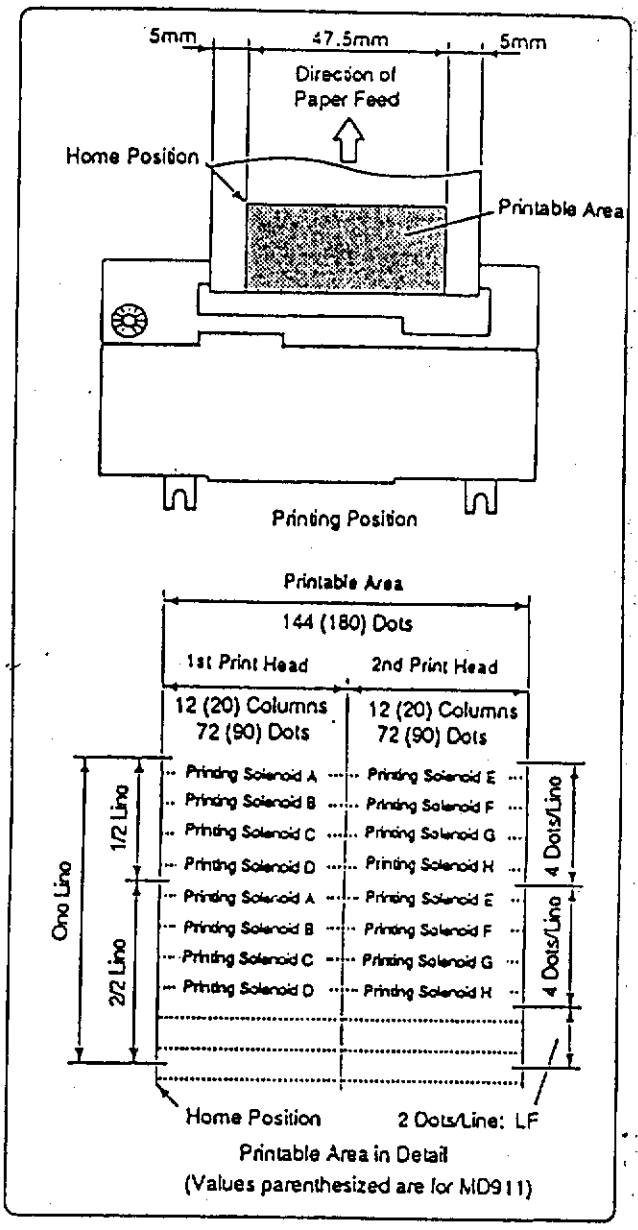
(2) Printing data and printing position

The number of printing columns and one character dot matrix vary, depending on whether the printer is the MD910 or MD911.

For the MD910, the number of printing columns is 24, and each 12 columns of printing on the left and right is performed by each print head. 4 dots/line is produced by one print head movement.

6 (5 + 1) horizontal dots make up one character and the total number of horizontal dots in the printable area is 144 (12 columns x 2 x 6 dots).

For the MD911, the number of printing columns is 40, and each 20 columns of printing on the left and right is performed by each print head. 4 dots/line is produced by one print head movement. 4.5 (4 + 0.5) horizontal dots make up one character and the total number of horizontal dots in the printable area is 180 (20 columns x 2 x 4.5 dots).



(3) Head drive mechanism

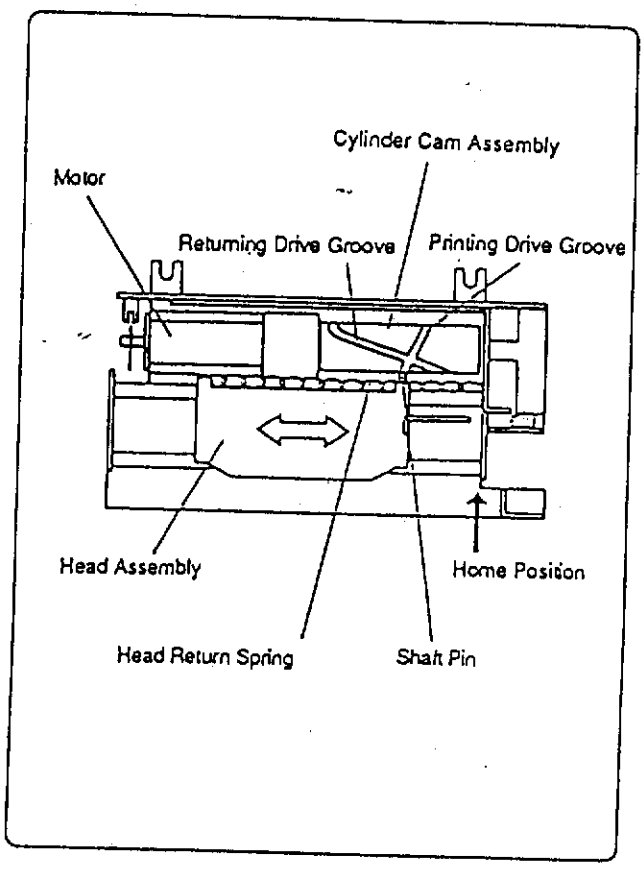
The head assembly is connected to the cylinder cam assembly via a shaft pin. The shaft pin is inserted in a scribed groove on the outside of the cylinder cam assembly and moves along the groove when the cylinder cam assembly is turned to drive the head assembly.

When the head assembly travels beyond the home position, the shaft pin goes through a sharp curve in the scribed groove, so it moves slowly. At this time, printing is performed.

When the head assembly travels beyond the printable area, the direction of movement is changed to the home position because the direction of groove is reversed and the head return spring tension is activated.

At this time, the head assembly travels at high-speed because the groove is turned to the slow curve.

Register paper feeding is performed when the head assembly returns. When the head assembly travels to the home position, it returns to the original groove position, and the operation is repeated.



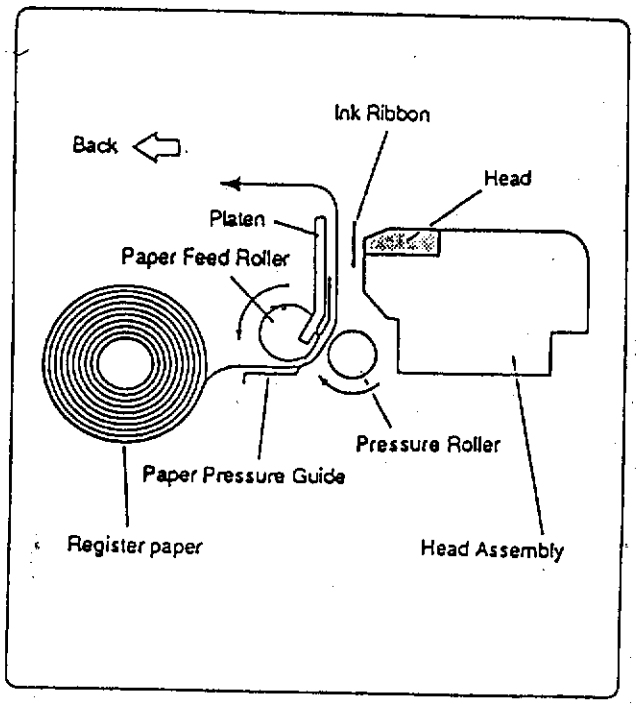
2-3-4 Paper feed mechanism

Since this printer completes one line of printing by dividing it into upper and lower halves, two types of paper feeding are provided; one is paper feeding without LF (line feed) because the lower half is printed after the upper half. The other is paper feeding with LF because upper half of the next line is printed after completing one line.

(1) Paper path

The register paper is loaded from the back of the printer and moved to the paper feed roller and the pressure roller along the paper pressure guide. The register paper moved is pressed against the paper feed roller by the pressure roller and fed upward when the paper feed roller turns.

The register paper then passes through the platen and the print head and comes out to the back again. When the register paper passes through the platen and the print head, it is printed by the ink ribbon of the ribbon cartridge on the print head.



(2) Paper feeding without LF (line feed) mechanism

The PF cam gear that drives paper feeding turns one time per head assembly shuttle.

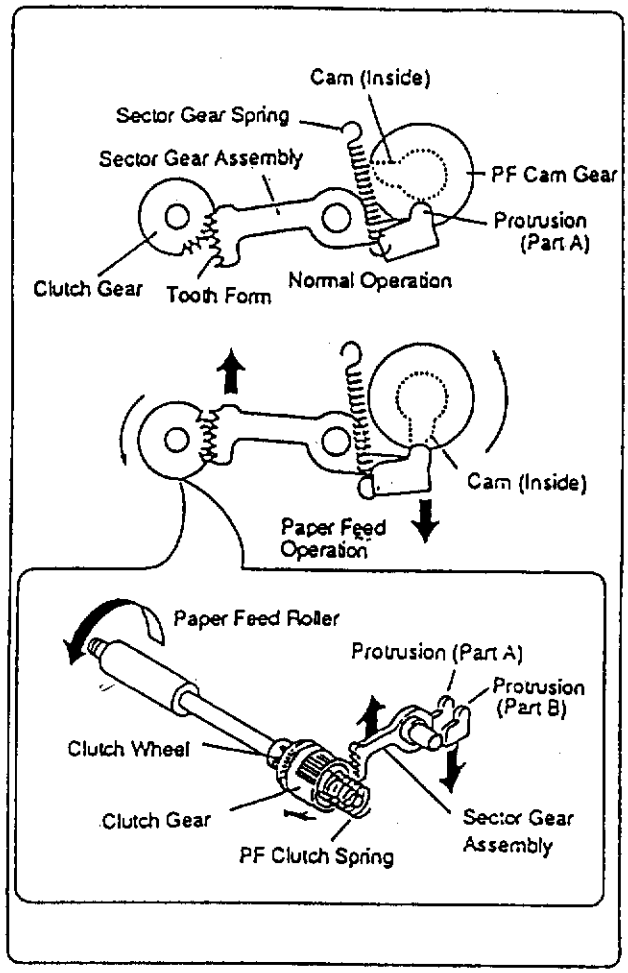
The cam inside the PF cam gear presses down the protrusion (part A) of the sector gear assembly when the head assembly returns. The sector gear assembly has teeth on the opposite side of the protrusion which engage with the clutch gear that is concentric to the paper feed roller.

The paper feed roller has a clutch wheel next to the clutch gear to transmit the driving force. Normally this clutch wheel is not in contact.

The sector gear assembly has a fulcrum at the middle, so if the protrusion is pressed down, the teeth are raised to turn the clutch gear. The clutch gear then is pushed out by the PF clutch spring and engages with the clutch wheel to rotate the paper feed roller.

This rotation, i.e., the paper feeding, depends on the amount of ascent of the teeth of the sector gear assembly. 4 dots/line is ensured without LF.

When the cam inside the PF cam gear goes past due to rotation, the protrusion of the sector gear assembly is raised again by the sector gear spring so that the clutch gear separates from the clutch wheel and stops the paper feed roller.



(3) Paper feeding with LF (line feed) mechanism

In paper feeding with LF mechanism, only the protrusion pressing down mechanism is different from that of paper feeding without LF mechanism.

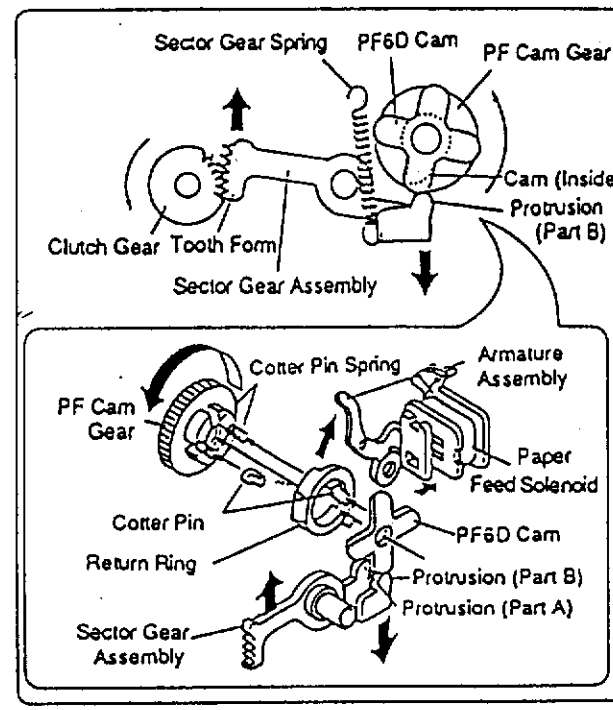
Two cotter pins are set on the outside of the PF cam gear and turn together with the PF cam gear. The cotter pins are always exerting a force to uncoil but are restrained by the return ring. One part of the return ring is thin, so that when the cotter pin passes through this thin part while rotating, it springs out of the return ring.

When performing paper feeding without LF, no cotter pin spring is required, so the armature assembly is inserted in the thin part of the return ring instead. The armature assembly is linked with the paper feed solenoid.

When performing paper feeding with LF, the paper feed solenoid turns ON and the armature assembly is detached from the return ring.

The PF6D cam is set on the outside of the return ring and the driving force of the PF cam gear is transmitted by the cotter pin spring.

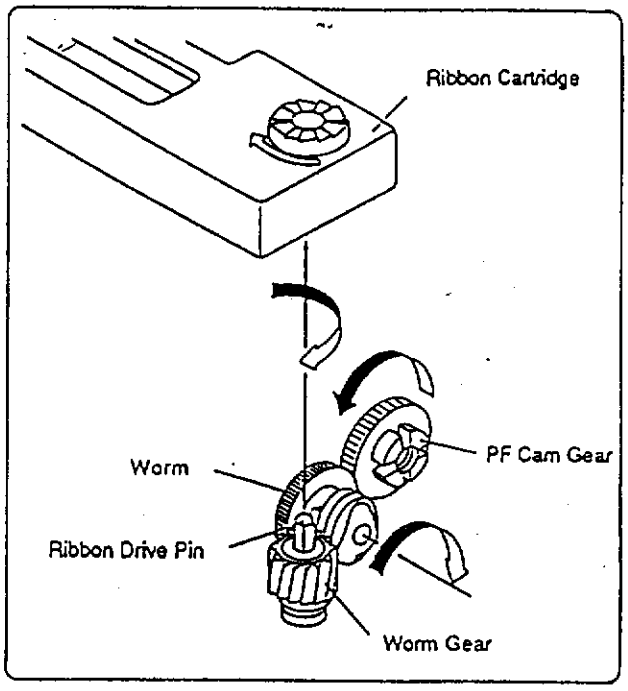
As the PF6D cam turns, the outer protrusion (part B) of the sector gear assembly is lowered and the paper feed roller rotates in the same manner as during paper feeding without LF mechanism. At this time, the PF6D cam is larger than the cam inside the PF cam gear, so the rotation of the paper feed roller is 6 dots/line, i.e., 2 more dots per line than with paper feeding without the LF.



2-3-5 Ribbon cartridge drive mechanism

The PF cam gear that drives paper feeding is also used to turn the ribbon cartridge.

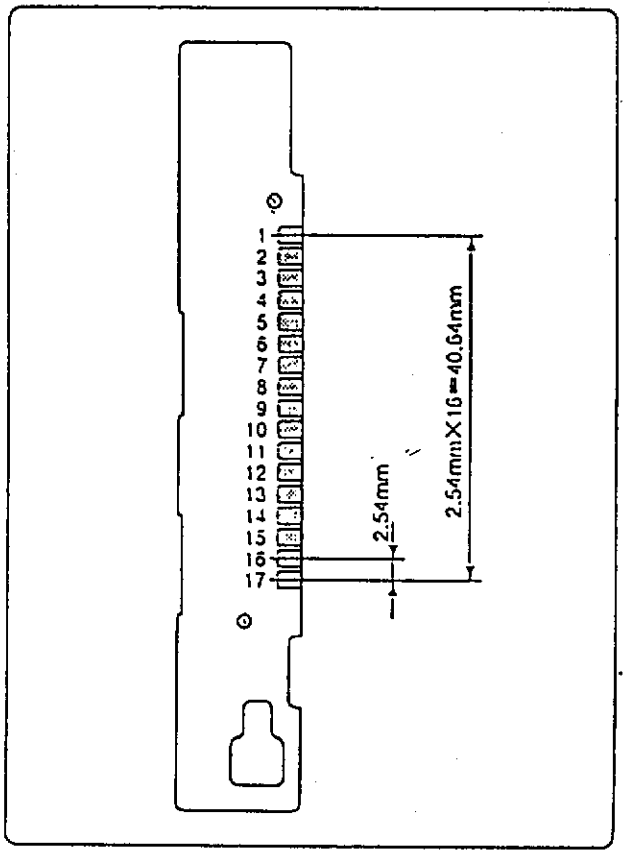
The driving force of the PF cam gear is transmitted to the worm where the direction of operation is changed 90°. The driving force converted is transmitted from the worm to the worm gear and the ribbon cartridge is turned by the ribbon drive pin. Therefore, the ribbon cartridge is always moving while printing is being performed.



2-4 External connection terminals

External connection terminals are located within the PCB terminal assembly and their connections are implemented by directly soldering the print pattern surface.

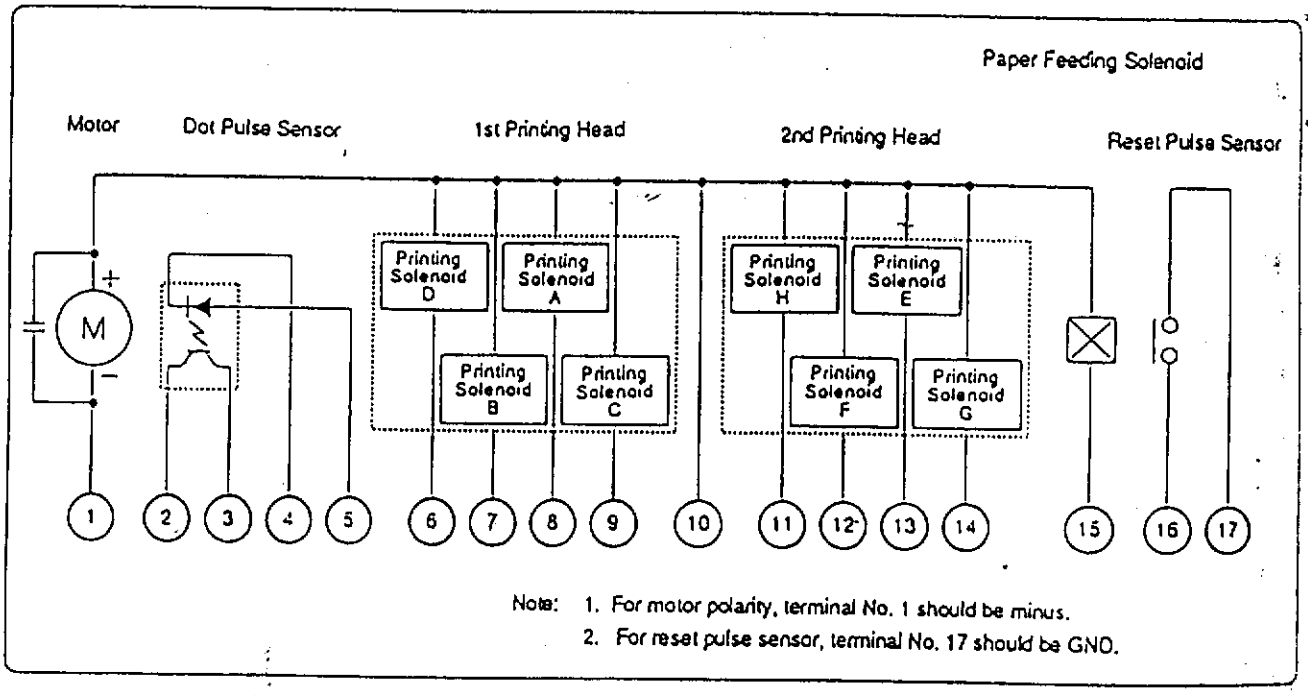
2-4-1 Terminal arrangement



2-4-2 Terminal mechanism

Terminal No.	Terminal name	Remarks
1	Motor (–)	Motor is ON with GND
2	Phototransistor emitter	Dot pulse sensor
3	Phototransistor collector	
4	LED cathode	
5	LED anode	
6	Printing solenoid D (–)	1st print head Each solenoid is ON with GND
7	Printing solenoid B (–)	
8	Printing solenoid A (–)	
9	Printing solenoid C (–)	
10	Common (+)	Power side of print head, motor and paper feeding solenoid
11	Printing solenoid H (–)	2nd print head Each solenoid is ON with GND
12	Printing solenoid F (–)	
13	Printing solenoid E (–)	
14	Printing solenoid G (–)	
15	Paper feeding solenoid (–)	Solenoid is ON with GND
16	Reset pulse sensor output	Power side
17	Reset pulse sensor output	GND side

2-4-3 Terminal circuit diagram



Note: 1. For motor polarity, terminal No. 1 should be minus.
2. For reset pulse sensor, terminal No. 17 should be GND.

3 Disassembly/Reassembly

Prior to maintenance work, be sure to observe the following caution:

CAUTION

(1) When the printer is operating satisfactorily, do not unnecessarily disassemble, reassemble or adjust the printer. In particular, do not loosen any screws on the components.

(2) Check that the printer is in good condition before turning on the power.

(3) Never try to print without register paper in the printer.

(4) Check that the register paper is set properly.

(5) In maintenance work, never leave any parts or screws in the printer.

(6) In disassembly and reassembly, check that any wires and cords are not damaged and are laid out properly. Handle these wires and cords carefully.

3-1 Tools

The list of necessary tools is as follows:

1. Philips head screwdriver
2. Tweezers
3. Small radio pliers
4. Oil brush
5. Small pincers

3-2 Disassembly procedure

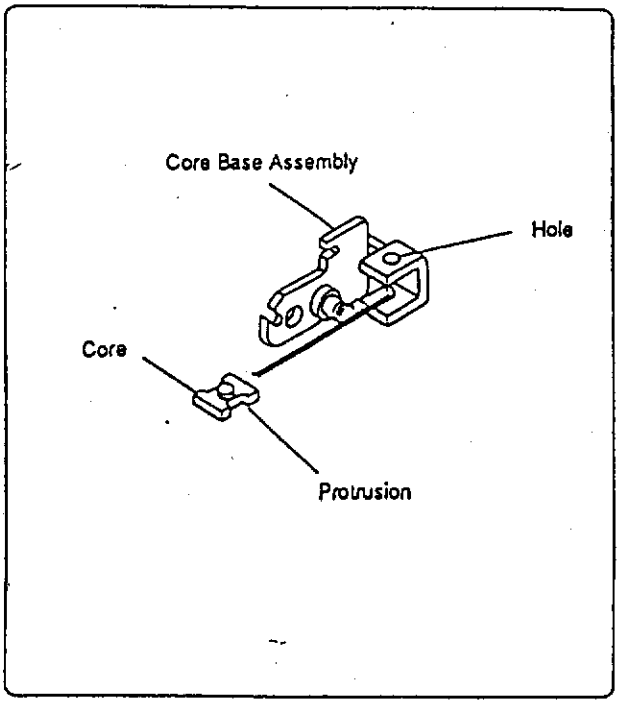
To perform disassembly, reverse the assembly procedure (item 3-3). Disassemble each part gradually from the frame.

3-3 Assembly procedure

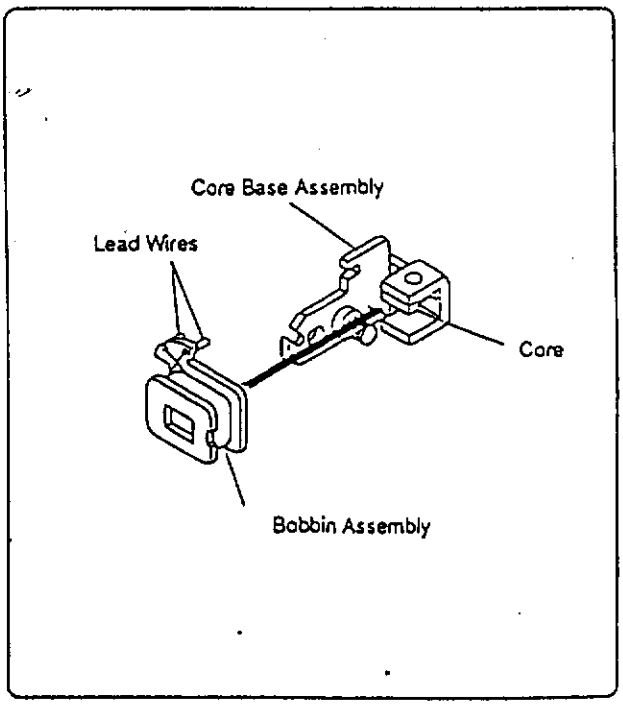
The assembly procedure is described by major assembly blocks.
Part names in text are the same as those in Parts List.

3-3-1 Setting paper feed solenoid assembly

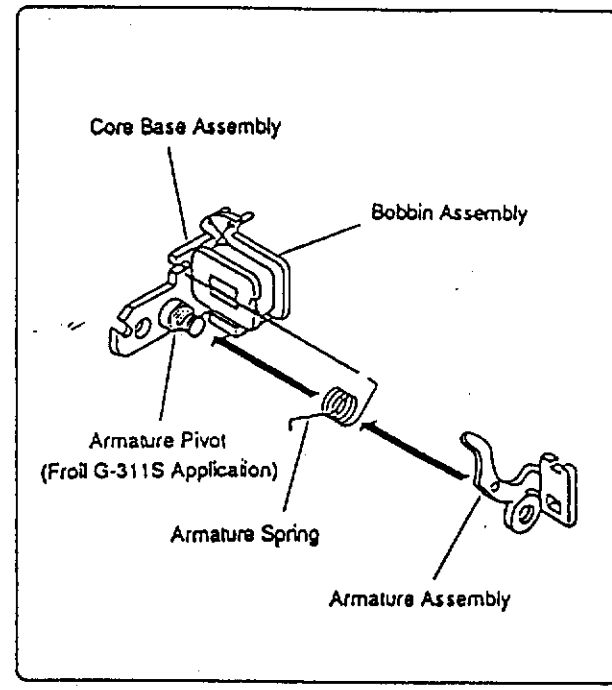
(1) Place the core in core base assembly. At this time, align the protrusion of the core with the hole of the core base assembly.



(2) Insert the bobbin assembly where the core has already been fitted in the core base assembly. At this time, the lead wires face outside and there should be no gap between the bobbin assembly and the core base assembly.

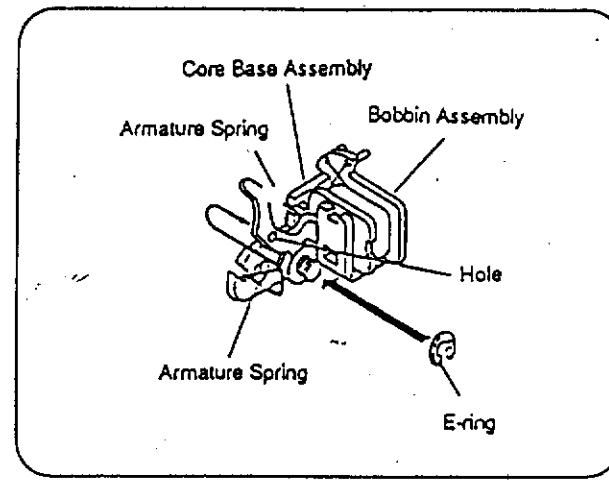


(3) First apply Froil G-311S to the armature pivot of the bobbin assembly, then install the armature spring and the armature assembly. At this time, check the direction of armature spring.



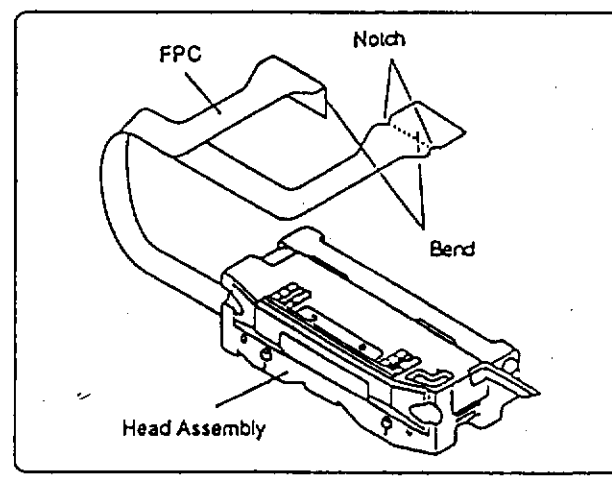
(4) Secure the armature assembly with the E-ring and attach the armature spring to the hole of the armature assembly.

Note: When installing the E-ring and armature spring, use small radio pliers or tweezers.



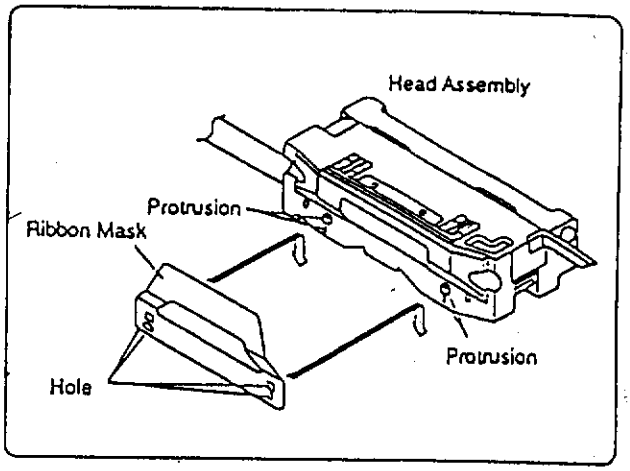
3-3-2 Setting the head assembly

(1) Two tips of FPC are extended from the head assembly. Bend the two tips at right angles from the notch line.

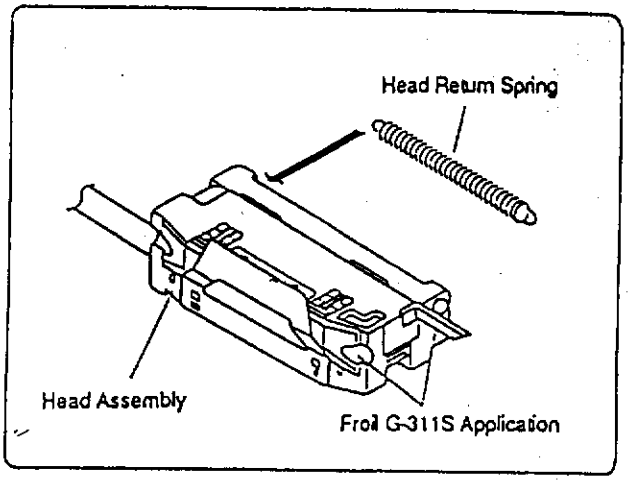


(2) Place the ribbon mask in the head assembly. At this time, align the holes of the ribbon mask with the protrusions of the head assembly.

Note: The ribbon mask is very thin, so take care not to bend it when installing it.



(3) Install the head return spring in the head assembly.

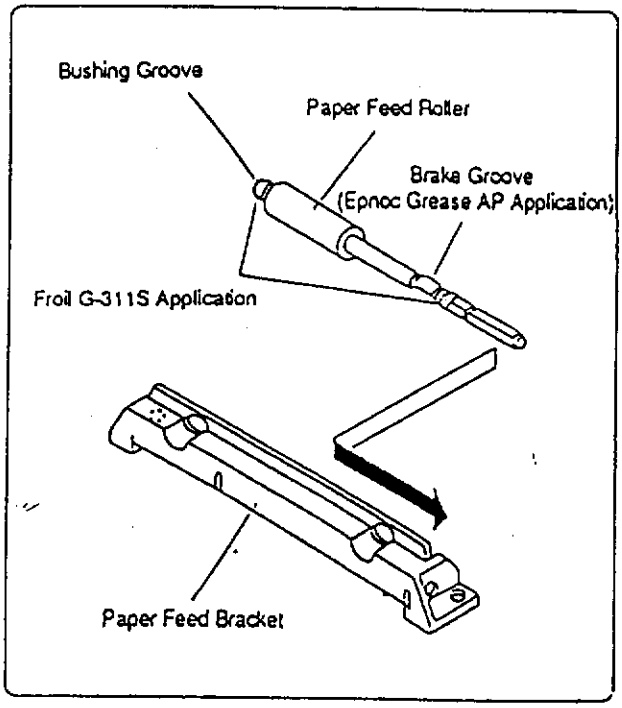


3-3-3 Setting the paper feed assembly

(1) Apply Froil G-311S to the two parts of the paper feed roller shaft where paper feed bracket touches.

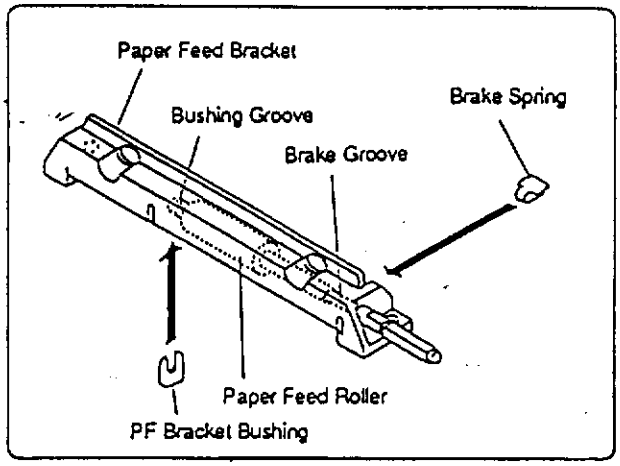
(2) Apply Epnoc grease AP to the brake groove of the paper feed roller. Note: The paper feed roller must be free from sticky oil.

(3) Place the paper feed roller in the paper feed bracket. At this time, the longer shaft should be inserted first.

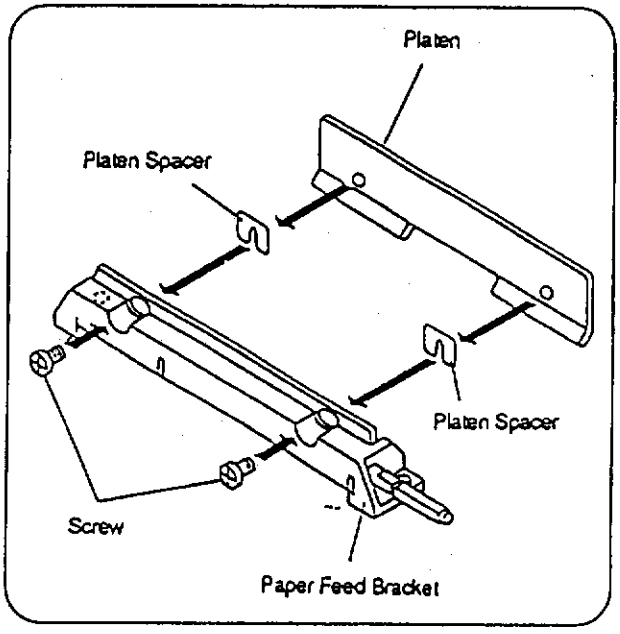


(4) Install the PF bracket bushing in the bushing groove of the paper feed bracket and secure the paper feed roller.

(5) Install the brake spring in the brake groove of the paper feed roller.



(6) Attach the platen to the paper feed bracket with two platen spacers and two screws (M2 x 2.5).

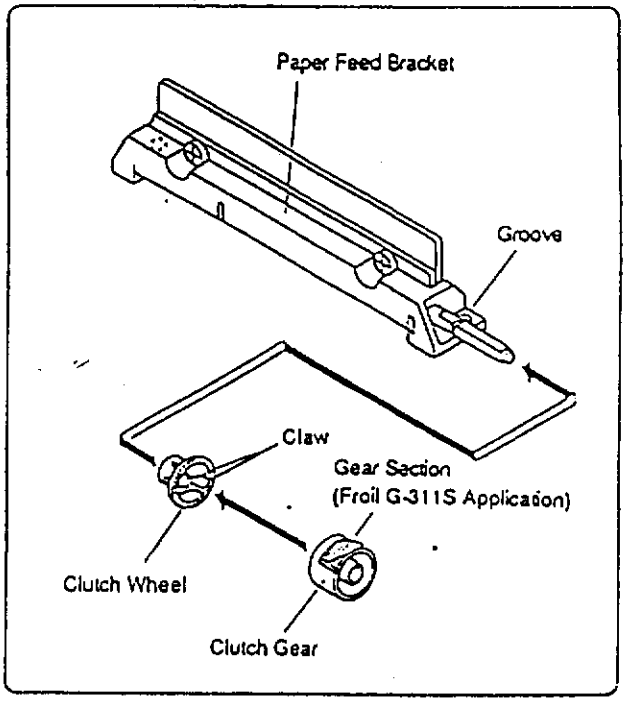


(7) Insert the clutch wheel in the paper feed roller shaft coming out of the paper feed bracket.

Note: When inserting, push the clutch wheel until the claws of the clutch wheel are engaged with the shaft groove of the paper feed roller.

(8) Insert the clutch gear in the paper feed roller shaft.

(9) Apply Froil G-311S to the gear section of the clutch gear.

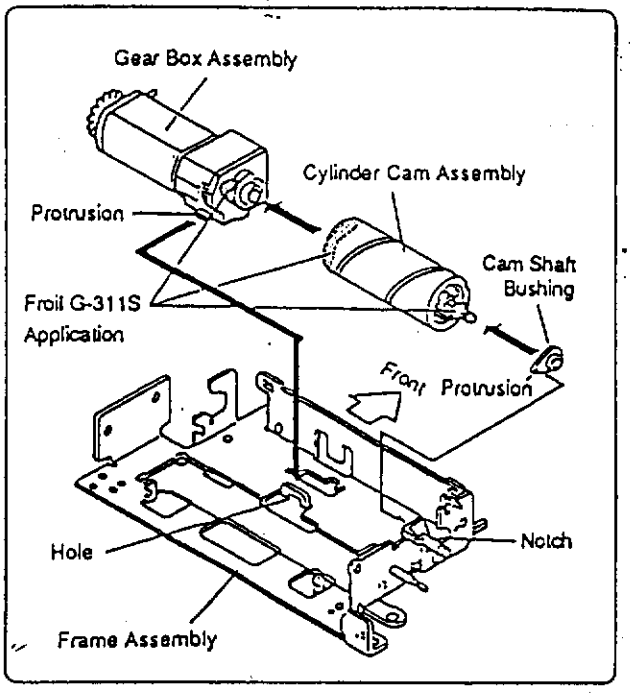


3-3-4 Setting the main body assembly

(1) Apply Froil G-311S to the gear of the gear box assembly, the shaft of the cylinder cam assembly and the teeth, the opposite of the shaft.

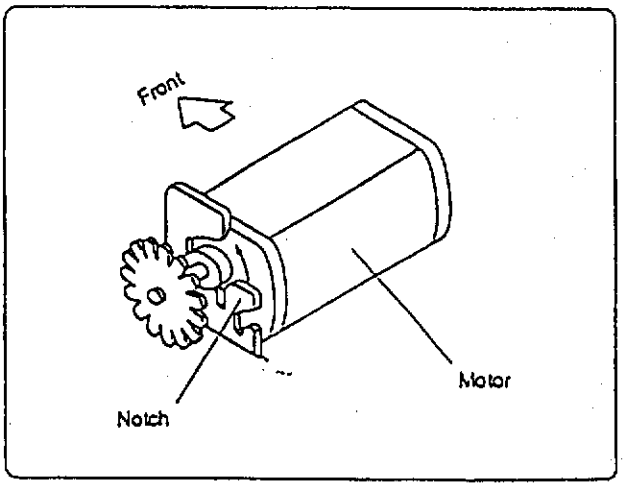
(2) Combine the cylinder cam assembly with the gear box assembly and install the cam shaft bushing in the shaft of the cylinder cam assembly. Then put block assembled in frame assembly.

Note:
1) When assembling, align the protrusion of the gear box assembly with the hole on the bend of the frame assembly.
2) After assembling, align the protrusion, a whirl-stop of the cam shaft bushing with the notched hole on the right of the frame assembly.



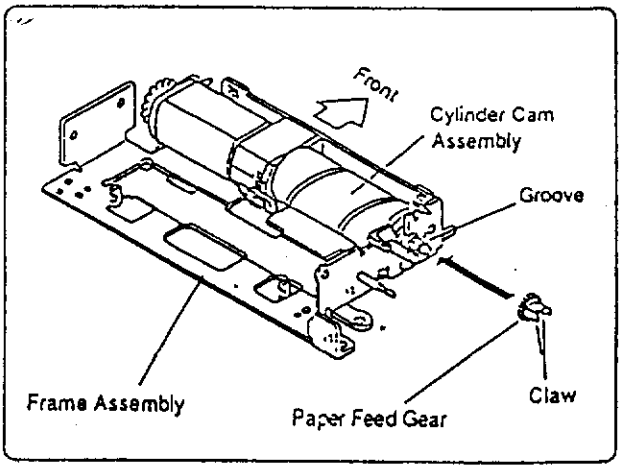
(3) Bend the notched section on the left of the frame assembly to secure the motor of the gear box assembly.

Note:
1) After securing this, check that the cylinder cam assembly turns smoothly. If not, re-install it.
2) Handle the notched section on the left of the frame assembly carefully because it may be damaged if it is bent and turned often.

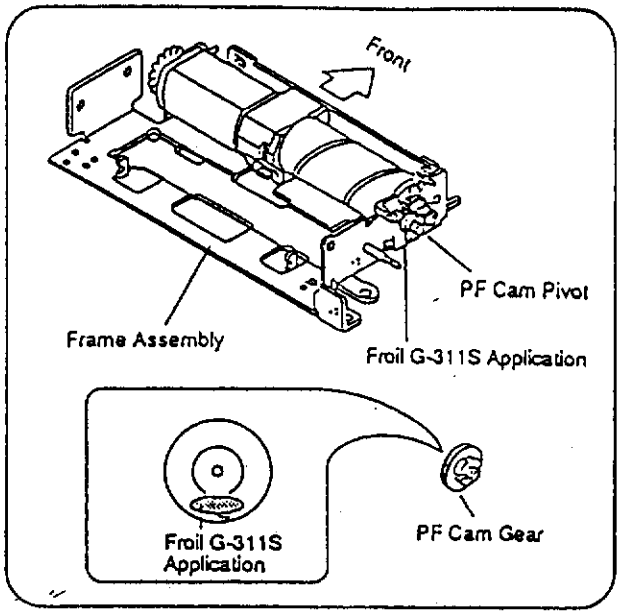


(4) Insert the paper feed gear in the shaft of the cylinder cam assembly.

Note: When inserting the gear, push the claws of the paper feed gear until they fully engage with the shaft grooves.



(5) Apply Froil-311S to the pivot of the PF cam and the cam of the PF cam gear.

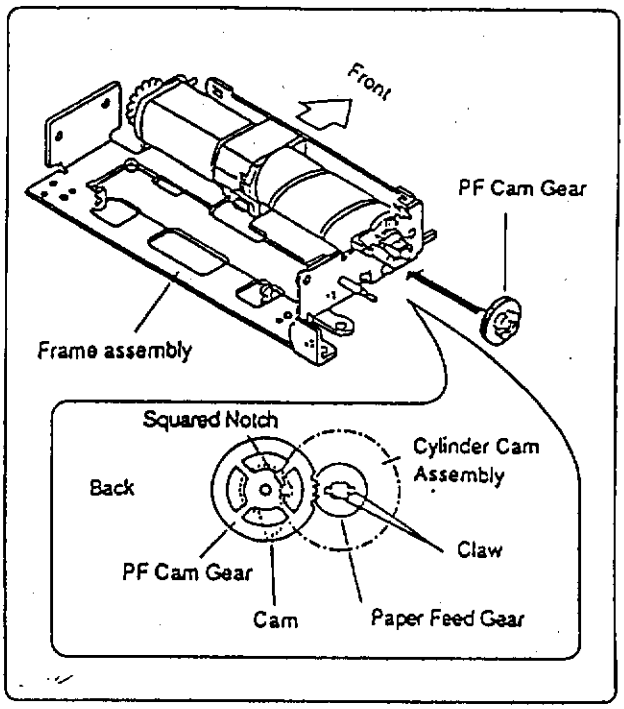


(6) The cam faces inside. Insert the PF cam gear in the pivot of the PF cam.

Note:

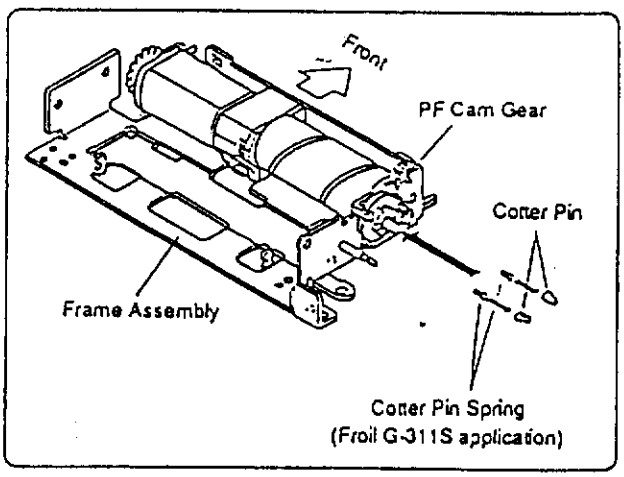
1) When inserting the gear, turn the cylinder cam assembly beforehand so that the claws of the paper feed gear are horizontal. At this time, the squared notch of the cylinder cam assembly should face the back.

2) Four-sectored protruding parts of the PF cam gear should face the outside. Engage the center of the protruding part that is horizontal when the inside cam faces down with the paper feed gear.



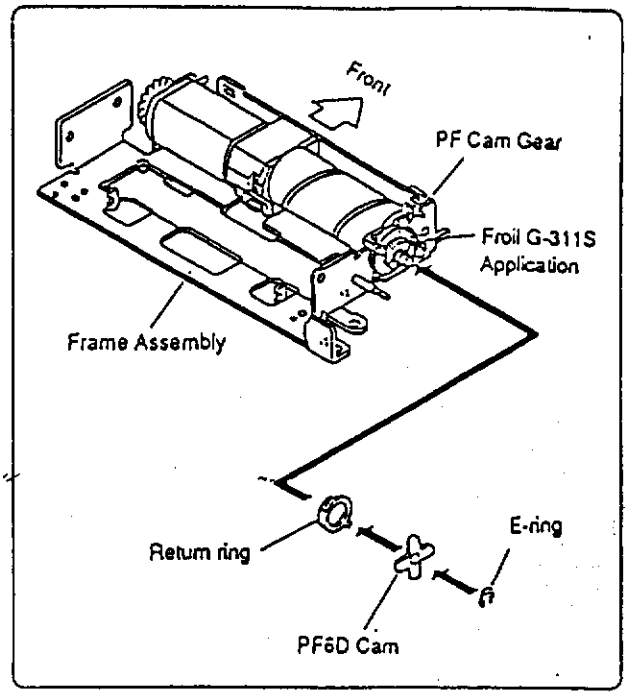
(7) Apply Froil G-311S to the two cotter pin springs and then insert them in cotter pins.

(8) Put the two cotter pins in the PF cam gear.

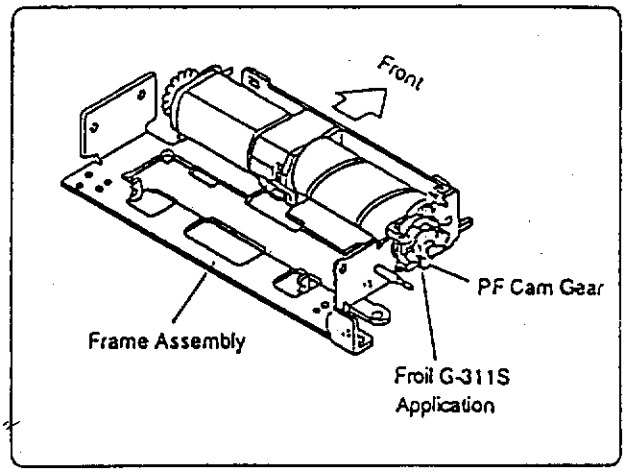


(9) Apply Froil G-311S to the upper surface of the PF cam gear.

(10) Install the return ring and the PF6D cam in the PF cam gear and secure it with the E-ring.

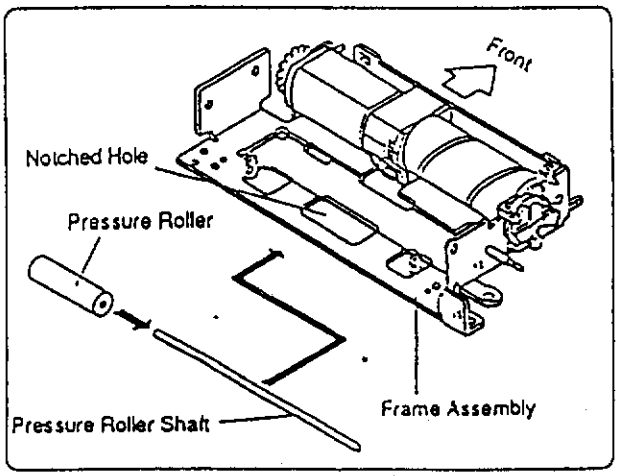


(11) Apply Froil G-311S to the outside and surfaces of the PF6D cam.

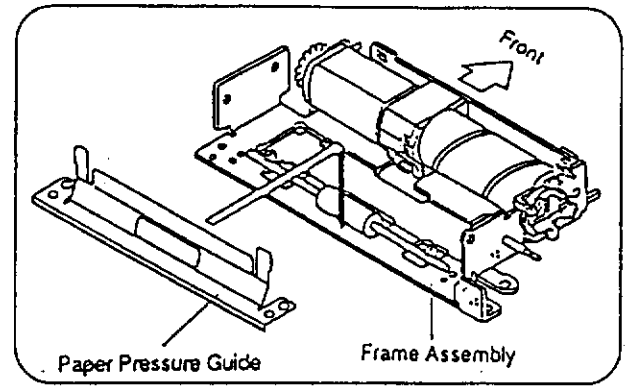


(12) Insert the pressure roller in the pressure roller shaft and set it in the frame assembly.

Note: The pressure roller must be set in the notched hole of the frame assembly.



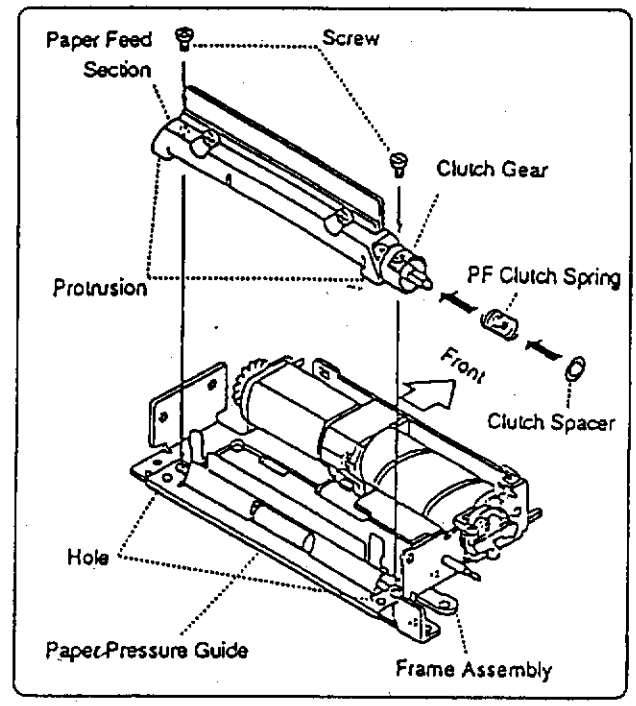
(13) Mount the paper pressure guide on the back of the frame assembly.



(14) Set the PF clutch spring and the clutch spacer in the clutch gear of the paper feed and then put it in the frame assembly from over the paper pressure guide.

Note:

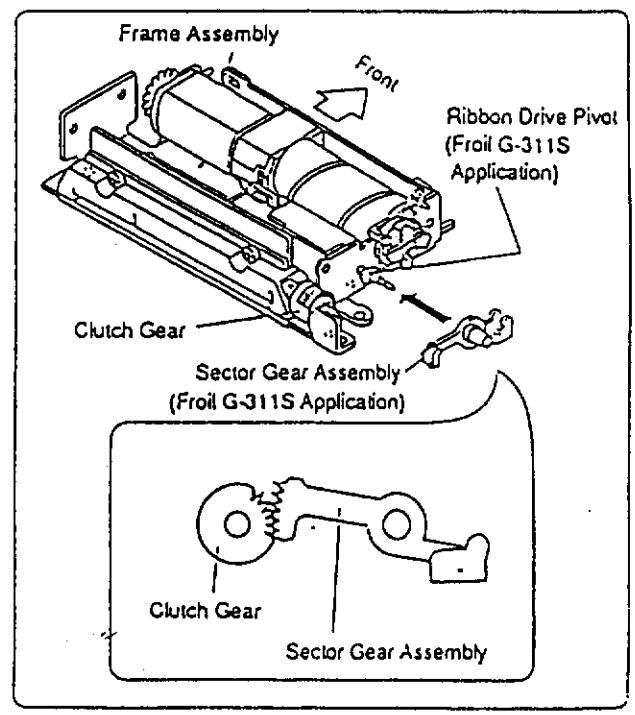
1) The clutch spacer must be set from the right of the frame assembly to the inside. Therefore, set it while the PF clutch spring is shortened.
2) When assembling, align the protrusions on the bottom of the paper feed bracket with the holes of the frame assembly.



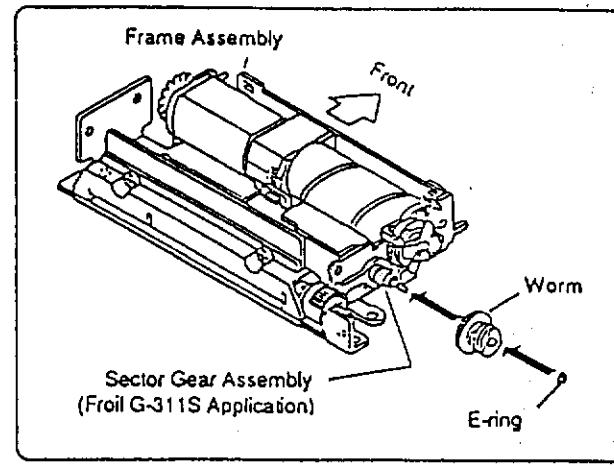
(15) Secure both the paper feed and the paper pressure guide to the frame assembly with two screws (M2 x 2.5).

(16) Apply Froil G-311S to the pivot of the ribbon drive and the teeth of the sector gear assembly.

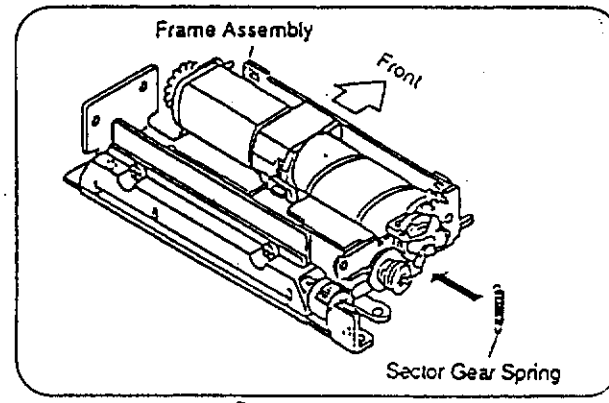
(17) Insert the sector gear assembly in the pivot of the ribbon drive. Note: When inserting the assembly, engage the bottom teeth of the sector gear assembly with the final gear of the clutch gear.



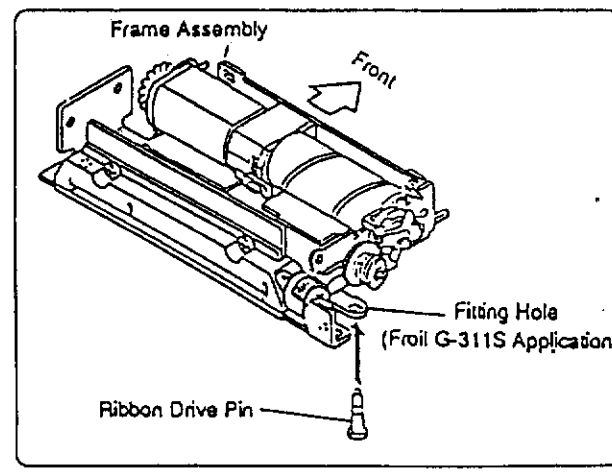
(18) Apply Froil G-311S to the bushing of the sector gear assembly and then insert the worm and secure it with the E-ring.



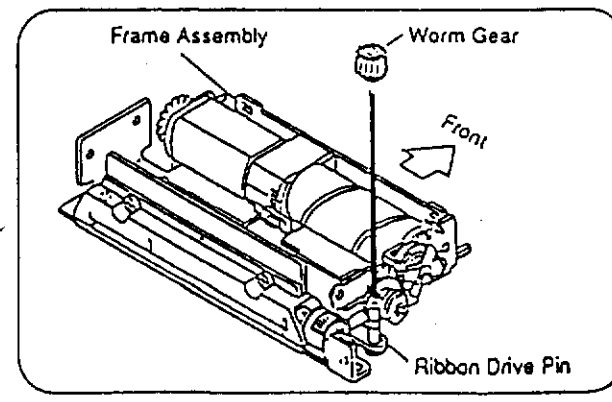
(19) Set the sector gear spring between the sector gear assembly and the frame assembly.



(20) Apply Froil G-311S to the fitting hole of the ribbon drive and then insert the ribbon drive pin from under the bottom of the frame assembly.

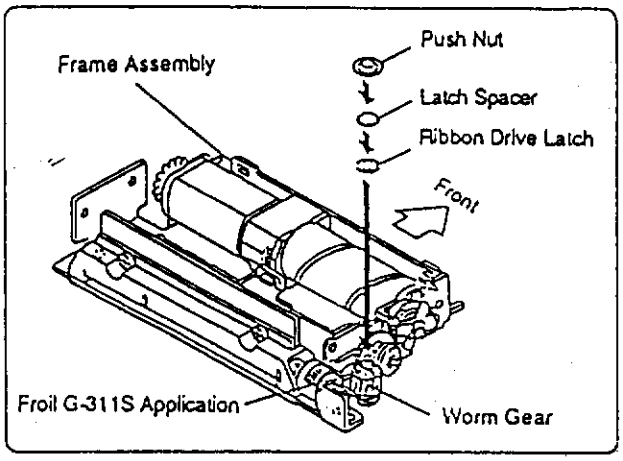


(21) Insert the worm gear in the ribbon drive pin.

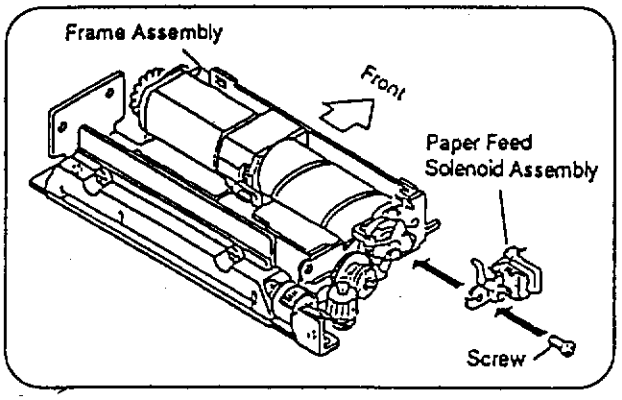


(22) Apply Froil G-311S to the upper surface of the worm gear and then install the ribbon drive latch and the latch spacer and secure them with the push nut.

Note: When installing these, check the direction of ribbon drive latch.

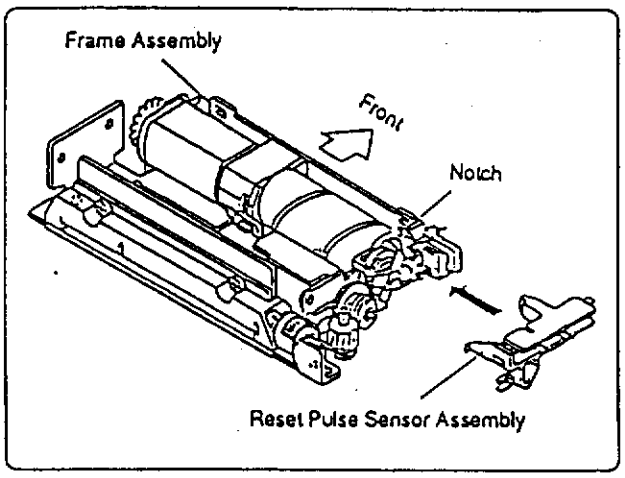


(23) Secure the solenoid assembly to the right of the frame assembly with a single screw.

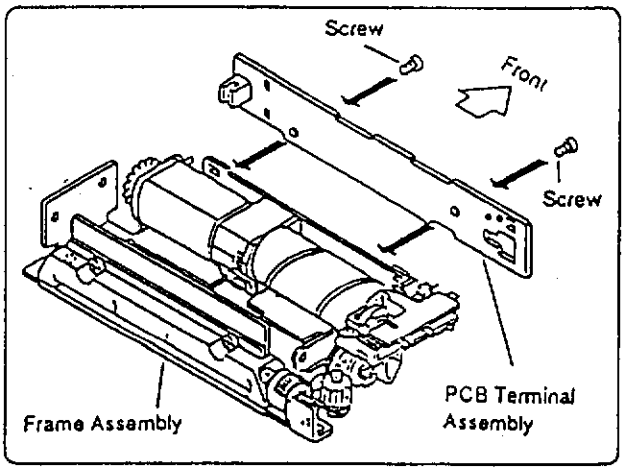


(24) Install the reset pulse sensor assembly to the right of the frame assembly and secure it by bending the notched section of the right of the frame assembly.

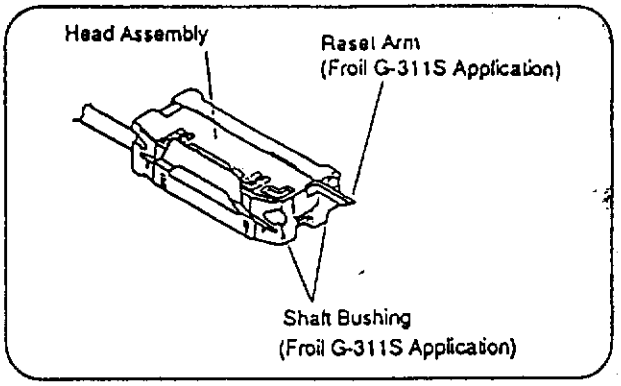
Note: Handle the notched section of the right of the frame assembly carefully because it may be damaged if it is bent or turned often.



(25) Secure the PCB terminal assembly to the front of the frame assembly with two screws (M2 x 2.5).

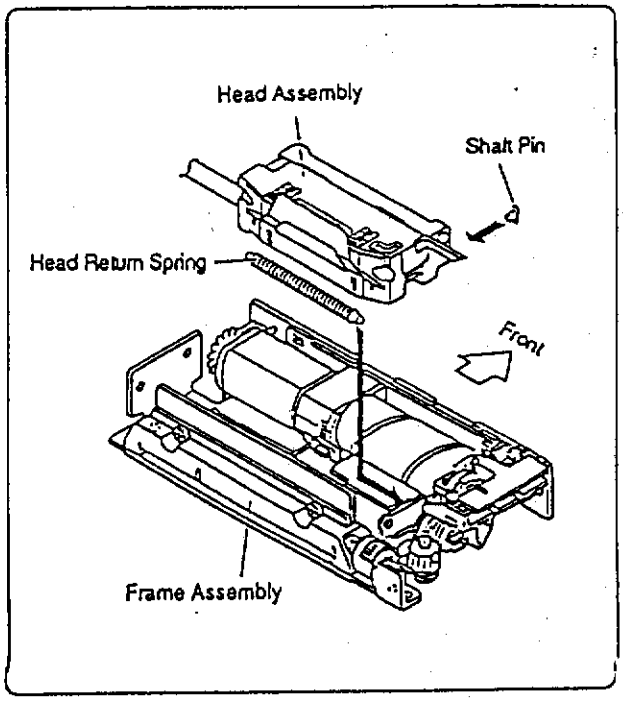


(26) Apply Froil G-311S to the tip of the reset arm and the two shaft bushings of the head assembly.



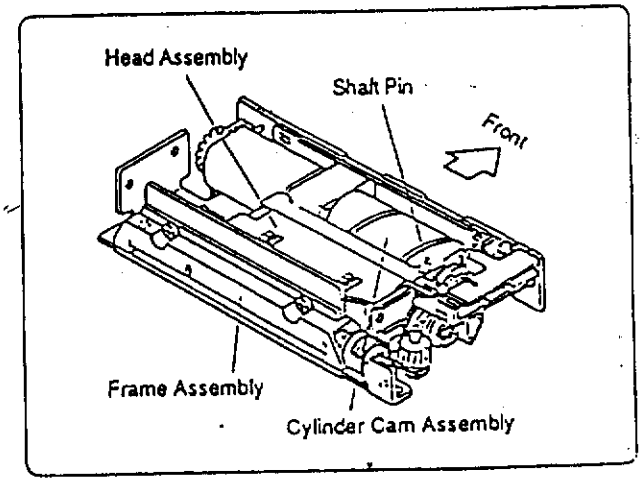
(27) Set the shaft pin in the head assembly.

(28) Hang one end of the head return spring, which is set in the head assembly, on the notched section of the right of the head assembly.



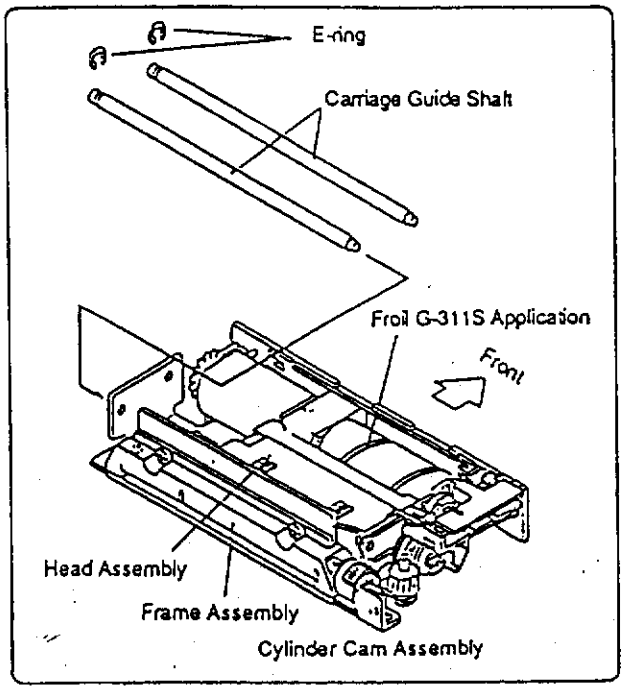
(29) Insert the tip of the shaft pin, which is set in the head assembly, in the groove of the cylinder cam assembly.

Note: Before insertion, the squared notch of the cylinder cam assembly should face the back and the head assembly should touch the right of the frame assembly.



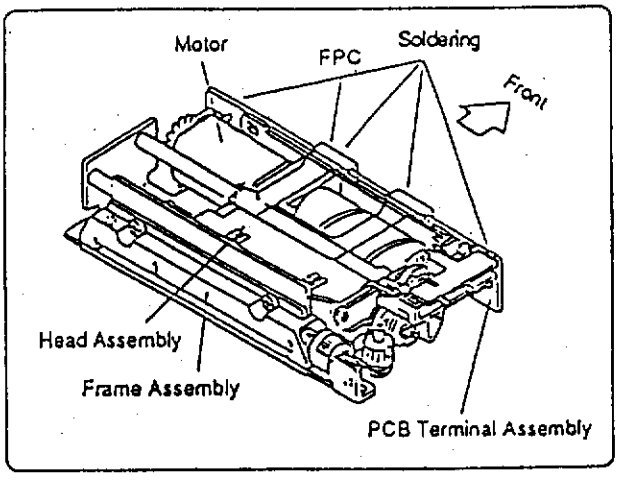
(30) Insert the two carriage guide shafts from the left of the frame assembly and pass them through the head assembly and secure them with the E-rings.

(31) Apply Froil G-311S to the groove of the cylinder cam assembly.



(32) Solder the following terminals on the PCB terminal assembly: FPC terminals (ten) to the head assembly, terminals (two) of the paper feed solenoid assembly and terminals (two) of the reset pulse sensor assembly.

Note: When soldering the terminals of the reset pulse sensor assembly, two terminal leaves are pressed back but the leaf tips should not protrude from the case.



(33) Pass the curl of the grounding spring through the hole in the near side right of the frame and then hang the V-section at the end of the opposite side of the frame on the groove of the paper feed roller shaft.