

**SEIKO**

**QUARTZ**

**Cal.47A**

























**PARTS LIST**







Calibre No.	<b>47A</b>	Jewels	<b>7j</b>	Style Name
-------------	------------	--------	-----------	------------



**Characteristics**

Casing diameter :  $\phi$  15.3 mm  
 Maximum height : 3.8 mm  
 Frequency of quartz crystal oscillator : **32,768 Hz**  
 (Hz=Hertz . . . . . Cycle per second)  
 Driving system : Step motor system (2 poles)  
 Regulation system : Trimmer condenser

 131 771	  221 770	  231 770	  241 770	 261 770	 271 770	 281 589
 282 589	 354 770	 383 770	 384 770	 386 770	 390 770	 436 770
 491 589	 701 770	 4001 770	 4002 770	 4146 770	 4219 771	 U.C.C. 384

						$\frac{2}{1}$
011 411	027 446	022 289	022 362	022 382	022 423	

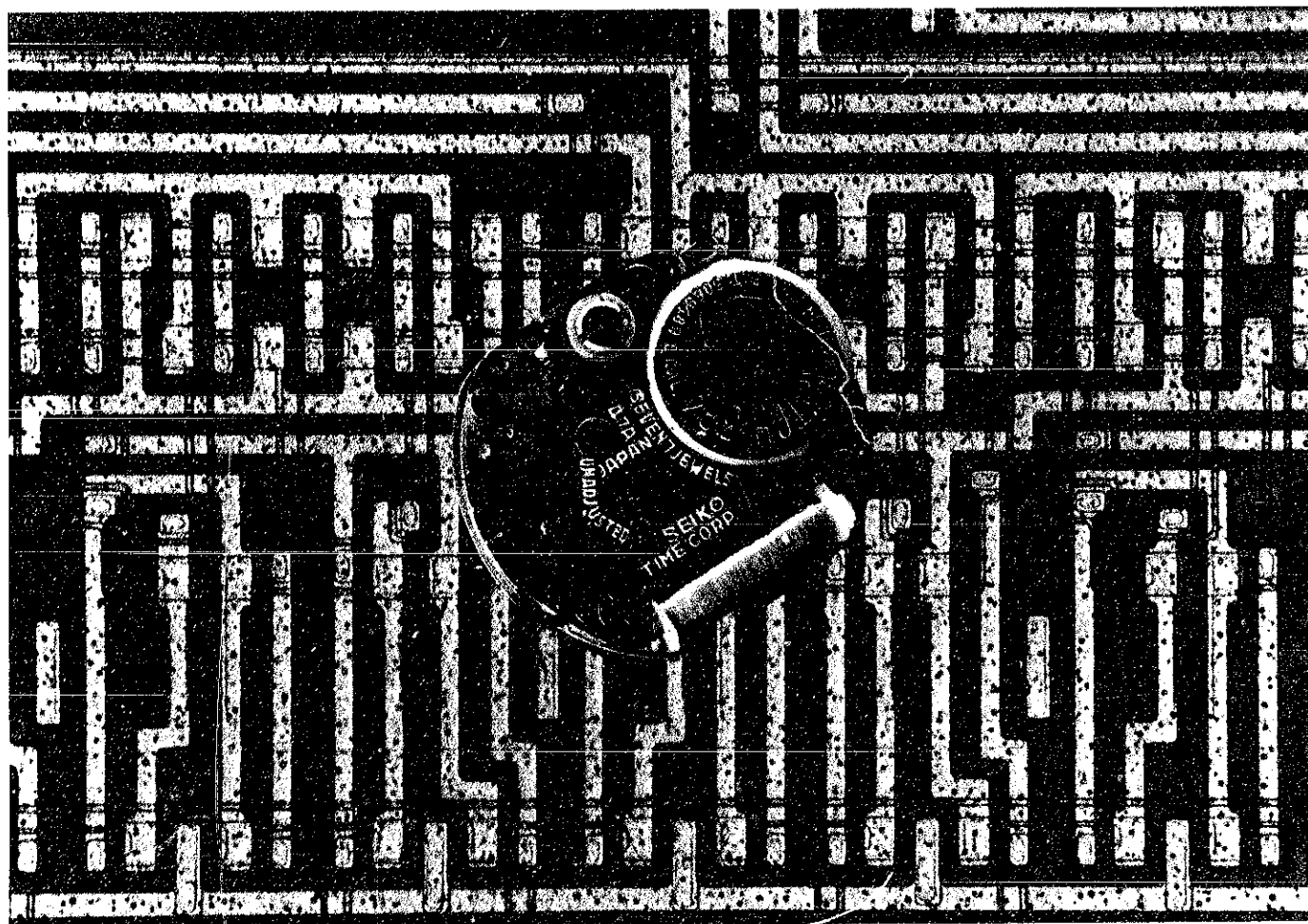
Calibre No.		Jewels	Style Name	
<b>47A</b>		<b>7j</b>		
PART NO.	PART NAME	PART NO.	PART NAME	
<b>131 771</b>	Third wheel bridge			
<b>221 770</b>	Center wheel & pinion			
<b>231 770</b>	Third wheel & pinion			
<b>241 770</b>	Fourth wheel & pinion			
<b>261 770</b>	Minute wheel			
<b>271 770</b>	Hour wheel			
<b>281 589</b>	Setting wheel			
<b>282 589</b>	Clutch wheel			
<b>354 770</b>	Winding stem			
<b>383 770</b>	Setting lever			
<b>384 770</b>	Yoke			
<b>386 770</b>	Setting lever spring			
<b>390 770</b>	Setting lever axle			
<b>436 770</b>	Lower end-piece for third wheel			
<b>491 589</b>	Dial washer			
<b>701 770</b>	Fifth wheel & pinion			
<b>4001 770</b>	Circuit block with crystal oscillator & trimmer condenser			
<b>4002 770</b>	Coil block			
<b>4146 770</b>	Step rotor			
<b>4219 771</b>	Insulator for battery			
<b>022 289</b>	Setting lever spring screw			
<b>022 289</b>	Lower end-piece screw for third wheel			
<b>022 289</b>	Dial screw			
<b>022 382</b>	Screw for circuit block & coil block			
<b>022 423</b>	Circuit block screw B			
<b>022 423</b>	Battery guard screw			
<b>022 362</b>	Third wheel bridge screw			
<b>022 362</b>	Coil block screw			
<b>022 362</b>	Circuit block screw A			
<b>011 411</b>	Upper cap jewel for step rotor			
<b>011 411</b>	Lower cap jewel for step rotor			
<b>011 411</b>	Upper hole jewel for third wheel			
<b>011 411</b>	Lower hole jewel for third wheel			
<b>011 411</b>	Upper hole jewel for fourth wheel			
<b>011 411</b>	Upper hole jewel for fifth wheel			
<b>011 411</b>	Lower hole jewel for fifth wheel			
<b>027 446</b>	Lower guide bush for step rotor			
<b>U.C.C.384</b>	Silver oxide battery			

# TECHNICAL GUIDE

## SEIKO

QUARTZ

CAL. 47A



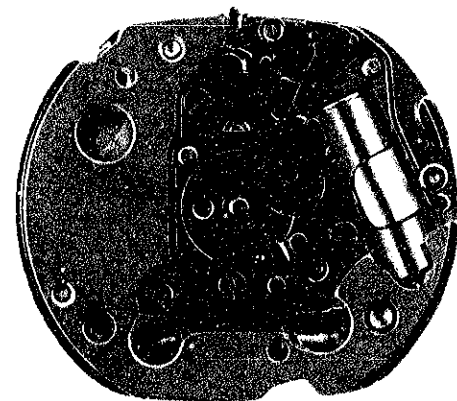
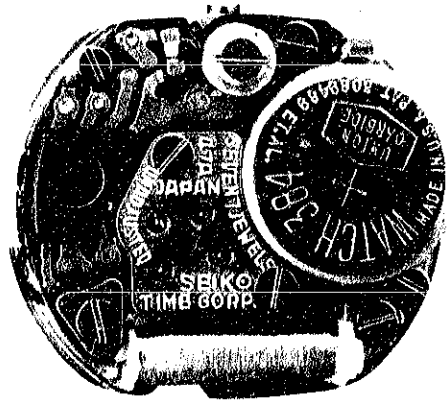
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SEIKO QUARTZ CRYSTAL WATCH Cal. 47A

SEIKO Quartz Cal. 47A is a thin and compact quartz crystal oscillator watch providing easy after-sale servicing, which contains the excellent basic functions developed for Cal. 41 series which has obtained a reputation for its high accuracy and reliability.

Calibre 47A



Movement



Actual Size

I. SPECIFICATIONS AND FEATURES

1. Specifications

Item	Cal. No.	47A
Time indication		Two hands (Hour and minute)
Additional mechanism		Electronic circuit reset switch
Crystal oscillator		32,768 Hz (Hz = Hertz . . . Cycles per second)
Loss/gain		Loss/gain at normal temperature Monthly rate: less than 15 seconds (Annual rate: less than 3 minutes)
Casing diameter		φ 15.3 mm
Height		3.8 mm
Operational temperature range		-10°C ~ +60°C (14°F ~ 140°F)
Driving system		Step motor system (2 poles)
Regulation system		Trimmer condenser
Battery power		Silver oxide battery (U.C.C. 384) Battery life is over one year Voltage, 1.5 V
Jewels		7 jewels

2. Features

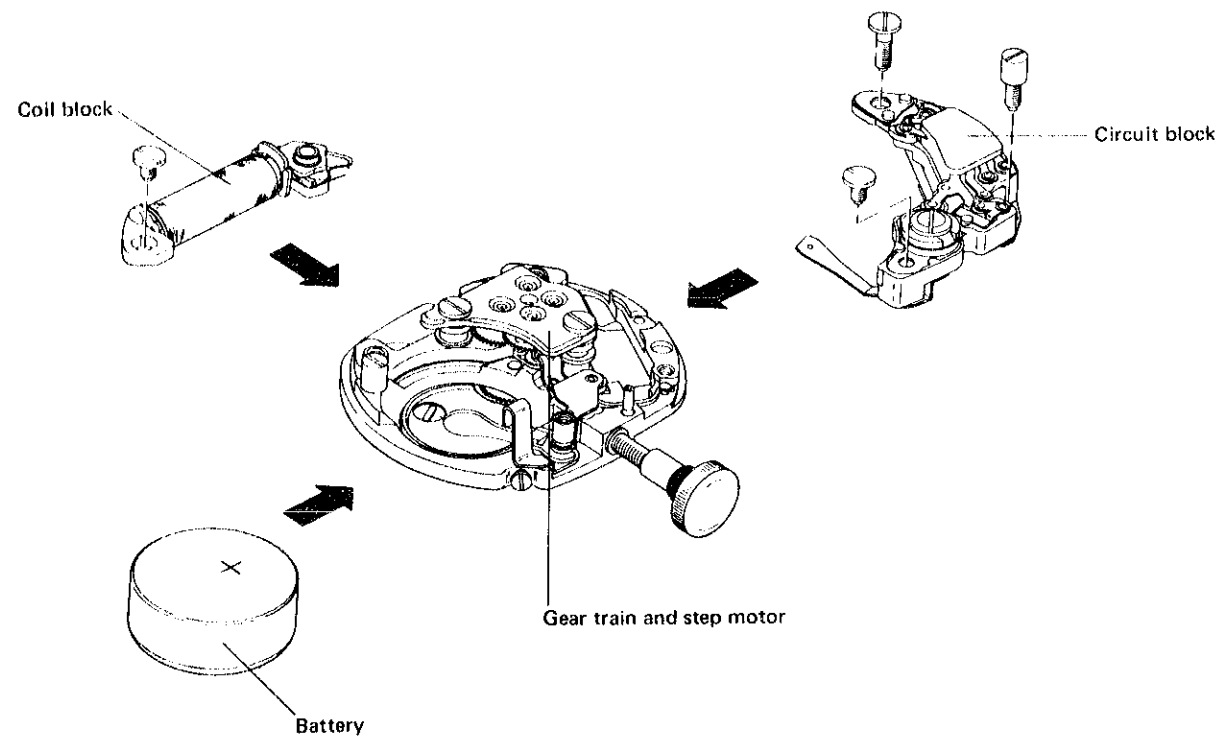
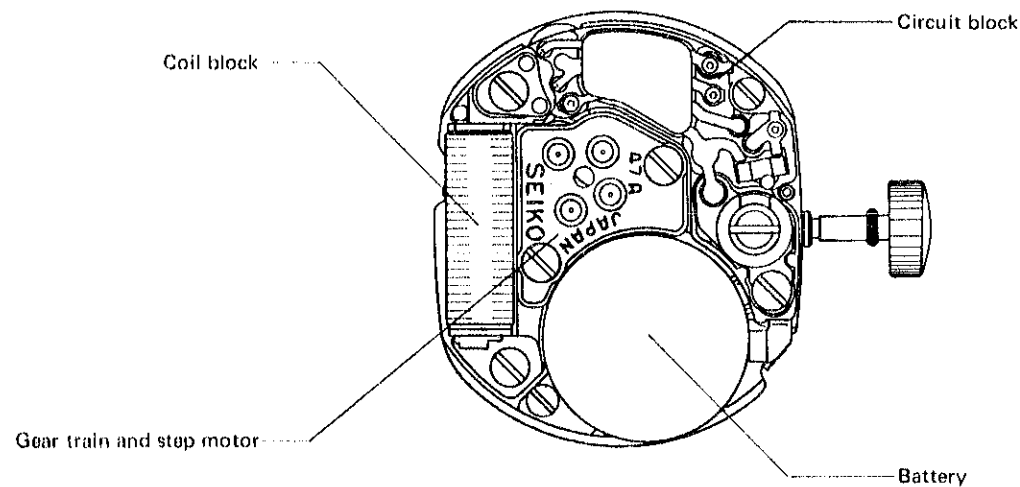
This ladies' dress watch is artistically produced with a craftsmanship which is the mode of today. Contained in its microcosm, like a tiny shell of about 0.65cm<sup>3</sup>, are modules of a quartz crystal oscillator, coil block and other functional parts to form a timeless gem which takes on the same touch of elegance and profile as the already proven mechanical watch Cal. 11 (ZW series).

## II. FUNCTIONING

### 1. Movement structure

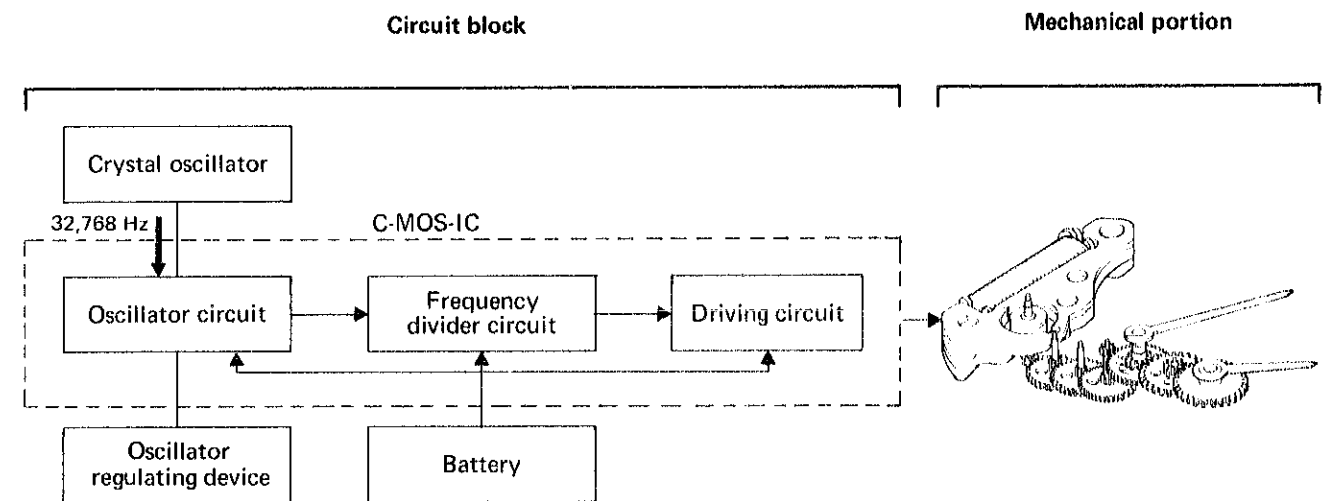
The movement consists of the circuit block, coil block, battery and the mechanical portion of which the main component are a step motor and a gear train.

The circuit block and coil block can be replaced separately. Thus easy checking, servicing and adjustment is possible.



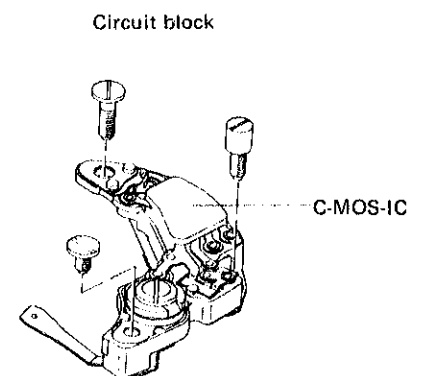
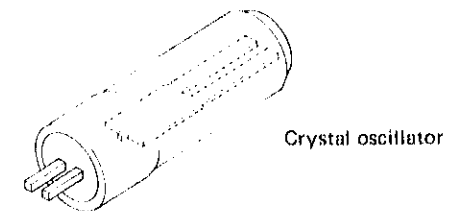
### 2. Outline of functioning

- (1) The crystal oscillator, when voltage is supplied, oscillates accurately at 32,768 Hz.
- (2) The electronic circuit receives the 32,768 Hz oscillations (electronic signals) and converts them into impulses at the rate of one per 2.5 seconds.
- (3) The one-per 2.5 seconds signals are transmitted to the coil block, causing step motor to rotate momentarily once every 2.5 seconds in 180° increments.
- (4) This rotation is transmitted to the gear train, thus moving the hands.



### 3. Functioning of electronic circuit block

- The quartz crystal oscillator, having been specially treated, is a tuning fork shaped oscillator that is ultra-small and by far thinner than ordinary ones. In order to secure long stability and to protect itself against outside influences, the crystal oscillator is housed in a cylinder-type vacuum capsule. When voltage is supplied from the electronic circuit, the crystal oscillator makes stabilized oscillations exactly at 32,768 Hz.
- The C-MOS-IC consists of the oscillator circuit, frequency divider circuit and driving circuit, and is connected electrically with the other electronic parts by the lead terminal. The oscillator circuit supplies voltage to the crystal oscillator to cause it to oscillate at 32,768 Hz and at the same time it takes out the oscillations in the form of an electrical signal. The frequency divider circuit divides the 32,768 Hz electrical signal to finally obtain a one per 2.5 seconds signal, which is transmitted to the step motor through the driving circuit.

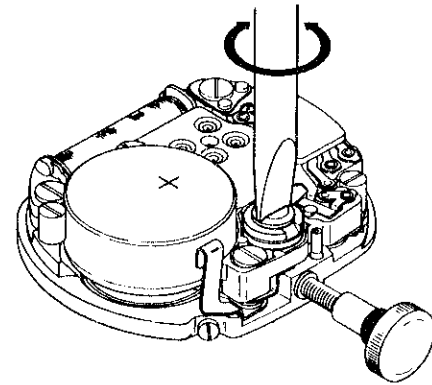


● **Oscillator regulating device**

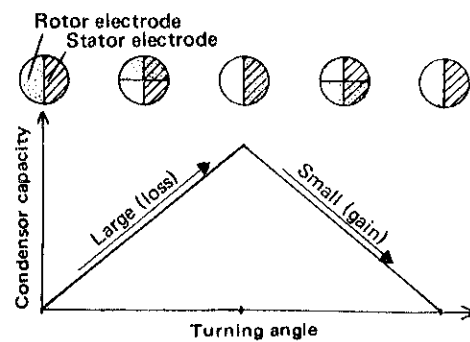
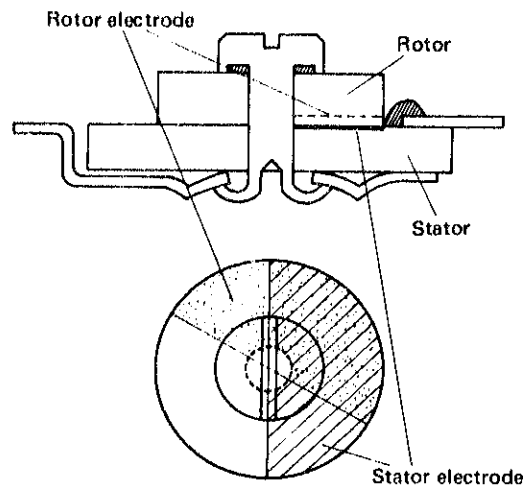
Adjustment of the oscillator of Cal. 47A watch can be easily made by simply turning the trimmer condenser.

● **Function of the trimmer condenser**

The trimmer condenser consists of a rotor electrode and a stator electrode. Turning the shaft fixed to the rotor changes the overlapped area between the rotor electrode and stator electrode, which in turn changes the capacitance of the trimmer condenser. Turning the trimmer condenser changes its capacitance as shown in the diagram. Time is adjusted by the magnitude of this change.



○ Checking accuracy cannot be made with conventional mechanical wrist-watch testers. It is necessary to use a QUARTZ TESTER.



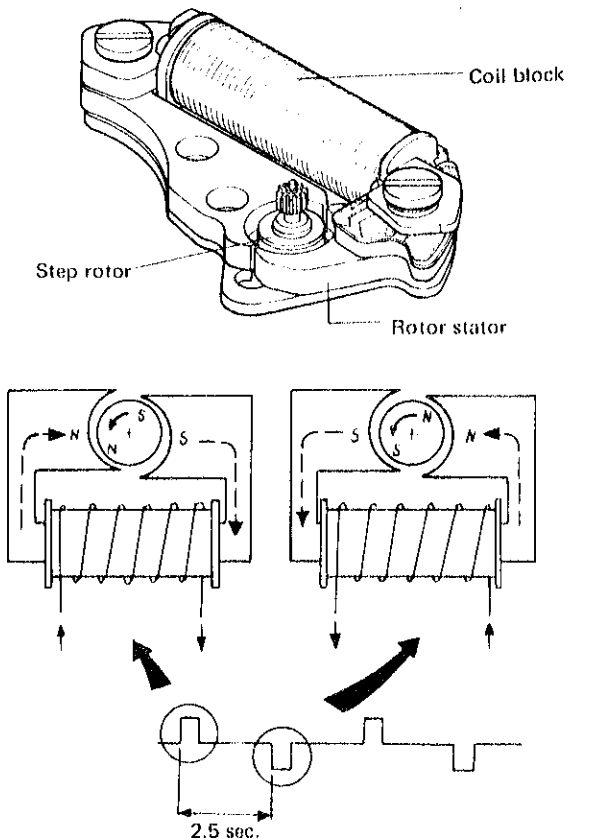
**4. Functioning of mechanical portion**

**(1) Step motor**

The step motor changes accurately the signals transmitted from the electronic circuit into a rotating motion, and the step motor consists of the coil block, rotor stator and step rotor.

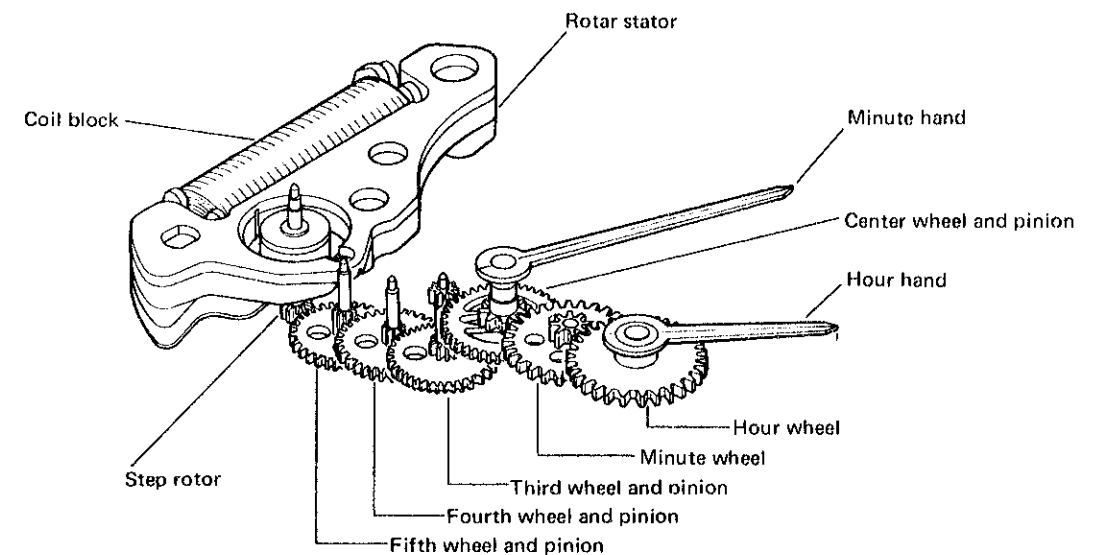
The following are the principles of functioning of the step motor.

- [1] **Current flows into the coil block**  
The current, of which the flow direction is changed once every 2.5 seconds, is transmitted from the driving circuit into the coil block.
- [2] **Rotor stator becomes magnets**  
When current flows into the coil block, the two rotor stators become magnets and the tip portions become, respectively, N and S poles.
- [3] **Step rotor rotates**  
The N and S poles of the rotor stator tips and the N and S poles of the step rotor alternately repel and attract, causing the step rotor to rotate momentarily in 180° increments in a constant direction once every 2.5 seconds.
- [4] **Gear train is driven**  
When the step rotor rotates, the gear which engages with the pinion of the step rotor rotates to drive the gear train.



**(2) Gear train mechanism**

The rotation of the step motor is transmitted to the fifth wheel, fourth wheel, third wheel, center wheel, minute wheel and hour wheel. Thus, the direction in which driving force is transmitted is opposite that for conventional mechanical watches. Incidentally, since this gear train is made smaller and thinner for special use in the watches with two hands, the fourth wheel is not positioned at the center.

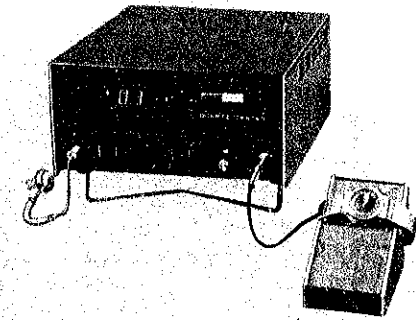


### III. AFTER-SALE SERVICING INSTRUMENTS AND MATERIALS

For repair servicing, the following SEIKO after-sale servicing instruments and materials are necessary. These instruments and materials are available at the head office of SEIKO.

#### 1. Quartz Tester

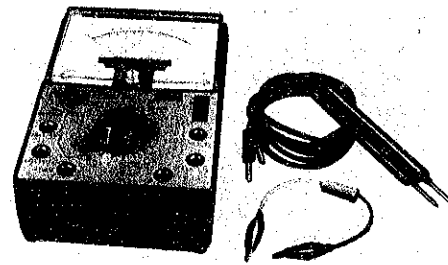
Used to check time accuracy (daily rates) and flow of current from circuit block.



Quartz tester

#### 2. Volt-ohm-meter & Condenser Kit

Used to check battery voltage and measure resistance, conductivity and current consumption.



Volt-ohm-meter and condenser kit

#### 3. Movement holder (S-662)

Used for disassembling, reassembling, checking and adjusting the movement.



Movement holder S-662

#### 4. Others

- (1) Anti-magnetic tweezers for handling step rotor.
- (2) Non-metallic tweezers for handling battery.

### IV. DISASSEMBLING, REASSEMBLING, LUBRICATING AND CLEANING

#### 1. Disassembling, Reassembling and Lubricating

##### • Disassembling and Reassembling

Disassembling procedures Figs.: ① ~ ③①

Reassembling procedures Figs.: ③① ~ ①

##### • Lubricating

Types of oil

● Moebius A

○ SEIKO Watch Oil S-6

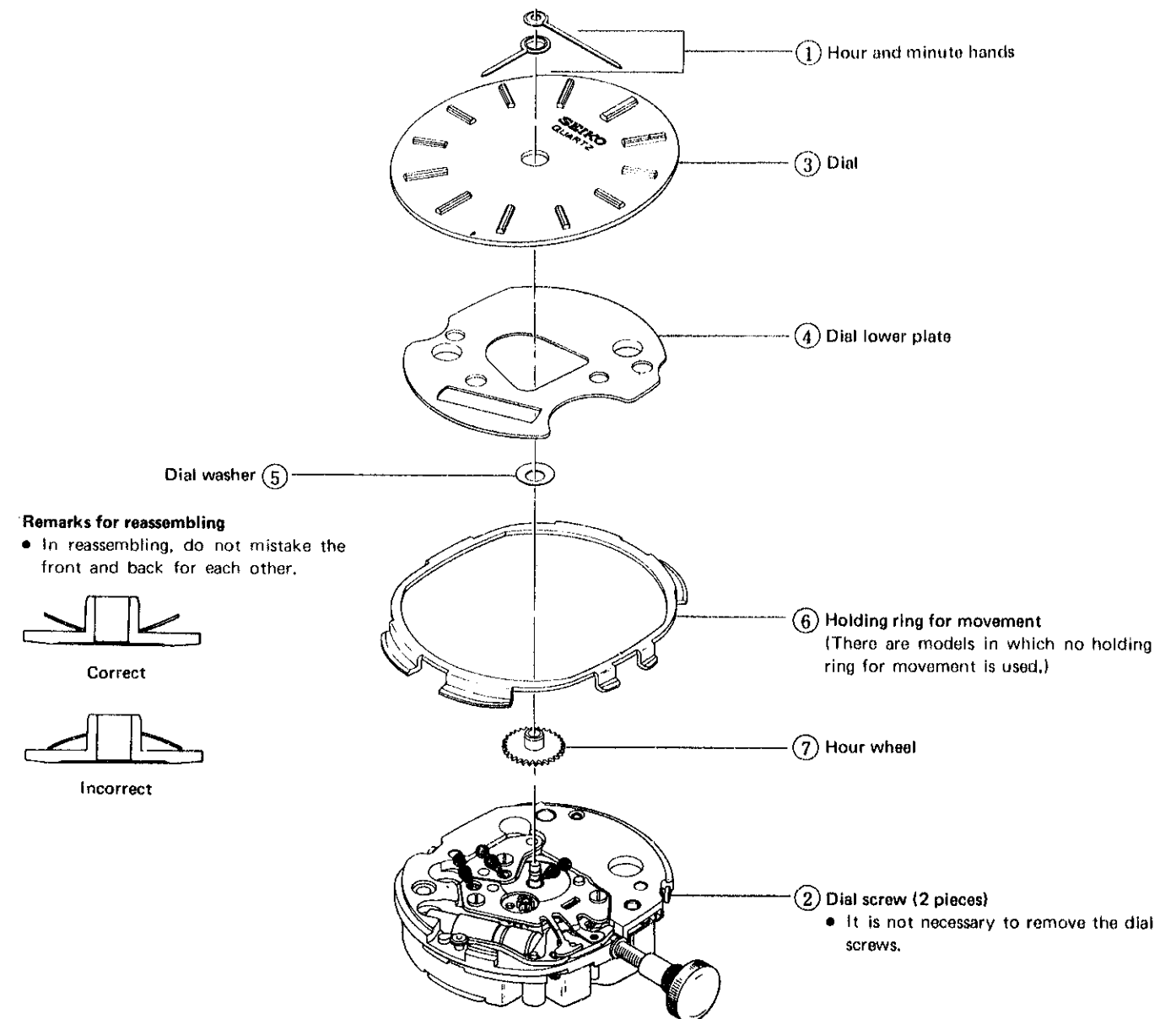
Oil quantity

∞ Liberal

○ Normal

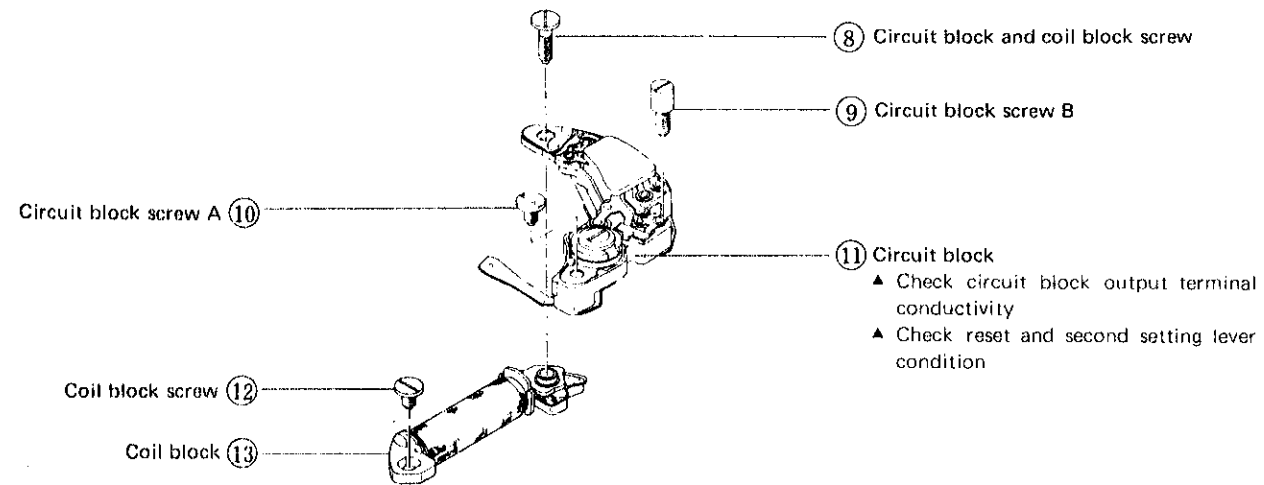
○ Extremely small

#### (1) Disassembling, reassembling and lubricating of the minute hand~hour wheel





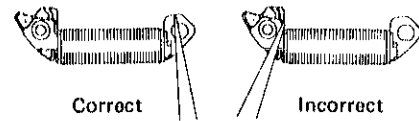
(2) Disassembling, reassembling and lubricating of the circuit block, coil block and gear train mechanism



- ⑧ Circuit block and coil block screw
- ⑨ Circuit block screw B
- ⑩ Circuit block screw A
- ⑪ Circuit block
  - ▲ Check circuit block output terminal conductivity
  - ▲ Check reset and second setting lever condition
- ⑫ Coil block screw
- ⑬ Coil block

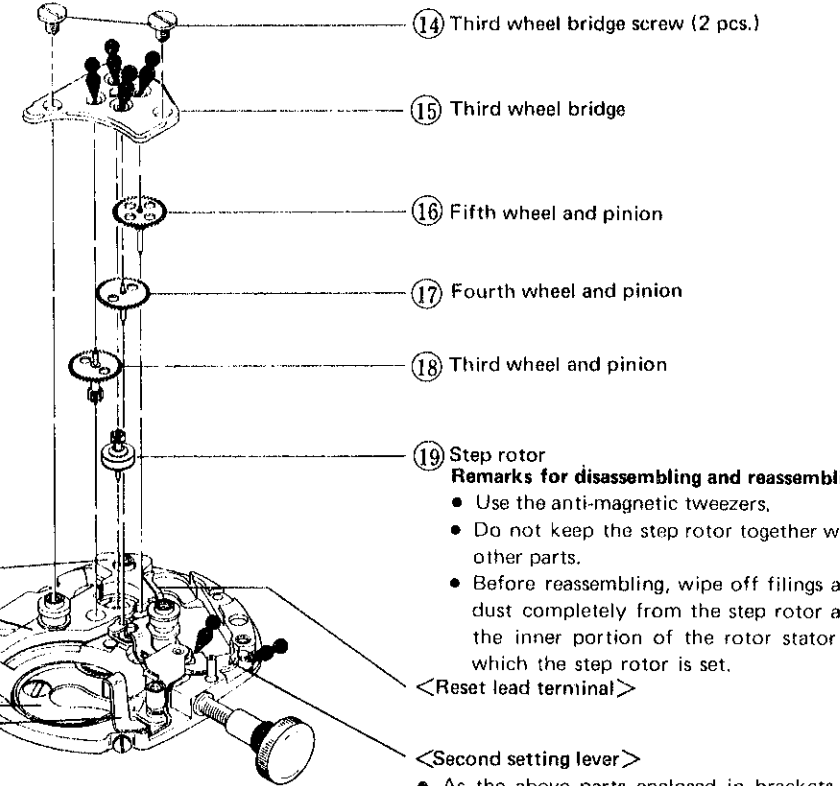
**Remarks for disassembling and reassembling**

- Be careful not to scratch the coil wire and lead terminal.
- Handle as shown in the illustration below.



**Remarks for disassembling and reassembling of the gear train.**

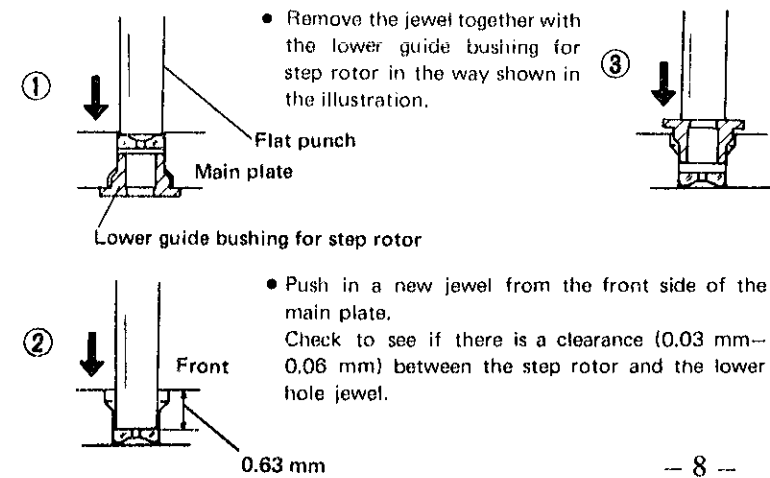
- Be sure to disassemble and reassemble with the winding stem pushed in.



- ⑭ Third wheel bridge screw (2 pcs.)
- ⑮ Third wheel bridge
- ⑯ Fifth wheel and pinion
- ⑰ Fourth wheel and pinion
- ⑱ Third wheel and pinion
- ⑲ Step rotor
  - Remarks for disassembling and reassembling**
  - Use the anti-magnetic tweezers.
  - Do not keep the step rotor together with other parts.
  - Before reassembling, wipe off filings and dust completely from the step rotor and the inner portion of the rotor stator in which the step rotor is set.
- ⑳ Lower end-piece screw for third wheel
- ㉑ Lower end-piece for third wheel
- ㉒ Setting lever spring screw
- ㉓ Setting lever spring
- ㉔ Setting wheel
  - Remarks for reassembling**
  - Place the setting wheel with its grooved side up.
- ㉕ Minute wheel
- ㉖ Center wheel and pinion
- ㉗ Yoke
  - Remarks for disassembling and reassembling**
  - When disassembling, remove the clutch wheel side first.
  - When reassembling, set the spring portion first and then the clutch wheel side.
- ㉘ Setting lever
- ㉙ Setting lever axle
- ㉚ Clutch wheel
- ㉛ Winding stem

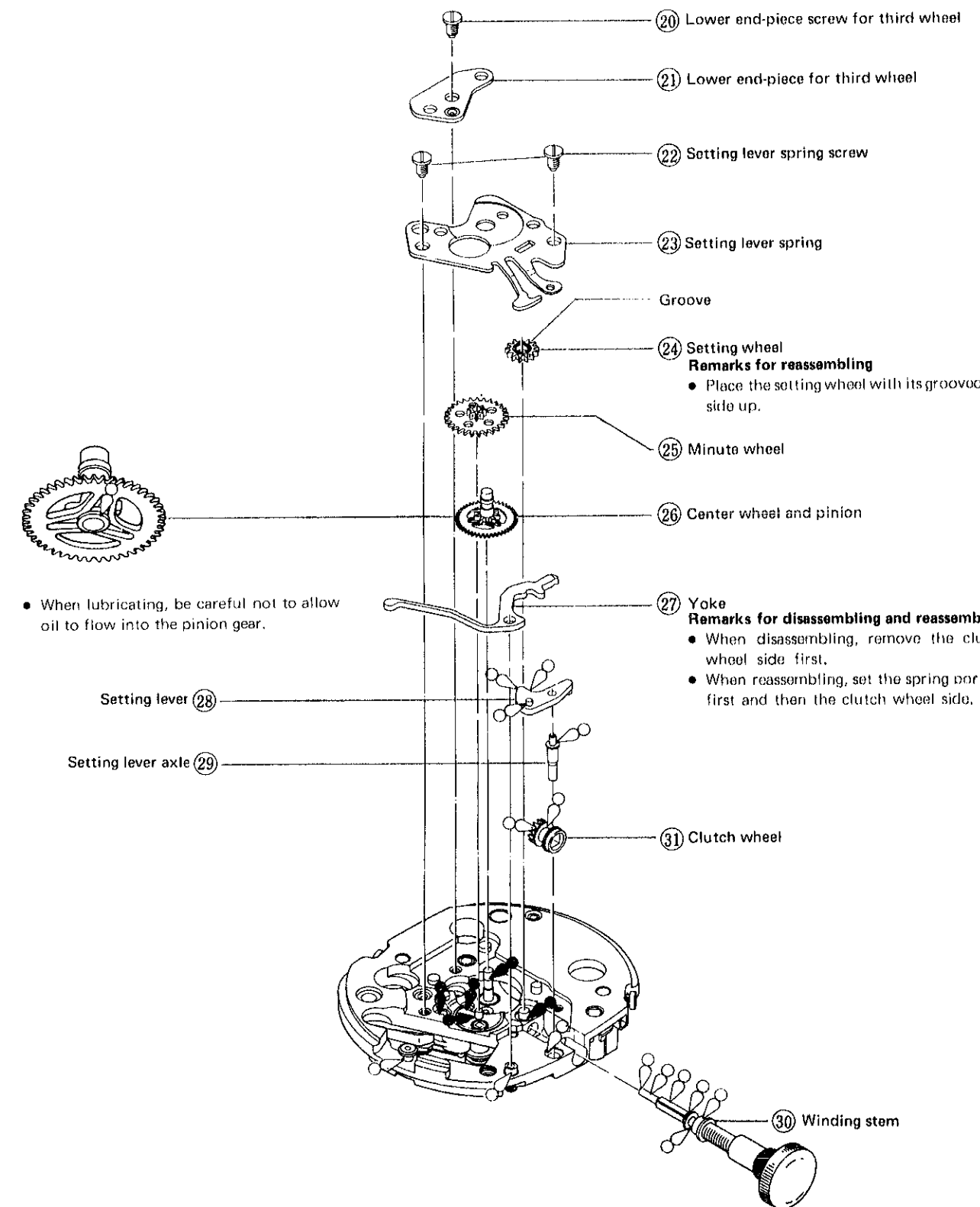
- <Rotor stator>
- <Battery guard screw>
- <Insulator for battery>
- <Plus terminal of battery connection>
- It is not necessary to remove the above parts enclosed in brackets.
- <Reset lead terminal>
- <Second setting lever>
- As the above parts enclosed in brackets are combined with the main plate, it is impossible to remove them.

**How to replace lower hole jewel for the step rotor**



- Remove the jewel together with the lower guide bushing for step rotor in the way shown in the illustration.
- Push in a new jewel from the front side of the main plate. Check to see if there is a clearance (0.03 mm--0.06 mm) between the step rotor and the lower hole jewel.
- Push in the lower guide bushing for step rotor. Make sure to push it in so that it touches the main plate.

(3) Disassembling, reassembling and lubricating of the setting mechanism

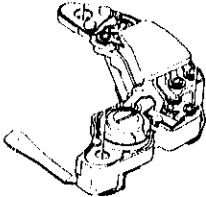
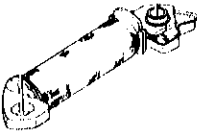
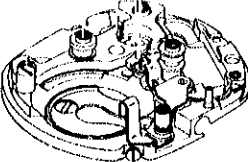



- When lubricating, be careful not to allow oil to flow into the pinion gear.

## 2. Cleaning

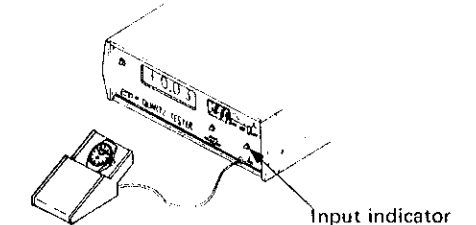
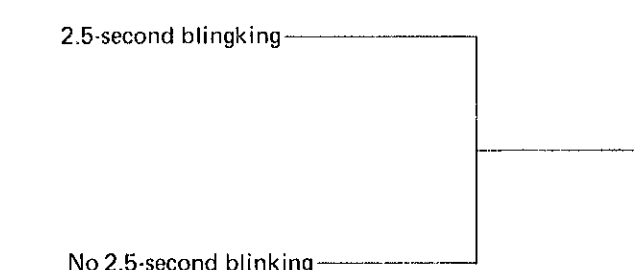
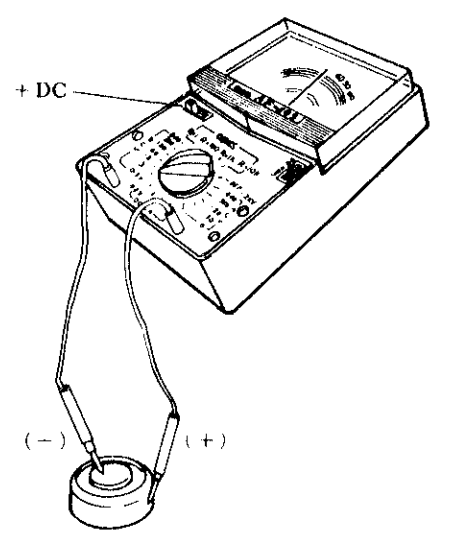
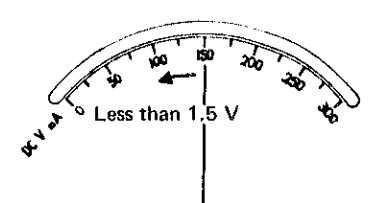
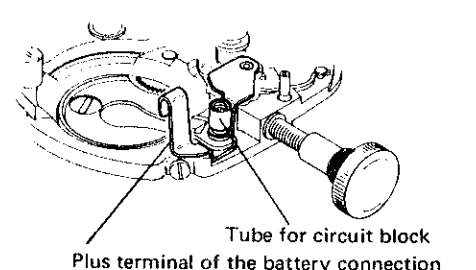
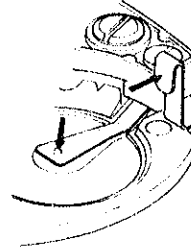
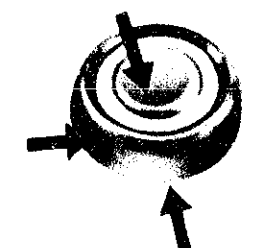
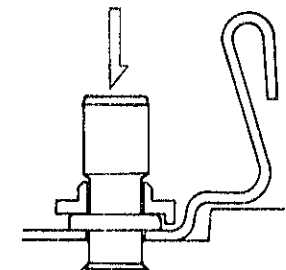
Since several special parts (electronic, etc.) used in the Cal. 47A differ from conventional mechanical watches, use the following cleaning methods when cleaning.

### Cleaning method

Name of parts	Cleaning	Drying	Solution	Remarks
(1) Circuit block   Coil block 	DO NOT CLEAN			Conductive portion <u>ONLY</u> may be cleaned with a cloth moistened with benzine or alcohol. Dry in <u>COOL</u> air.
(2) Main plate   Step rotor 	Rinse or scrub with a soft brush	Cool air drying	Benzine, alcohol	<ul style="list-style-type: none"> <li>• Be careful not to remove the parts fixed to the main plate.</li> <li>• Use a clean solution as the step rotor is magnetized. Any foreign matter which cannot be removed by cleaning should be removed with rodico or adhesive tape.</li> </ul>
(3) Others	Clean with the cleaner, rinse or gently scrub with a soft brush	Cool or hot air drying	Benzine, trichloroethylene, alcohol	



2. Procedures for checking and adjustment

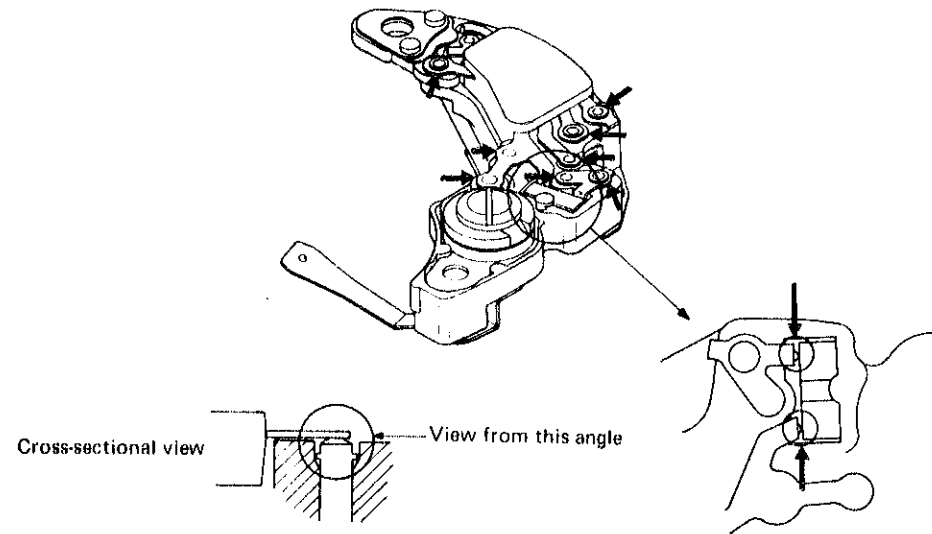
	Procedures	Results	Adjustment and Repair
CHECK OUTPUT SIGNAL	<p>Check for output signal</p> <ol style="list-style-type: none"> <li>1. Set up the Quartz Tester</li> <li>2. Checking Place the watch in the center of the microphone with the 6 or 12 o'clock side up and check for the output signal (Blinking input indication light). The output signal blinks every 2.5 seconds.</li> </ol> <p>Note:</p> <ul style="list-style-type: none"> <li>• Push in the crown to the normal position.</li> <li>• Turn the measuring time selection switch to the "10 second" position (for QT-10) or "0.01 second" position (for QT-100).</li> </ul> 	<p>2.5-second blinking</p> <p>No 2.5-second blinking</p> 	<p>Proceed to <b>B</b></p>
CHECK BATTERY VOLTAGE	<p>Use the following procedures to check battery voltage.</p> <ol style="list-style-type: none"> <li>1. Set up the Volt-ohm-meter. Range to be used DC 3V</li> <li>2. Measuring <ul style="list-style-type: none"> <li>• Probe Red (+) ..... Battery surface (+)</li> <li>• Probe Black (-) ..... Battery surface (-)</li> </ul> </li> </ol> <p>Note:</p> <p>When handling the battery, use a non-metallic tweezers or a fingercot.</p> 	<p>More than 1.5 V</p> <p>Less than 1.5 V</p> 	<p>In procedures in A, if a 2.5-second blinking is found, <b>Check mechanical portion.</b></p> <p>In procedures A, if a 2.5-second blinking is NOT found, <b>Check electronic circuit block.</b></p> <p><b>Replace with a provisional battery.</b></p> <ul style="list-style-type: none"> <li>• If the watch operates after battery replacement, proceed to <b>I</b></li> <li>• If the watch does not operate, check the <b>Check electronic circuit block.</b></li> </ul>
CHECK BATTERY CONDUCTIVITY	<p>Use the following procedures to check if the battery current flow to the circuit is normal.</p> <ol style="list-style-type: none"> <li>1. Check to see if the plus terminal of the battery connection and the tube for circuit block are loose.</li> <li>2. Check for any foreign matter on the connecting portion of the battery, plus terminal of the battery connection and the battery connection.</li> </ol>   	<p>Not loosened</p> <p>Loosened</p> <p>Untamminated</p> <p>Contaminated</p>	<p>Proceed to <b>C</b> 2.</p> <ul style="list-style-type: none"> <li>• Tap the top of the tube for circuit block to fix it to the plus terminal of the battery connection.</li> </ul>  <p>Proceed to <b>D</b></p> <ul style="list-style-type: none"> <li>• Wipe off carefully. Be careful not to bend the plus terminal of the battery connection and the battery connection.</li> </ul>

**D**

CHECK CIRCUIT BLOCK CONDUCTIVITY

**Procedures**

Check for short circuit and defective conductivity of the circuit block.  
Remove the circuit block and check for the conductivity of the arrow-marked portions by using a microscope.

**Results**

Neither short circuit nor defective conductivity

Short circuit and defective conductivity

**Adjustment and Repair**

Proceed to

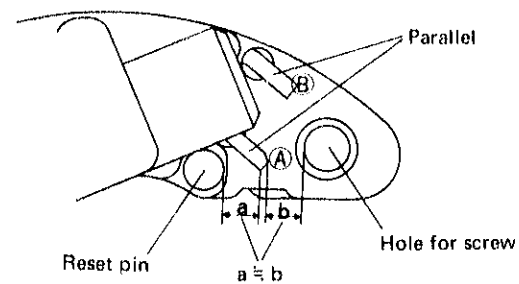
**E**

- Replace the circuit block with a new one.

**III**

CHECK CIRCUIT BLOCK OUTPUT TERMINAL CONDUCTIVITY

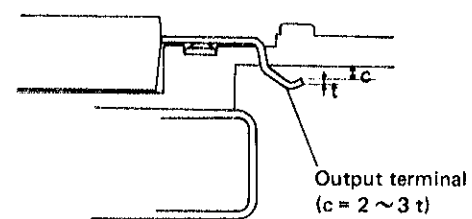
Remove the circuit block to check the contacting portion of the coil and the circuit block.



1. Check to see if the output terminal (A) is positioned as shown in the illustration. Also, check to see if the output terminal (A) parallels the output terminal (B).

2. Check to see if the clearance "C" is from two to three times in width the thickness of the output terminal when viewed from the side.

3. Check for any contamination on the output terminal and the coil lead terminal.



Normal

Defective

Normal

Defective

Uncontaminated

Contaminated

Proceed to

**E**

2.

- Correct the defective portion.

Proceed to

**E**

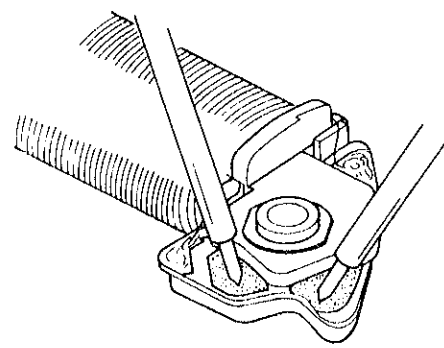
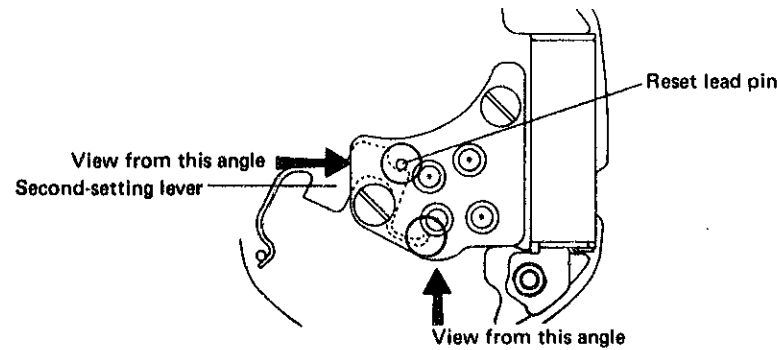
3.

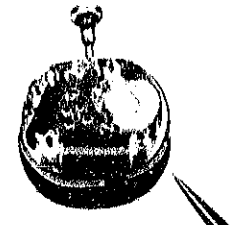
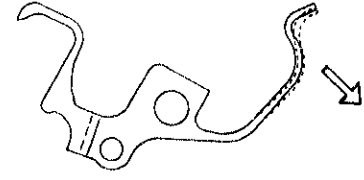
- Correct the defective portion.

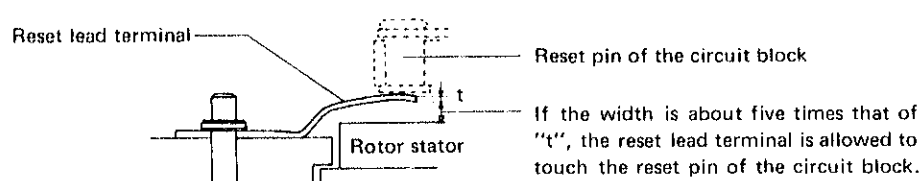
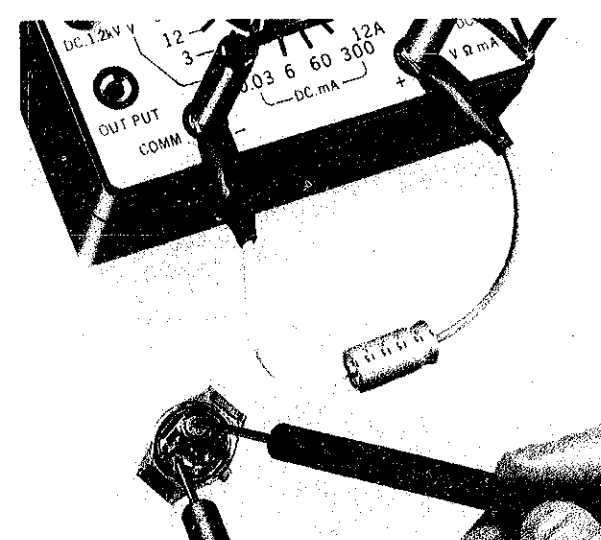
Proceed to

**F**

- Wipe off any foreign matter

	Procedures
CHECK COIL BLOCK	<p>Check for broken coil wire and short circuit of the coil block.</p> <ol style="list-style-type: none"> <li><b>1. Set up the Volt-ohm-meter</b> Range to be used OHMS R x 100</li> <li><b>2. Checking</b> Touch the red and black probes to the two terminals of the coil respectively.</li> </ol> 
CHECK OUTPUT SIGNAL	<p>Check the output signal.</p> <ol style="list-style-type: none"> <li><b>1. Set up the Quartz Tester.</b></li> <li><b>2. Checking method</b> Check using the same procedures as in <b>A</b></li> </ol>
CHECK RESET AND SECOND SETTING LEVER CONDITION	<p>Check for the reset and second setting lever condition.</p> <ol style="list-style-type: none"> <li>With the circuit block and the battery reassembled, check to see if the step rotor stops exactly when the crown is pulled out to the first click and starts moving when the crown is pushed back to the normal position.</li> <li>With the circuit block and the battery disassembled and the crown pulled out to the first click, check to see if the second-setting lever controls the fifth pinion and if the second-setting lever contacts the reset lead pin.</li> </ol> 

Results	Adjustment and Repair
<p>1.5 KΩ ~ 3.5 KΩ →</p> <p>Less than 1.5 KΩ (Short circuit) →</p> <p>More than 3.5 KΩ (Broken wire) →</p>	<p>Proceed to <b>G</b> if the electronic circuit must be checked.</p> <p>Proceed to <b>H</b> if the mechanical portion must be checked.</p> <ul style="list-style-type: none"> <li>Replace the coil block with a new one. Remove the circuit block and unscrew the circuit block screw. (It is not necessary to remove the third wheel bridge.)</li> </ul> 
<p>2.5-second blinking →</p> <p>Move →</p> <p>Stop →</p> <p>No 2.5-second blinking →</p>	<p>Proceed to <b>I</b></p> <p><b>Check mechanical portion</b> <b>H</b></p> <ul style="list-style-type: none"> <li>Replace the circuit block.</li> </ul>
<p>Stops immediately and starts moving again. →</p> <p>Does not stop →</p> <p>The second-setting lever controls the fifth pinion. Connected →</p> <p>The second-setting lever does not control the fifth pinion. Disconnected →</p>	<p>Proceed to <b>H</b> 2.</p> <p>Proceed to <b>H</b> 2.</p> <p>Proceed to <b>H</b> 3.</p> <ul style="list-style-type: none"> <li>Bend the tail of the second-setting lever for adjustment.</li> </ul> 

	Procedures	Results	Adjustment and Repair
	<p>3. Check to see if the reset lead terminal touches the reset pin of the circuit block and if there is any contamination on the contacting portion.</p> 	<p>Connected —————→</p> <p>Uncontaminated —————→</p> <p>Disconnected —————→</p> <p>Contaminated —————→</p>	<p>Proceed to <b>I</b></p> <ul style="list-style-type: none"> <li>If disconnected, correct the reset lead terminal as shown in the illustration.</li> <li>If contaminated, wipe off any foreign matter.</li> </ul>
CHECK ACCURACY	<p>Check gain and loss of time.</p> <p>1. Set up the Quartz Tester</p> <p>2. Checking</p> <p>Follow the same procedures as in <b>A</b></p>	<p>Correct —————→</p> <p>Incorrect —————→</p>	<p>Replace battery</p> <p>Time accuracy adjusting</p>
MEASURING CURRENT CONSUMPTION	<p>In case where a frequent battery change is required, a current consumption test is recommended. Use the following procedures:</p> <p>1. Set up the Volt-ohm-meter</p> <ul style="list-style-type: none"> <li>Range to be used DC 0.03 mA</li> <li>Set up the condenser of 200 ~ 500 <math>\mu</math>F as shown in a photo.</li> </ul> <p>2. Measurement</p> <ul style="list-style-type: none"> <li>Place the battery on the third wheel bridge with its minus side up.</li> <li>Probe Red (+) . . . Battery connection</li> <li>Probe Black (-) . . . Battery surface (-)</li> </ul> 	<p>Less than 3.5 <math>\mu</math>A —————→</p> <p>More than 3.5 <math>\mu</math>A —————→</p> <p><b>Remarks:</b> There might be a slight difference in the measured value depending upon the type of volt-ohm-meter. When judging the circuit block condition, be sure to take this into consideration.</p>	<p>Proceed to <b>I</b></p> <p>Proceed to <b>F</b> When the coil block is found normal, replace the circuit block with a new one.</p> <p>All procedures of Disassembling and Reassembling, and Checking and Adjustment are completed.</p>