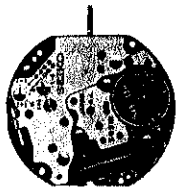
SEIKO

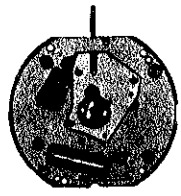
QUARTZ

Cal. 5931A

PARTS LIST

Cal. 5931A





131 492

☆231 490

☆241 492

261 491

☆270 490

☆271 491

281 490

282 490

☆354 494

☆354 496

383 491

384 490

385 490

388 491

391 492

436 490

491 220

493 220

☆701 490

4001 490

4002 490

4146 490

4239 490

4242 490

4259 490

☆4446 490

011 527

011 541

011 542

☆SEIKO SB-DK

012 467

012 468

012 469

012 766

017 167

017 170

017 171

017 172

017 192

017 936

2/1

☆⇨Please see remarks on the next reverse page.

Cal. 5931A

Characteristics

Casing diameter : ϕ 22.0 mm
Maximum height : 1.9 mm without battery
Jewels : 6 j
Frequency of quartz crystal oscillator : 32,768 Hz (Hz = Hertz . . . . . cycles per second)
Driving system : Step motor system (2 poles)
Regulation system : Rotary step switch type
Second setting device
Battery life indicator : Second hand moves in two-second interval.

PART NO.	PART NAME
131 492	Third wheel bridge
☆**231 490**	Third wheel & pinion
☆**241 492**	Fourth wheel & pinion (2.64 mm)
☆241 495	Fourth wheel & pinion (2.92 mm)
261 491	Minute wheel
☆**270 490**	Center minute wheel with cannon pinion (1.33 mm)
☆270 494	Center minute wheel with cannon pinion (1.58 mm)
☆**271 491**	Hour wheel (0.60 mm, Silver)
☆271 493	Hour wheel (0.80 mm, Gold)
281 490	Setting wheel
282 490	Clutch wheel
☆**354 494**	Winding stem (1 1.46 mm)
☆**354 496**	Winding stem (1 5.36 mm)
383 491	Setting lever
384 490	Yoke (Clutch lever)
385 490	Yoke spring (Clutch lever spring)
388 491	Setting lever spring
391 492	Second setting lever
436 490	Lower end-piece for third wheel
491 220	Dial washer
493 220	Hour wheel ring
☆**701 490**	Fifth wheel & pinion
4001 490	Circuit block
4002 490	Coil block
4146 490	Step rotor
4239 490	Rotor stator
4242 490	Plus terminal of battery connection
☆**4446 490**	Crystal unit cushion
011 527	Lower hole jewel for fifth wheel
011 541	Upper hole jewel for step rotor
011 541	Lower hole jewel for step rotor
011 542	Upper hole jewel for third wheel
011 542	Upper hole jewel for fourth wheel
011 542	Upper hole jewel for fifth wheel
012 467	Third wheel bridge screw
012 467	Coil block screw
012 467	Circuit block screw
012 468	Setting lever spring screw
012 469	Case screw
012 766	Lower end-piece screw for third wheel
017 167	Tube for third wheel bridge screw A
017 170	Tube for circuit block A
017 171	Tube for circuit block B
017 172	Tube for setting lever spring
017 192	Tube for third wheel bridge screw B
017 936	Eccentric dial pin
☆SEIKO SB-DK ☆SEIKO TR721SW	Silver peroxide battery

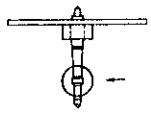
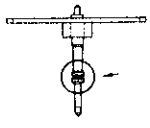
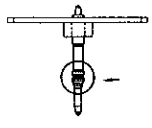
☆ ⇨ Please see remarks on the reverse page.
Part numbers in light letters are not shown in photos.

Cal. 5931A

Remarks :

Fourth wheel & pinion, Center minute wheel with cannon pinion, Hour wheel.
There are two different types as specified below.

Combination :

Type	Fourth wheel & pinion		Center minute wheel with cannon pinion	Hour wheel
a				Silver 
	☆241 492		☆270 490	☆271 491
b				Gold 
	☆241 495	☆241 495	☆270 494	☆271 493

Third wheel & pinion, Fourth wheel & pinion, Center minute wheel with cannon pinion, Fifth wheel & pinion and Crystal unit cushion.

☆231 490
☆241 492
☆270 490
☆701 490
☆4446 490
……The cogwheels designated by the same parts number may have different type of surfaces, but these cogwheels can be used in common.

Winding stem……Refer to the photograph on the front page.

☆354 494……Short winding stem
☆354 496……Long winding stem

If the combination of the winding stem and case is unknown, check the case number and refer to **"SEIKO Quartz Casing Parts List"** to choose a corresponding winding stem.

Battery

☆SEIKO SB-DK
☆SEIKO TR721SW
-----The applied battery for this calibre might be added the substitutive in the future. In that case, please refer to separate **"BATTERIES FOR SEIKO QUARTZ WATCHES".**

Anti-magnetic shield plate

There are two types of watches; one those with anti-magnetic shield plates and those without. However, it is not necessary to assemble the anti-magnetic shield plate or replace it with a new one when watches of Cal. 59 series are repaired.

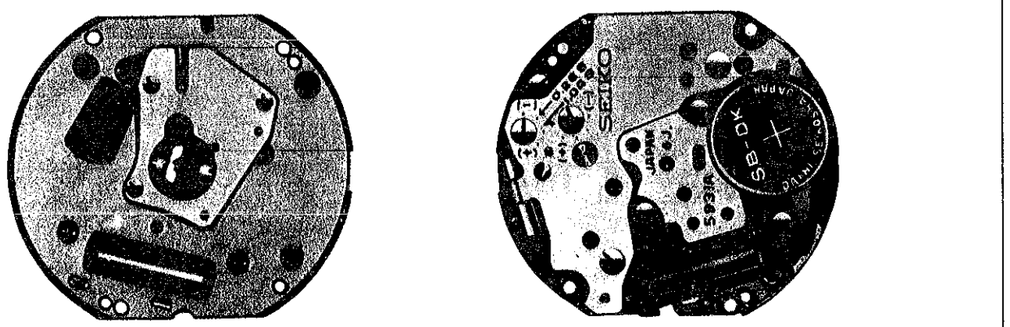
79. 7 Printed in Japan

TECHNICAL GUIDE

SEIKO

QUARTZ

CAL. 5931 A



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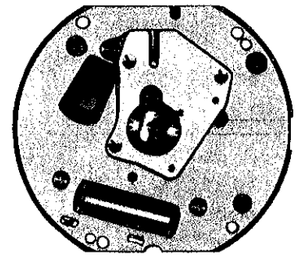
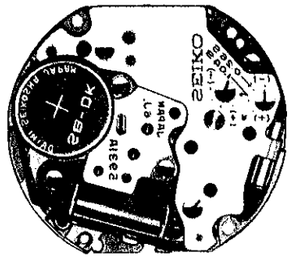
Cal. 5931A





Movement

I. SPECIFICATIONS AND FEATURES

1. Specifications

Item	Calibre No. 5931A
Time indication	Hour, minute and second hands
Additional mechanism	Second setting device (stops at every second) Battery life indicator Electronic circuit reset switch
Crystal oscillator	32,768 Hz (Hz = Hertz . . . . . Cycle per second)
Loss/gain	Loss/gain at normal temperature range Monthly rate : less than 15 seconds (Annual rate : less than 3 minutes)
Casing diameter	ϕ22.0 mm (20.0 mm between 3 o'clock and 9 o'clock sides)
Height	1.9 mm without battery
Operational temperature range	$-10^{\circ}C \sim +60^{\circ}C$ ($14^{\circ}F \sim 140^{\circ}F$)
Driving system	Step motor system (2 poles)
Regulation system	Rotary step switch
Battery power	Silver oxide battery SEIKO TR721SW or SB-DK Battery life is approximately 2 years. Voltage: 1.55V
Jewels	6 jewels

2. Features

(1) Cal. 5931A is an ultra-thin watch whose movement is 1.9mm thick. It has high reliability and is easy to disassemble and reassemble.

(2) The new technology (load-compensated drive pulse system) used in Cal. 5931A's electronic circuit block reduces current consumption, and this permits the ultra-thin battery (2.1mm thick) to be used for the watch. The battery life is approximately 2 years.

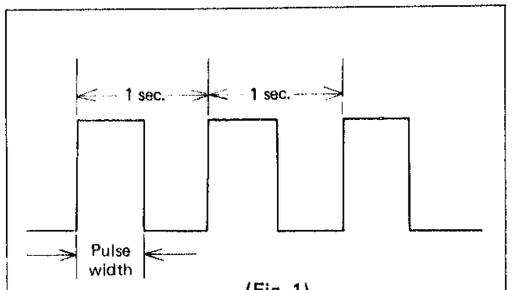
(3) As an adjustable frequency divider circuit is used in the electronic circuit block, a time adjustment is made by turning the rotary step switches instead of the conventional trimmer condenser.

3. Load-compensated drive pulse system for step motor (A special current-saving motor drive circuit)

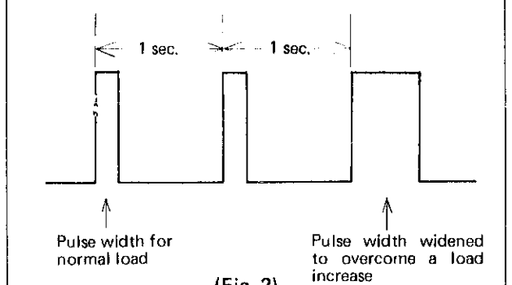
- In the ordinary quartz watch, the drive pulses supplied from the electronic circuit to the step motor have been constant in width. (See Fig. 1)

- In Cal. 5931A, the width of drive pulse is changed automatically to meet the power (load) required to drive the movement.
  Under normal conditions, the width of each pulse is narrowed to a minimum required for driving the step rotor. But when the load increases to feed the calendar or at the time of low temperatures, the pulse width is automatically widened and enough torque is provided to overcome the load increase. (See Fig. 2)

- In this way, the step rotor runs on a minimum necessary pulse width (minimum current), and thus the current consumption is greatly reduced.
  (For the measurement of current consumption, refer to "CHECK CURRENT CONSUMPTION" on page 18.)



(Fig. 1)



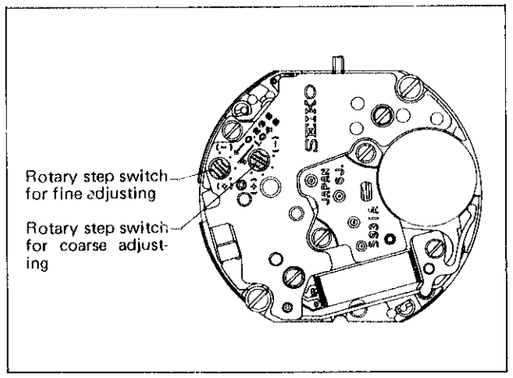
(Fig. 2)

4. Rotary step switch (Adjustable frequency divider circuit)

- In the ordinary quartz watch, the trimmer condenser is adjusted to control the gain or loss. The output frequency of the frequency divider circuit is not changed but the frequency of the oscillator circuit is changed to adjust the gain or loss of the watch. And this system saves current consumption and at the same time keeps the oscillator circuit in the best condition all the time, thus contributing to the stabilization of watch performance.

- In Cal. 5931A, however, the frequency of the oscillator circuit is held intact, and the adjustable frequency countdown system is employed in which a couple of rotary step switches are used to change the output frequency of the frequency divider circuit for time adjustment. Also, the movement is made thinner by the use of the rotary step switches than it would be when the trimmer condenser is used.

- One rotary step switch is for coarse adjustment of 1.04 sec. per step, and the other for fine adjustment of 0.26 sec. per step. Each switch has four steps and thus the gain or loss can be controlled in sixteen steps (4 steps x 4 steps).

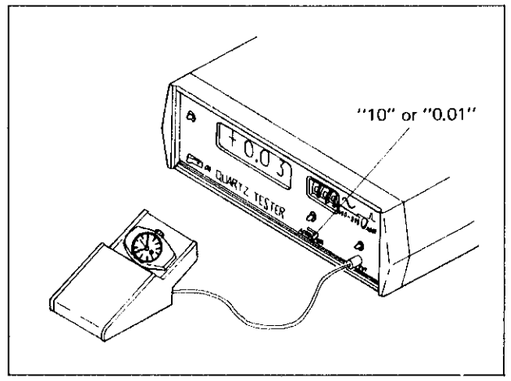


- **Time accuracy adjusting**

Procedures for time accuracy adjusting by the rotary step switches are different from those by the trimmer condenser. For time accuracy adjusting of Cal. 5931A, follow the procedures below.

(1) Remarks for time adjusting

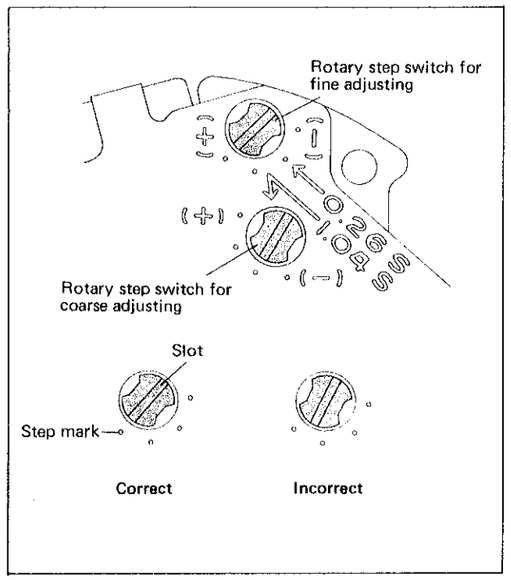
- Check time accuracy with the Quartz Tester. Be sure to set the measuring time selection switch at "10" or "0.01". At any other position, the measured value is false.
- Do not use the Ultrasonic microphone (US-32). If the Ultrasonic microphone is used, the measured value is false.



(2) Procedures for time adjusting

Turn the rotary step switches and adjust.

- Every 1-step turn of the rotary switch for coarse adjusting will change the daily rate by about 1.04 sec.
- Every 1-step turn of the rotary switch for fine adjusting will change the daily rate by about 0.26 sec.
  (The watch will gain by turning the switches clockwise and lose by turning the switches counterclockwise.)
- Turn the rotary step switches to bring the daily rate as close to 0 sec. as possible.
- When turning the rotary switches, bring the slot in each switch in line with the center of a step mark.
- After having turned the rotary step switches, be sure to check the time accuracy of the watch with the Quartz Tester.



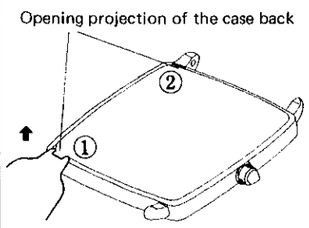
II. DISASSEMBLING AND REASSEMBLING OF THE CASE

Disassembling procedures Figs.: ① ~ ⑨

Reassembling procedures Figs.: ⑨ ~ ①

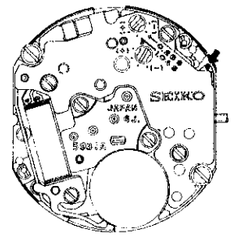
Lubricating: Silicone grease (500,000 c.s.), normal quantity

- **How to disassemble the case back**

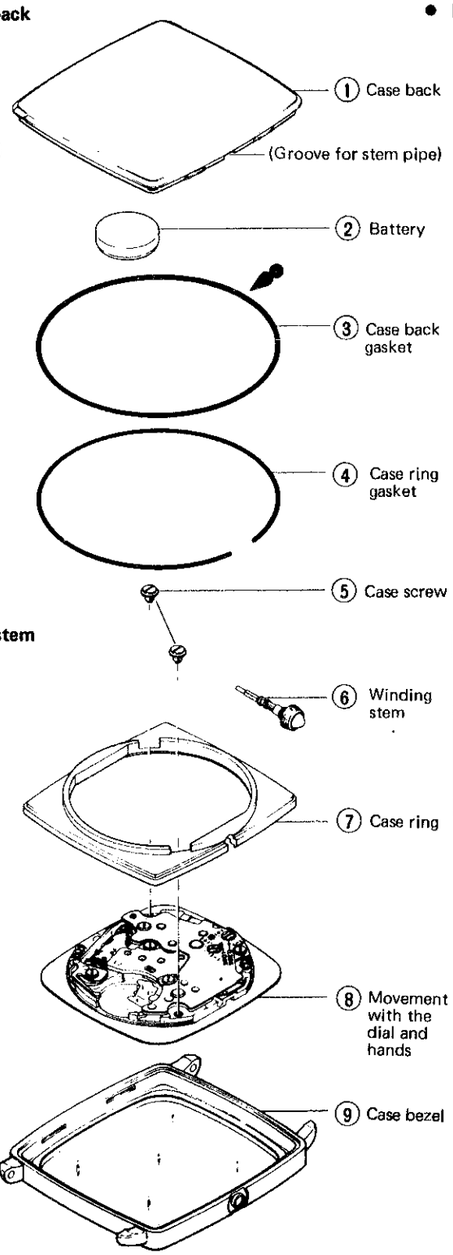


Pry up the case back by using the opening projection ① and then ②. Then push the case back toward the winding stem for disassembling.

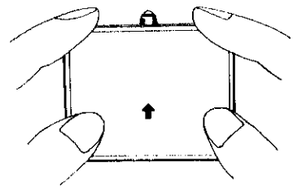
- **How to pull out the winding stem**



With the crown pushed in, push the arrow-marked portion of the setting lever and pull out the winding stem.

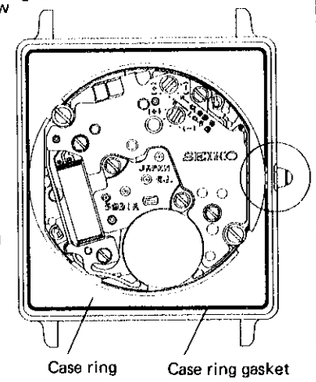


- **How to reassemble the case back**



- Be sure that the battery is set firmly in the movement.
- The case back has two projections that fit into the casebezel, one on the winding stem side and the other on the 9 o'clock side. First set the projection on the winding stem side in the casebezel and push the case back toward the winding stem for reassembling. Be careful not to push the glass.

Position for setting the case ring gasket



Set the case ring gasket so that the cut portion comes to the winding stem portion.

III. DISASSEMBLING, REASSEMBLING AND LUBRICATING

Disassembling procedures Figs. : ① ~ ㉛

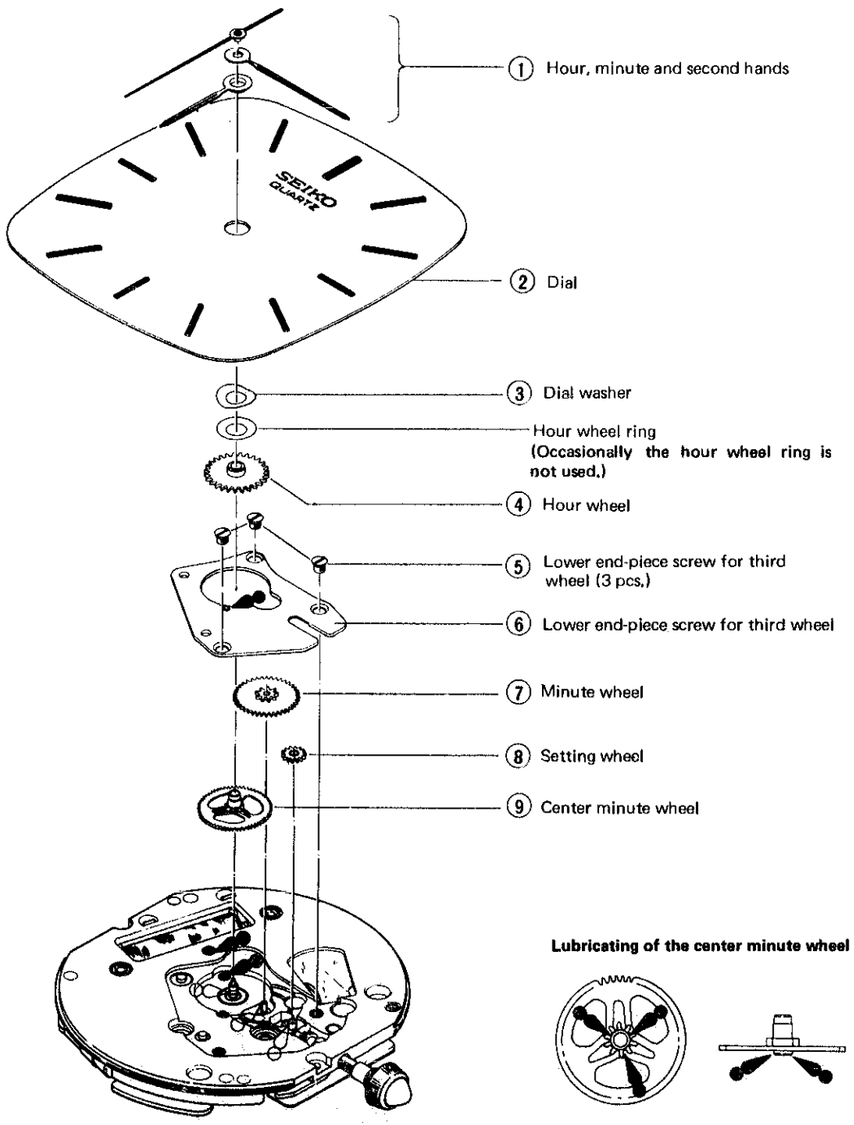
Reassembling procedures Figs. : ㉛ ~ ①

- **Lubricating**

Types of oil	Oil quantity
Moebius A	Liberal quantity
SEIKO Watch Oil, S-6	Normal quantity
	Extremely small quantity

- Use the movement holder S-666.

1. Indicating mechanism

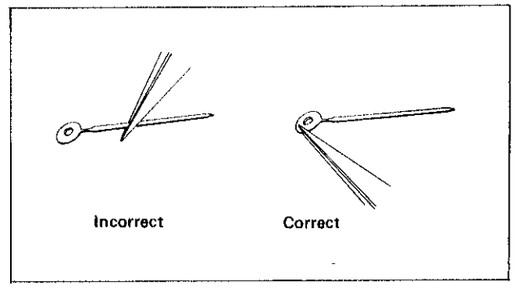


Lubricating of the center minute wheel

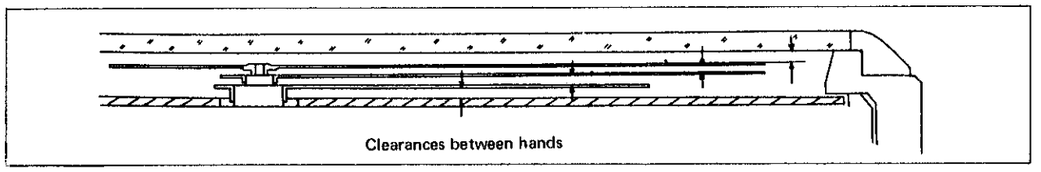
Remarks for disassembling and reassembling

① Hour, minute and second hands

1. The hands have only a little clearance between them. Be careful not to damage them when disassembling.
2. The hands are very thin. Be careful not to scratch or damage them when handling with tweezers.
3. If the hands are bent, correct the bend with tweezers after wrapping each of them in a vinyl sheet to protect them from damage and scratches by the tweezers.

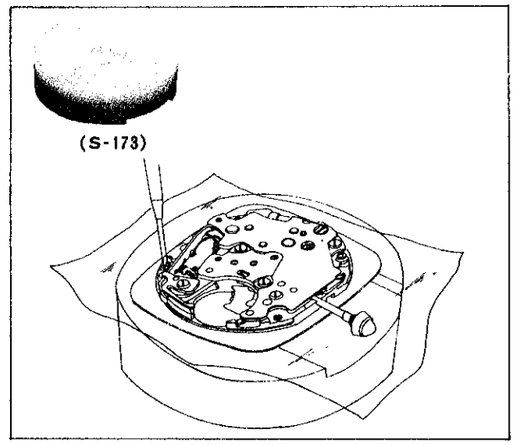


4. After the hands have been reassembled, turn them clockwise and counterclockwise to check to see if the hands do not touch each other and that the hour hand does not touch the dial.
Make these checks at more than four points (Ex. between 12 o'clock and 6 o'clock sides, and between 3 o'clock and 9 o'clock sides).



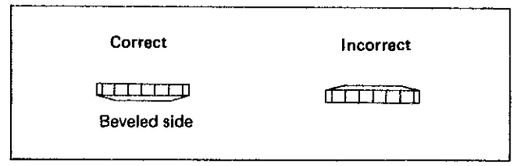
② Dial

As the dial is very thin, it is necessary to prevent it from being bent at its center when reassembling. Cover the inserting disk (S-173) used for digital watches with two or three pieces of vinyl sheet. Then put the dial with movement on it and turn the eccentric dial pin with a screwdriver for disassembling and reassembling the dial.

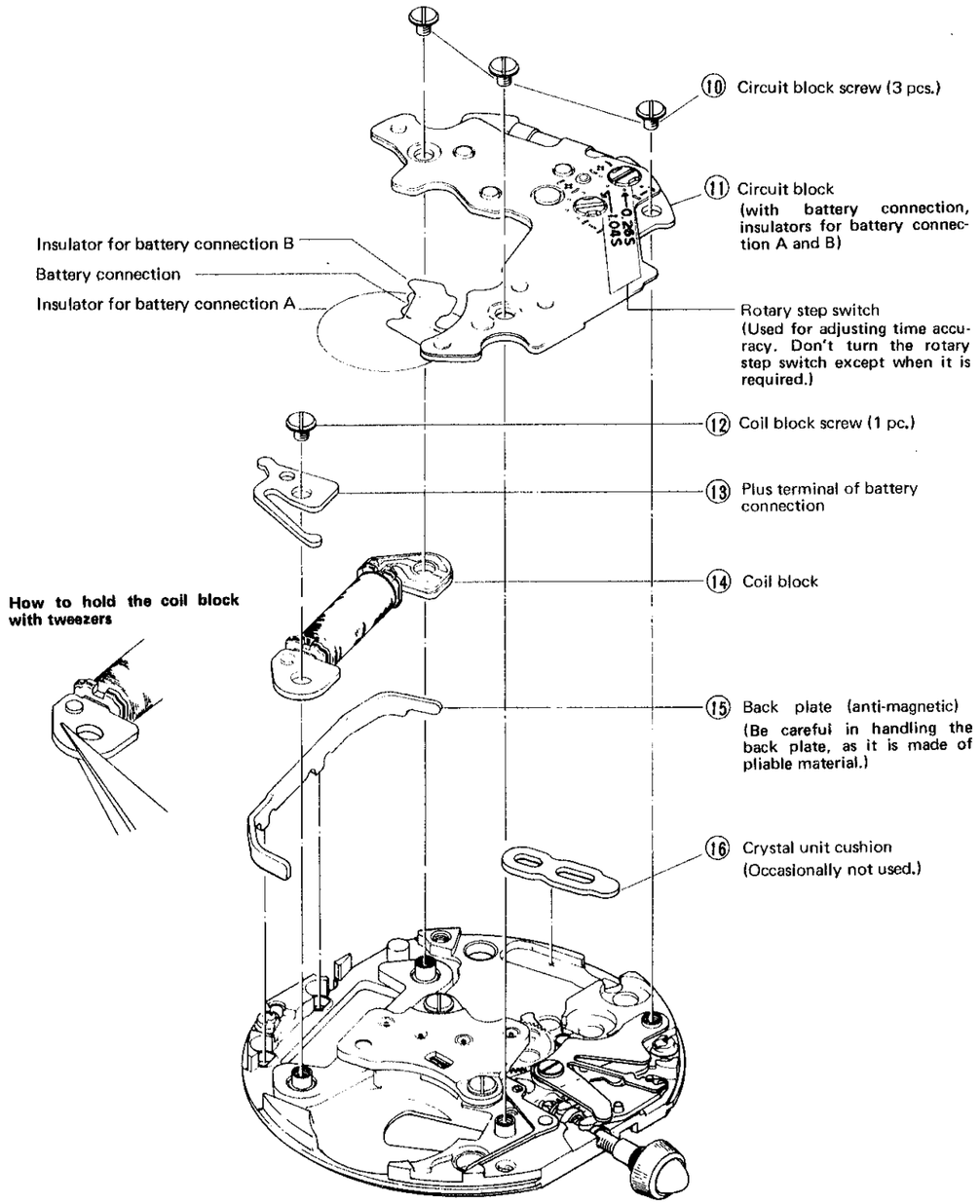


⑧ Setting wheel

Set the setting wheel with its beveled side down.



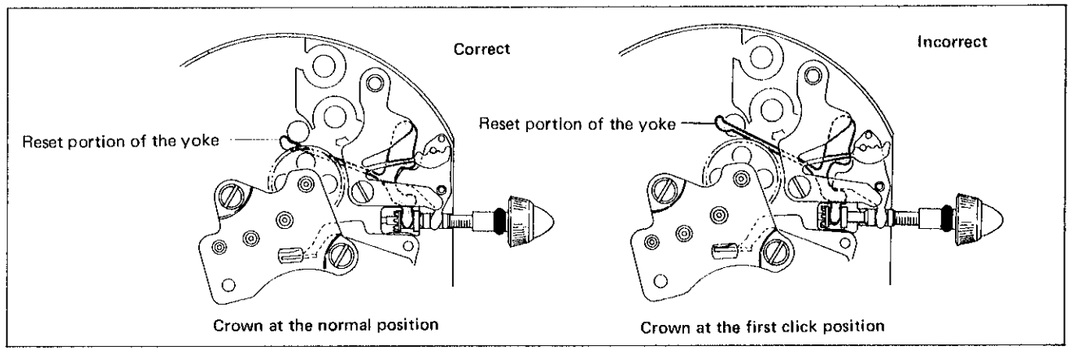
2. Electronic circuit



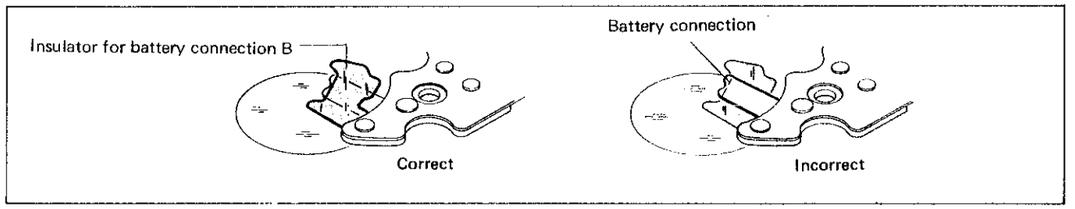
Remarks for disassembling and reassembling

⑪ Circuit block

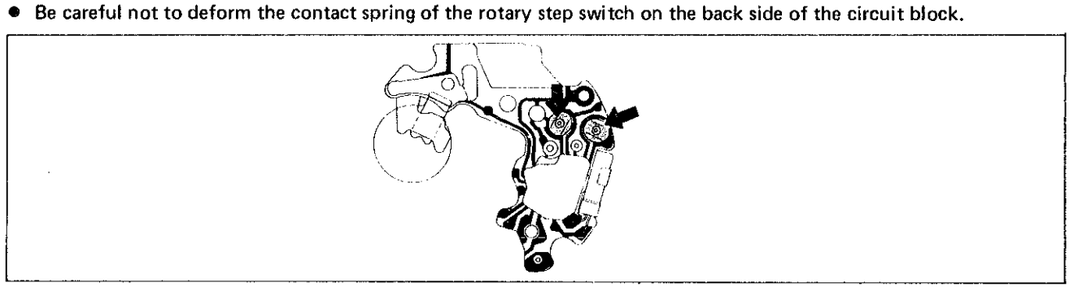
- With the crown in the normal position, detach the reset portion of the yoke from the reset pin and reassemble and disassemble the circuit block.



- Be sure that the battery connection is over the insulator for battery connection B of the circuit block.

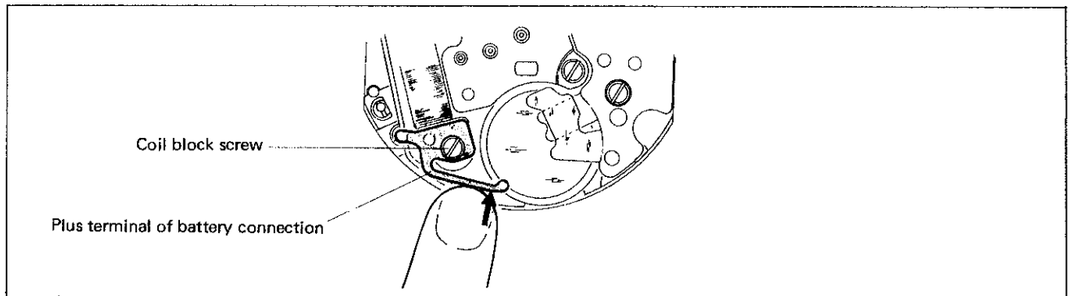


- Be careful not to deform the contact spring of the rotary step switch on the back side of the circuit block.

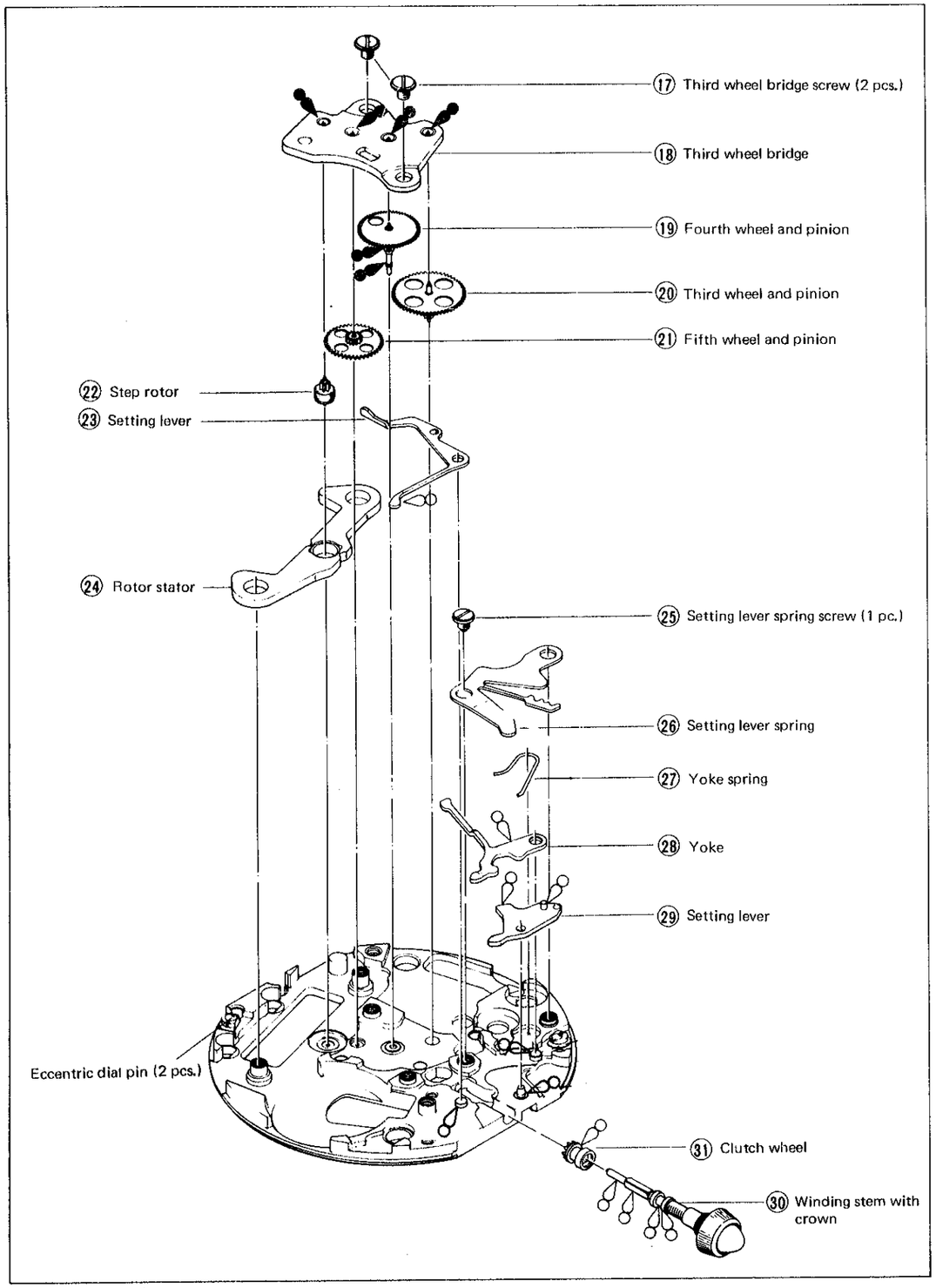


⑬ Plus terminal of battery connection

- Be sure to tighten the screw for the plus terminal of battery connection while pushing the arrow-marked tip of the plus terminal of battery connection toward the movement.

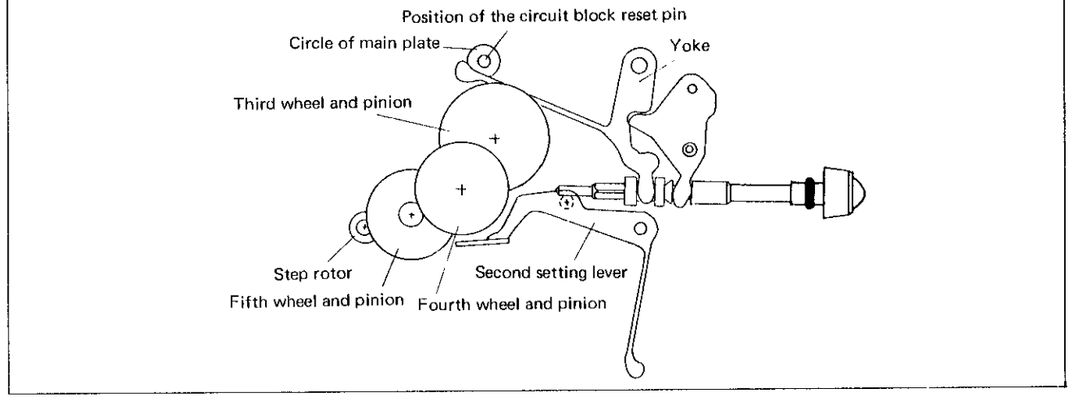


3. Gear train and setting mechanism



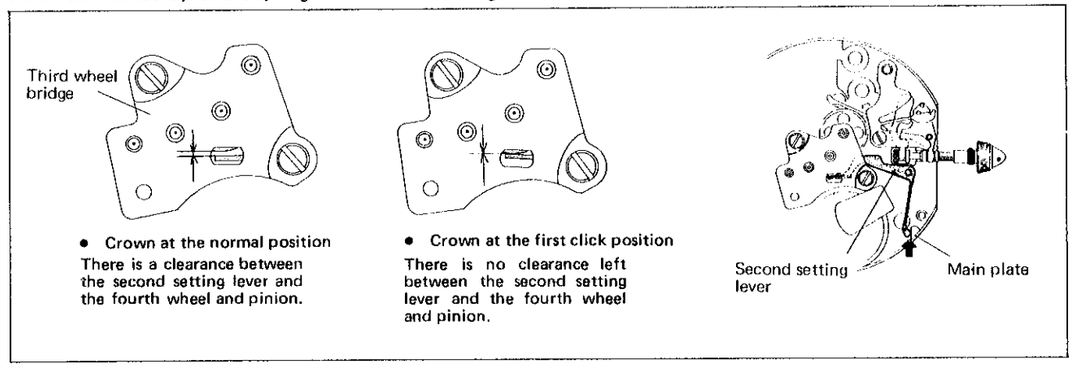
Remarks for disassembling and reassembling

- Positions of the gear train and the second setting lever



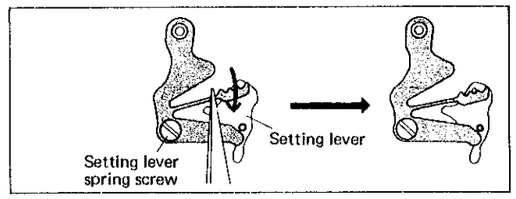
㉓ Second setting lever

Through the oval hole on the third wheel bridge, check to see if the second setting lever functions correctly and if the arrow-marked tip of the spring of the second setting lever is fixed to the main plate.



㉖ Setting lever spring

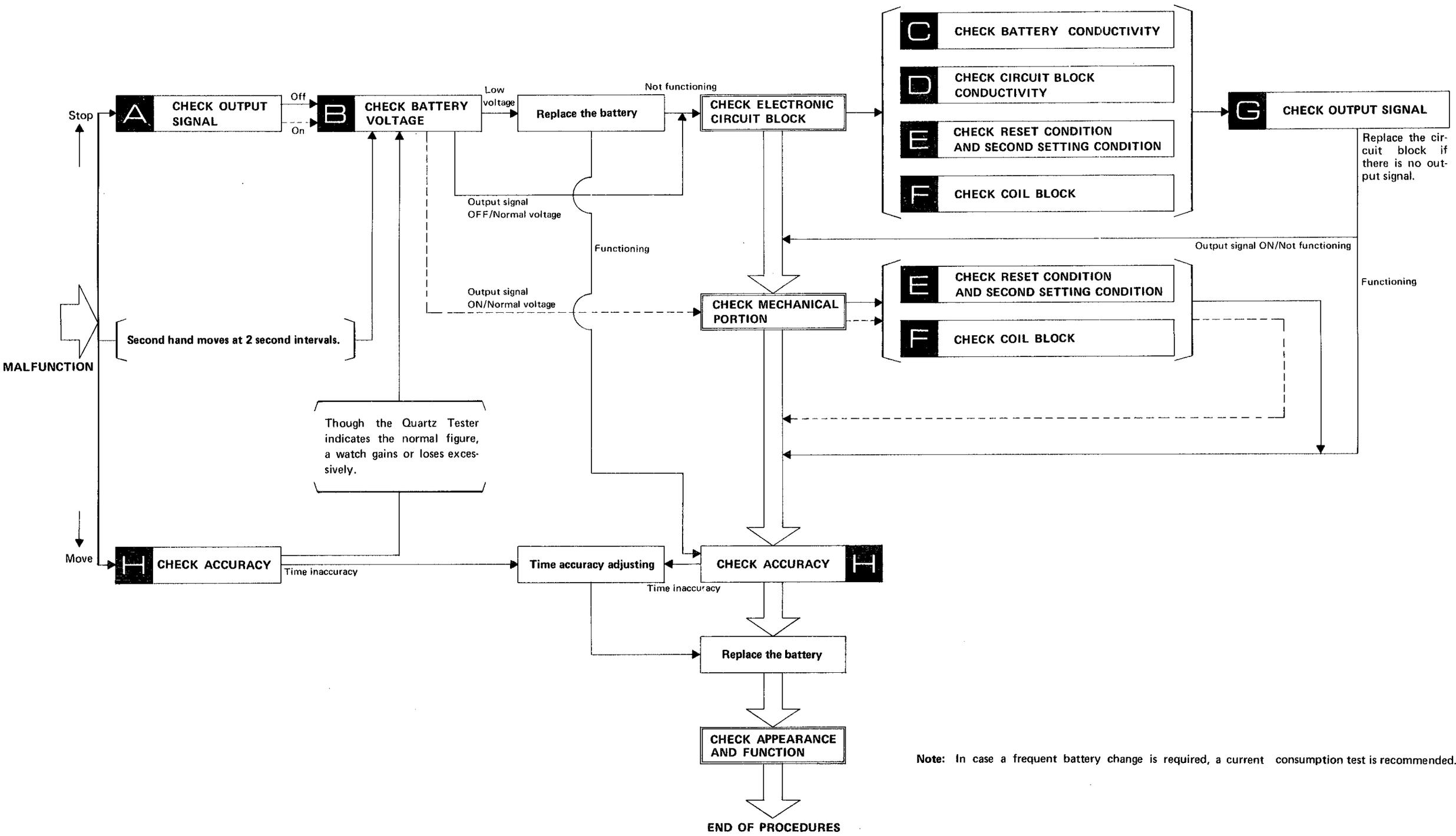
- **How to reassemble**
  With the crown at the normal position, tighten the setting lever spring screw. Then fix the setting lever spring to the post on the setting lever with tweezers.



- **List of screws used**

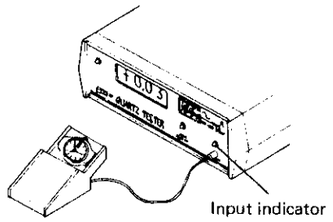
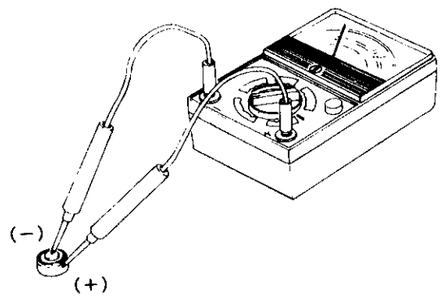
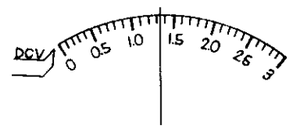
 • Third wheel bridge screw • Circuit block screw • Coil block screw	 • Case screw.	 • Lower end-piece screw for third wheel	 • Setting lever spring screw
6 pcs.	2 pcs.	3 pcs.	1 pc.

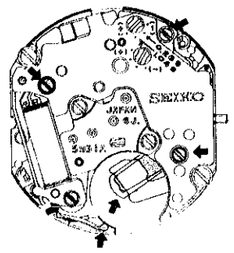
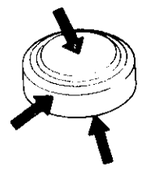
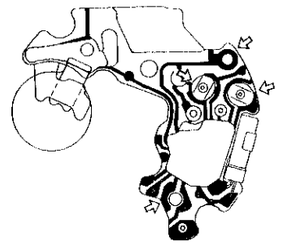
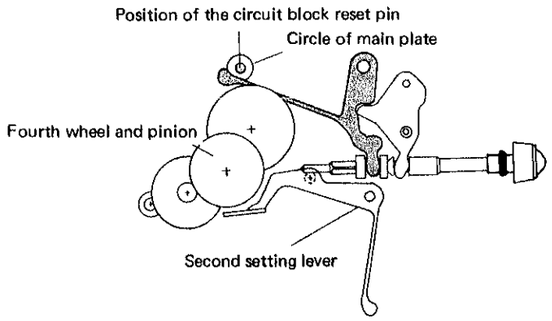
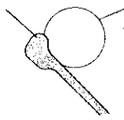
Guide table for checking and adjustment

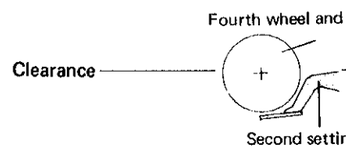


Note: In case a frequent battery change is required, a current consumption test is recommended.

2. Procedures for checking and adjustment

	Procedures	Result	Adjustment and Repair
A CHECK OUTPUT SIGNAL	Check output signal. (1) Set up the Quartz Tester.  (2) Checking Check for blinking input indicator. **Note:** • Check output signal with the crown pushed in to the normal position. • Set the range at 10 or 0.01. • Don't use the Ultrasonic microphone (US-32).	One-second blinking ——— Normal No one-second blinking ——— Defective →	Proceed to B.
B CHECK BATTERY VOLTAGE	Check battery voltage. (1) Set up the Volt-ohm-meter. Range to be used: DC3V  (2) Measuring • Probe Red (+) . . . . . Battery surface (+) • Probe Black (−) . . . . . Battery surface (−) **Note:** When handling the battery, use non-metallic tweezers or fingercots.	More than 1.5V ——— Normal → Less than 1.5V ——— Defective →  	Proceed to Check mechanical portion if one-second blinking is found. Proceed to Check electronic circuit block if one-second blinking is not found. Proceed to Replace the battery. • If the watch operates after battery replacement, proceed to I. • If the watch does not operate after battery replacement, proceed to Check electronic circuit block.
HOW TO CHECK BATTERY ELECTROLYTE LEAKAGE AND REPAIR	(1) Disassemble the movement. (2) Wipe off battery electrolyte on the circuit block. 1. Wipe off battery electrolyte with a cloth moistened with distilled water. (If distilled water is not available, use tap water.) 2. Rinse with alcohol. (If the cleaned portions remain wet with water, they will corrode with rust.) 3. Dry with warm air by using a dryer.	(3) Wipe off battery electrolyte on the other parts by following the cleaning procedures. (4) Reassemble the movement. (Replace the battery with a new one.) (5) Check to see if the watch functions and the current consumption is normal.	

	Procedure	Result	Adjustment and Repair
C CHECK BATTERY CONDUCTIVITY	Check to see if the battery current flow to the circuit is normal. (1) Check to see if the circuit block screws are tightened firmly. (2) Check for any foreign matter on the connecting portions of the battery, the battery connection and the plus terminal of battery connection.  	No loosened screw — Normal →	Proceed to D (2).
		Loosened screw — Defective →	Retighten the screw.
		Uncontaminated — Normal →	Proceed to D.
		Contaminated — Defective →	Wipe off any foreign matter.
D CHECK CIRCUIT BLOCK CONDUCTIVITY	Check for any defective conductivity of the conductive portions of the circuit block. (1) Check to see if the circuit block screws (3 pcs.) are tightened firmly. (2) Check for any defective conductivity of the conductive portions of the circuit block such as break in the welded portion, short circuit, etc. 	No loosened screw — Normal →	Proceed to D (2).
		Loosened screw — Defective →	Retighten the screw.
		No defective conductivity — Normal →	Proceed to E.
		Defective conductivity — Defective →	Wipe off any foreign matter or replace the circuit block with a new one.
E CHECK RESET CONDITION AND SECOND SETTING CONDITION	Check to see if the reset condition and the second setting condition are normal. (1) Check to see if the second hand stops immediately when the crown is pulled out to the first click and if it starts promptly one second after the crown is pushed in to the normal position. (Check output signal by using a Quartz Tester or check with the second hand reassembled.) (2) Check to see if there is clearance between the reset portion of the yoke and the circuit block reset pin. (Check with the circuit block disassembled. Position the reset pin by using the position of the circle of the main plate as a guide. (See illustration below.))  1. Check with the crown at the normal position. 2. Check with the crown at the first click position.	Stops completely and starts moving after one second. — Normal →	Proceed to F.
		Does not stop or move irregularly. — Defective →	Proceed to E (2).
		The reset portion is located at the outer circumference of the main plate. — Normal → 	Proceed to E (2)2.
		The reset portion is located at the center of the circle of the main plate. — Defective → 	Replace the yoke.
		The reset portion is located at the center of the circle of the main plate. — Normal → 	Proceed to E (3).
		The reset portion is located at the outer circumference of the circle of the main plate. — Defective → 	Replace the yoke.

	Procedure	Result	Adjustment and Repair
E CHECK RESET CONDITION AND SECOND SETTING CONDITION	(3) Check to see if there is clearance between the second setting portion of the second setting lever and the fourth wheel and pinion. (Check with the circuit block disassembled.) 1. Check with the crown at the normal position.	 Clearance — Normal →	Proceed to E (3)2.
		No clearance — Defective →	Replace the second setting lever.
		No clearance — Normal →	Proceed to F.
	2. Check with the crown at the first click position.	Clearance — Defective →	Replace the second setting lever.
F CHECK COIL BLOCK	Check for broken coil wire and short circuit of the coil block. (1) Set up the Volt-ohm-meter. Range to be used: OHMS R x 100 (2) Checking Apply the red and black probes of the Volt-ohm-meter to the two coil lead terminals. (Either red or black probe will do.)	2.0KΩ ~ 4.0KΩ — Normal →	Proceed to G.
		Less than 2.0KΩ (Short circuit) More than 4.0KΩ (Broken coil wire) — Defective →	Replace the coil block.
G CHECK OUTPUT SIGNAL	Check for output signal. (1) Set up the Quartz Tester. (2) Checking Follow the same procedures as in A.	One-second blinking — Functioning — Normal →	Proceed to H.
		One-second blinking — Not functioning — Defective →	Proceed to Check mechanical portion.
		No one-second blinking — Defective →	Replace the circuit block.
H CHECK ACCURACY	Check gain and loss of time. (1) Set up the Quartz Tester. (2) Checking Follow the same procedures as in A.	— Normal →	Replace the battery.
		— Defective →	Adjust time accuracy by referring to the time accuracy adjusting procedures on page 3.

CHECK CURRENT CONSUMPTION

In case a frequent battery change is required, a current consumption test is recommended.

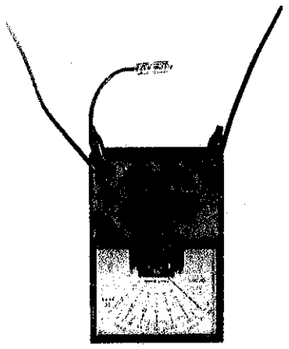
Procedure

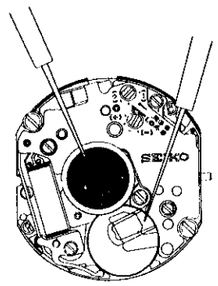
1. Set up the Volt-ohm-meter.
   Range to be used: DC12μA (DC 0.03mA)

2. Set up the condenser kit of 200 ~ 500 μF as shown in the photo.

3. Place the battery on the third wheel bridge with its minus side up.

4. Measuring
   Probe Red (+) ..... Battery connection
   Probe Black (–) ..... Battery surface (–)





When the current consumption is measured, the movement should not be under an extra load (ex. in a date changing condition).
While applying the probes, pull out the crown two or three times so that the movement may be in a reset condition, and then measure the current consumption.

5. Result
   Less than 1.3 μA ..... Normal
   More than 1.3 μA ..... Proceed to Check electronic circuit block.

Note: If the pointer of the Volt-ohm-meter swings over the maximum value when DC12μA or 0.03mA is used, change the range to a greater one (Ex. DC30mA) where the pointer does not run over the maximum value while applying the probes to the respective portions. Then, after two or three seconds, return the range to DC12μA or 0.03mA again for measuring.

All procedures of Disassembling, Reassembling, Checking and Adjustment are completed.