



TECHNICAL BULLETIN

BASIC MODEL SEIKO 3302A

This movement has been used extensively by Westclox (D-909) and Sears, as well as other watch companies. Because so many of these watches were sold in this country, this has been one of the most requested technical bulletins from watchmakers. We had originally planned to include this bulletin with membership renewal materials this year, but because of its length, we find it more economical to mail it to each member as part of the AWI News.

1. Specifications and Features

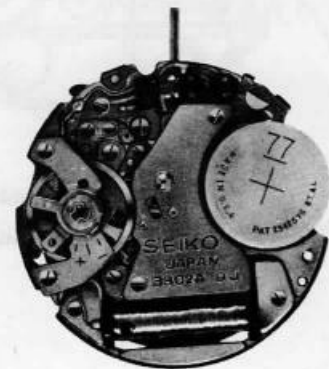
1) Specifications

Casing diameter	: 28.0 mm
Height	: 5.5 mm
Vibrations per hour	: 21,600
Driving system	: Contact point type, pallet-driven system (one-side drive)
Attached mechanism	: Second setting and power supply switch Calendar (Push-type date corrector)
Power cell	: Small silver oxide power cell (EVEREADY EPX-77)
Capacity	: 165 mAH
Voltage	: 1.5V
Size	: 11.6 ϕ mm x 5.6mm

2) Features

This pallet-driven power cell watch is designed to effect a very weak current flow at contact points through electronic circuits. Its service life is longer than that of conventional contact-point-type power cell watches and troubles seldom occur. Features of this watch include the following:

- 1) Driven by only one side of the pallet, power consumption is small. Service life of the power cell is extended over one year.
- 2) The power cell can be replaced very easily by opening the power cell lid. This case design facilitates after-servicing.
- 3) The contact points are made of a special kind of metal and a very weak current flows at the contact points through the integrated block. Service life of the contact points has been extended through these devices.
- 4) The integrated block portion can be replaced easily.
- 5) By the new second setting device, stabilized amplitude of the balance is obtainable from the very start of operation. It also performs the role of a power supply switch.



Movement

3302A Principles of Operation

1) Outline of operation

The sequence of operation of the pallet-driven system is shown in Fig. 1.1; composition of the movement is shown in Fig. 1.2.

When the crown is pushed back into its normal position, the second setting is released and the balance begins its operation. When the balance wheel rotates counterclockwise (as in Fig. 1.3), the contact point spring and the contact point make contact (ON) by the contact pin on the roller with jewel. Then the current flows on the coil and magnetizes the magnetic cores (A,B, and C), which repulses the permanent magnet of the pallet in the arrow direction and drives the pallet. In this case, the fork slot of the pallet imparts an impact to the roller jewel of the balance; at the same time, the pallet jewel drives the tooth of the escape wheel.

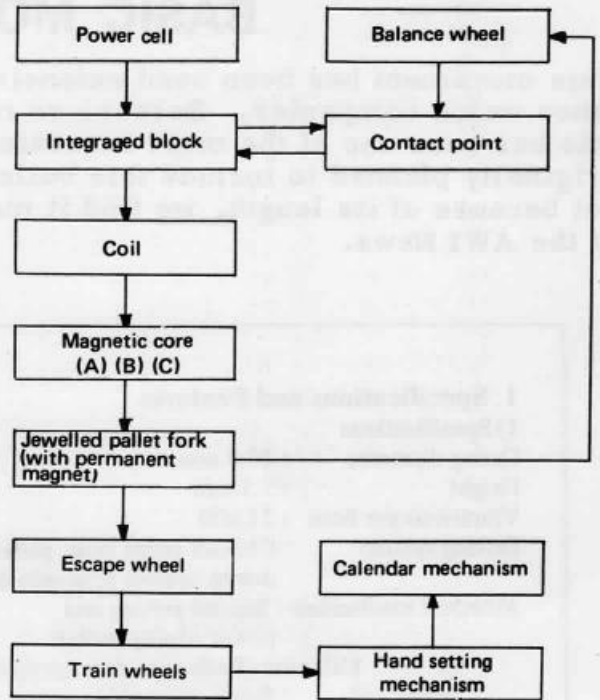


Fig. 1-1

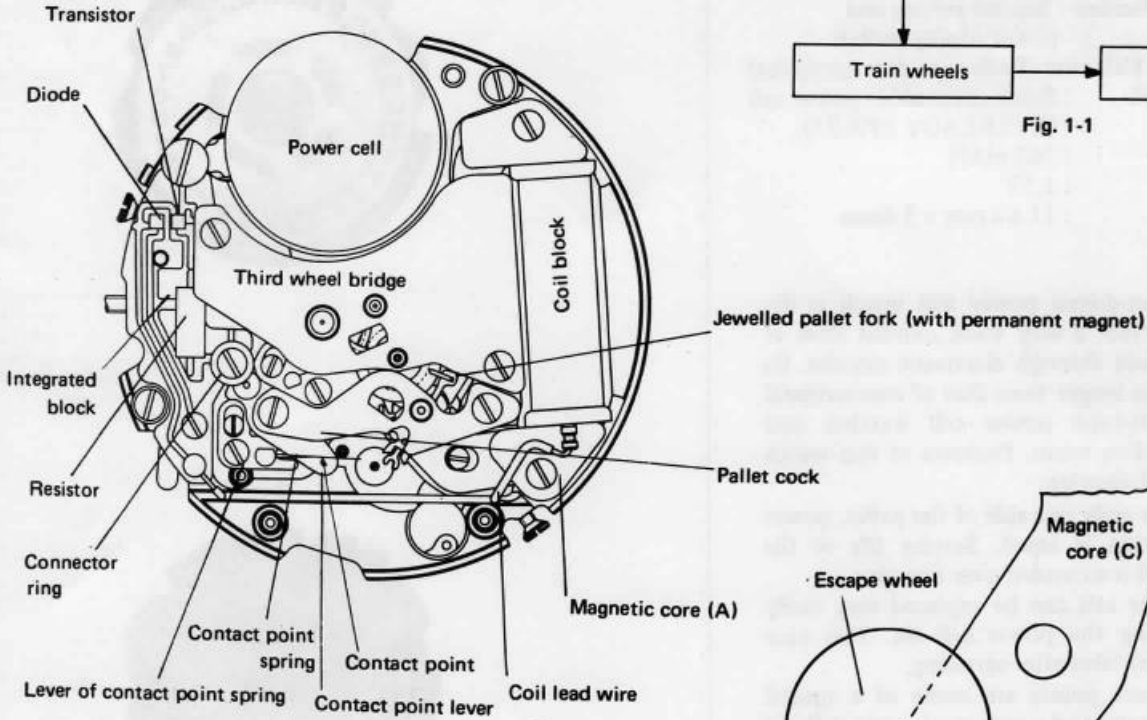


Fig. 1-2

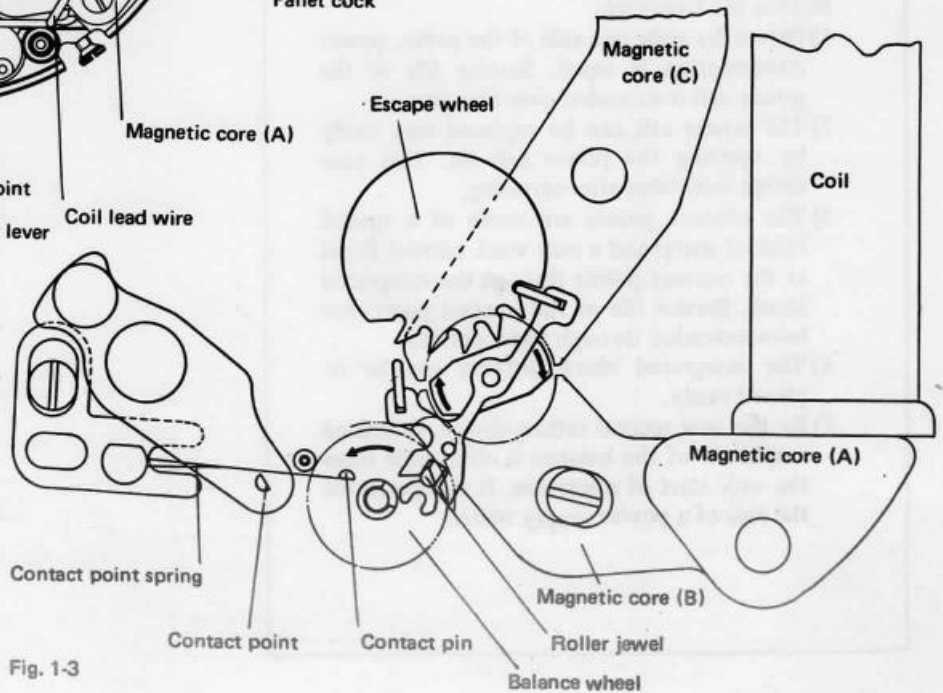


Fig. 1-3

3302A Principles of Operation

3) Pallet-driven mechanism

The power transmission system of this watch is different from that of conventional mechanical watches. Driving energy is transmitted from the pallet to the balance; at the same time, the tooth of the escape wheel & pinion is driven by the pallet jewels to move the train wheels. This is called a pallet driven mechanism. The following are the pallet driven processes:

- (1) When the pallet is standing still, the permanent magnet and magnetic cores B and C (which are usually not magnetized but will be magnetized only when power is fed to the coil) push the pallet to the entry pallet jewel or the exit pallet jewel's side and this one-side drawing revolving force performs "draw-safety-action." (Fig. 1.6)
- (2) When the balance rotates counterclockwise, and at the moment the roller jewel enters the fork slot of the pallet (as in Fig. 1.7), the contact point spring and the contact point make contact and the current flows on the coil, the magnetic cores A, B, and C are magnetized, and the pallet is driven in the arrow direction.
- (3) When the pallet is actuated, it imparts an impact to the roller jewel (as in Fig. 1.8), and rotates the balance; at the same time, the pallet jewel pushes the slope of the escape wheel's tooth and rotates the escape wheel.
The contact pin pushes the contact point spring aside (as in fig. 1.9).
- (4) When the balance rotates clockwise the pallet is driven in the reverse direction by elasticity of the hair spring, rotating the escape wheel (Fig. 1.10).

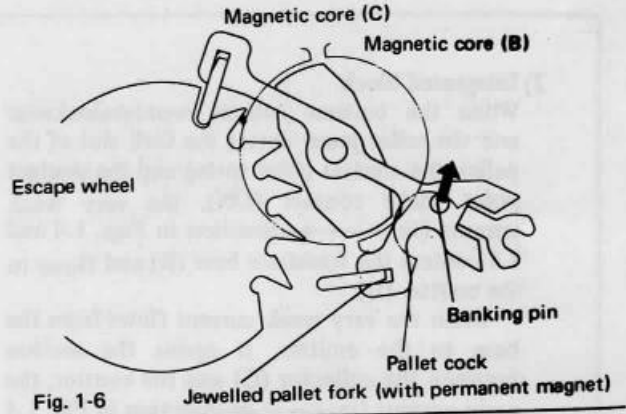


Fig. 1-6 Jewelled pallet fork (with permanent magnet)

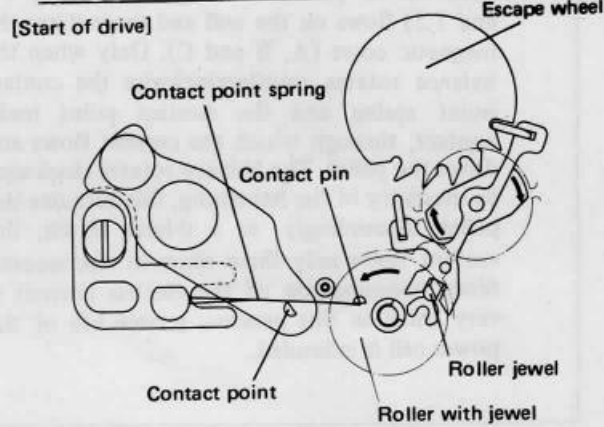


Fig. 1-7

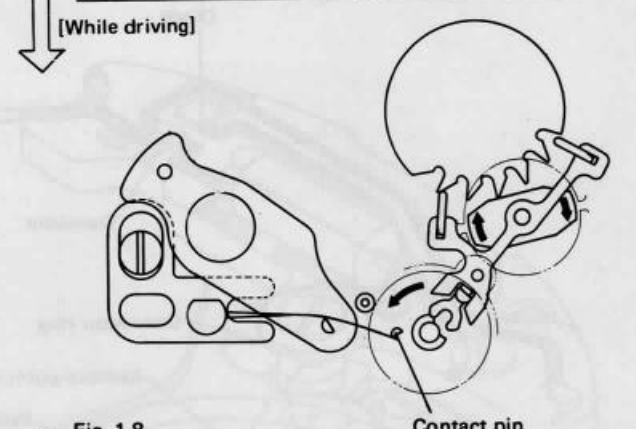


Fig. 1-8

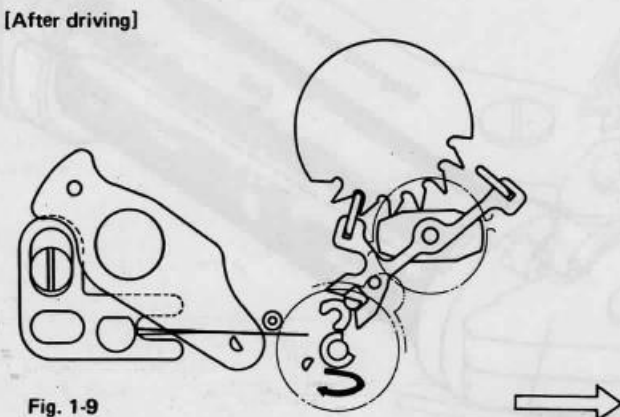


Fig. 1-9

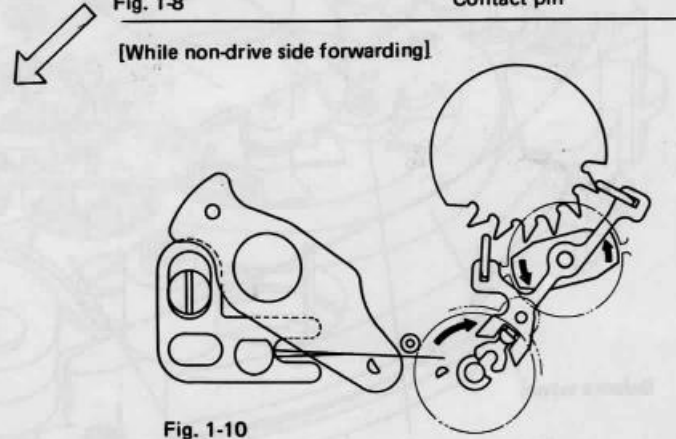


Fig. 1-10

3302A Principles of Operation

4) Retaining pawl mechanism

As shown in Fig. 1.11, the escape wheel & pinion is equipped with a click wheel.

When a reverse revolving force is exerted on the train wheel by impact, vibration, date driving, or hand setting while the watch is running, reverse rotation of the escape wheel & pinion is prevented by the click wheel assembled in the escape wheel and pinion and the retaining pawl.

5) Train wheels

Fig. 1.12 shows the train wheels

Although a conventional sweep second hand system is adopted for this watch, the driving force and the transmission direction are contrary to mechanical watches.

To prevent irregular movement of the second hand caused by impact, vibration, or other external force, a friction spring for sweep second pinion is adopted.

6) Second setting device concurrently with power supply switch

When the crown is pulled out, the projections of the balance wheel is linked with the balance stop lever spring by the balance stop lever (shown in Fig. 1.13) to set the second hand.

By leaving the crown drawn out while the watch is not in use, the contact point spring and the contact point do not make contact (OFF) and the balance is stopped. As a result, current does not flow and drain of the power cell is prevented.

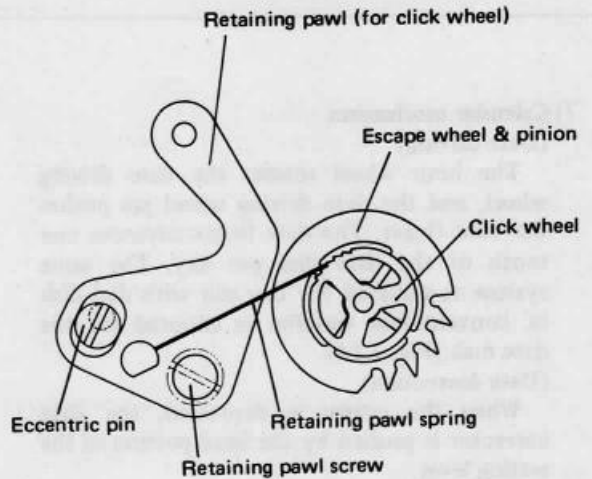


Fig. 1-11

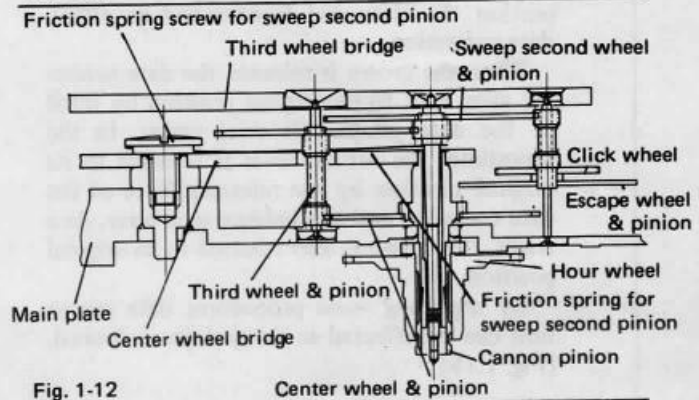


Fig. 1-12

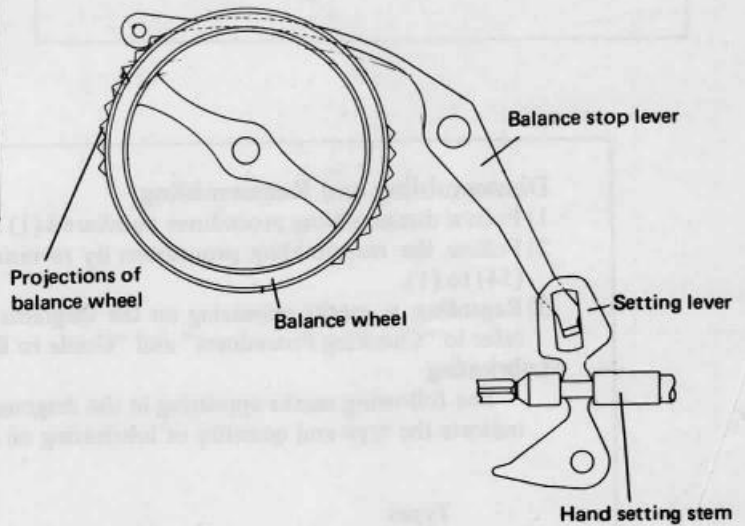
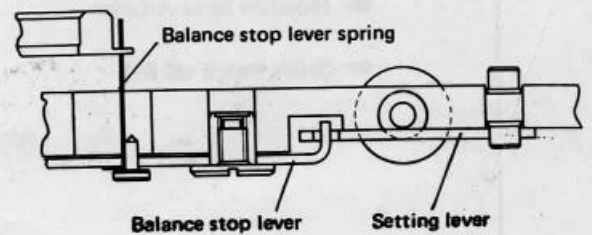


Fig. 1-13



3302A Principles of Operation

7) Calendar mechanism (Date driving)

The hour wheel rotates the date driving wheel, and the date driving wheel pin pushes the date finger. The date finger advances one tooth of the date dial per day. The same system as adopted for day star with dial disk of conventional watches is adopted for the date dial. (Fig. 1.14)

(Date correction)

When the crown is depressed, the date corrector is pushed by the head portion of the setting lever.

The A portion of the date corrector is bent upward (see Fig. 1.15), and through this bent portion the date dial is advanced to effect date correction.

When the crown is released the date corrector goes back to its original position by force of the date jumper (B side) spring. In the meantime, the setting lever is released to its original position by the releasing force of the date corrector and the balance stop lever. As a result, the crown is also released to its original position.

By repeating these procedures date correction can be effected as many days as desired. (Fig. 1.15)

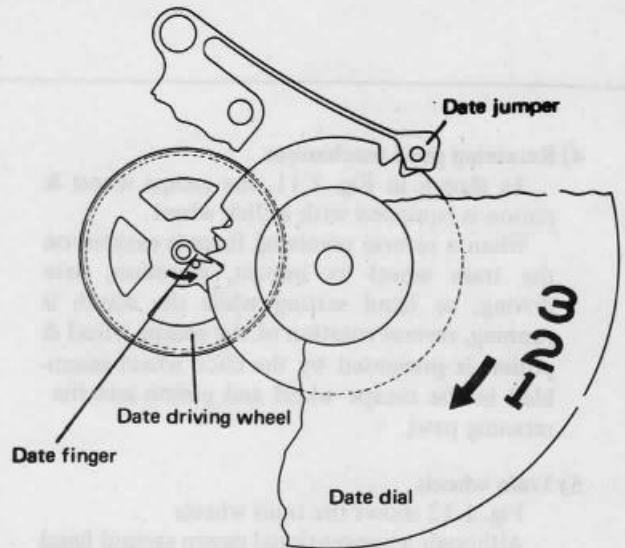


Fig. 1-14

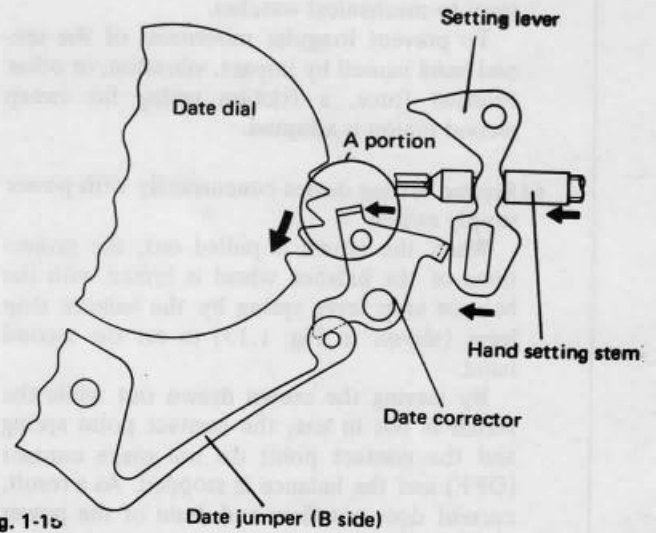


Fig. 1-15

Disassembling and Reassembling

- 1) Follow disassembling procedures numbered (1) to (54) in sequence.
- 2) Follow the reassembling procedures by reversing the disassembling procedures – that is, from (54) to (1).
- 3) Regarding ► marks appearing on the diagrams for disassembling and reassembling procedures, refer to “Checking Procedures” and “Guide to Repairs”.

Lubricating

The following marks appearing in the diagrams for disassembling and reassembling procedures indicate the type and quantity of lubricating oil and the machine parts to be lubricated:

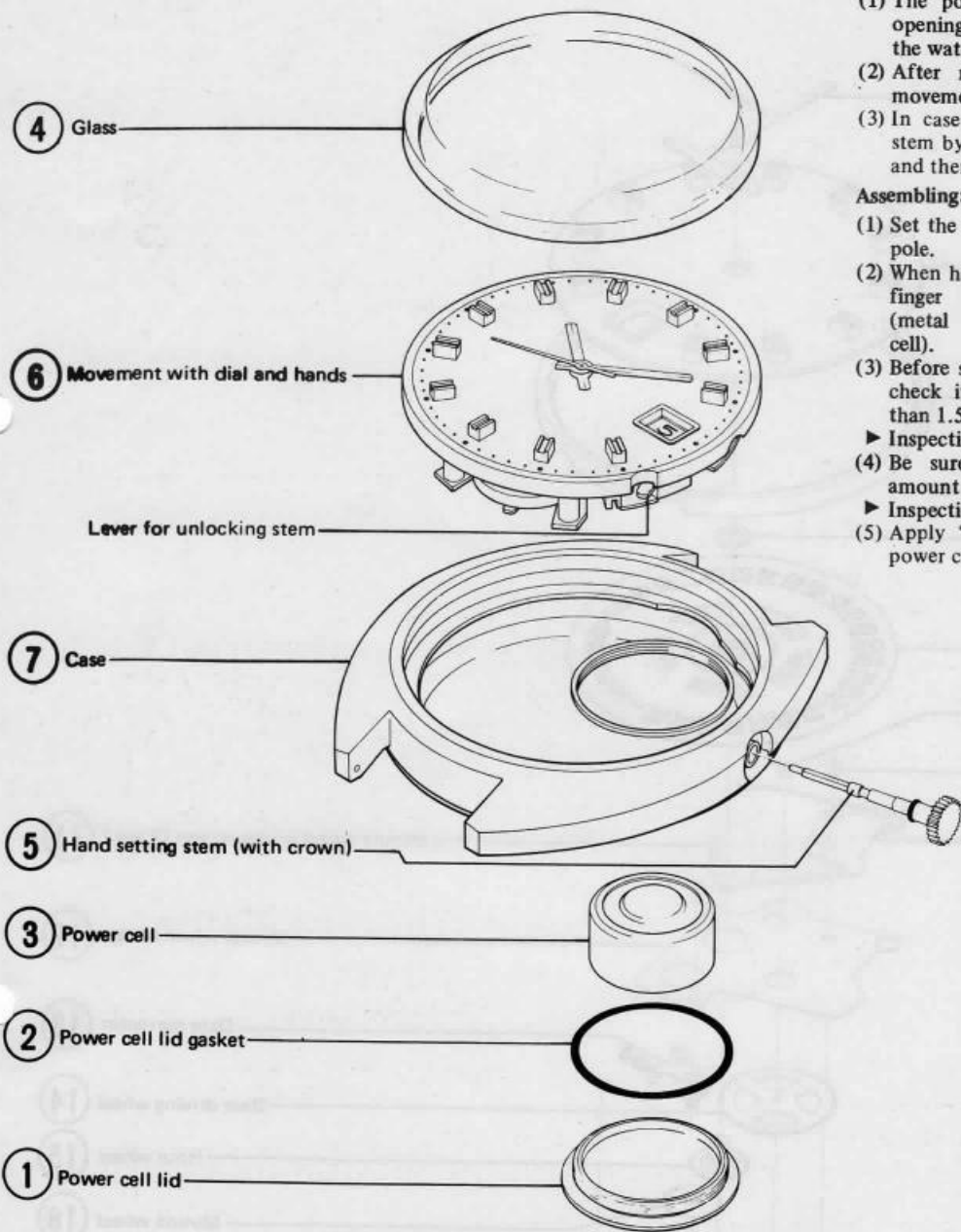
Types

- Moebius Synt-A-Lube
- Seiko watch oil S-4

Quantity

- Substantial quantity
- Normal quantity
- Extremely small quantity

3302A Replacing the Power Cell and Disassembling the Outer Parts



Disassembling:

- (1) The power cell can be readily removed by opening the power cell lid and turning over the watch.
- (2) After removing the power cell, take the movement out of the case.
- (3) In case of the one piece case, pull out the stem by pushing the lever for unlocking stem and then take out the movement.

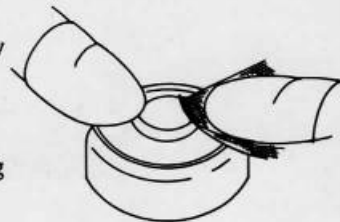
Assembling:

- (1) Set the power cell so that its lid side faces (+) pole.
- (2) When handling the power cell, be sure to wear finger cots or use nonmetallic tweezers (metal tweezers will short-circuit the power cell).
- (3) Before setting a power cell in the case, always check it for voltage (if the voltage is lower than 1.5V, replace it).
 - ▶ Inspection: Refer to 4.3302A-2
- (4) Be sure to check on the amplitude and amount of current consumption.
 - ▶ Inspection: Refer to 4.3302A-2
- (5) Apply "500,000 units" silicon grease to the power cell lid gasket.

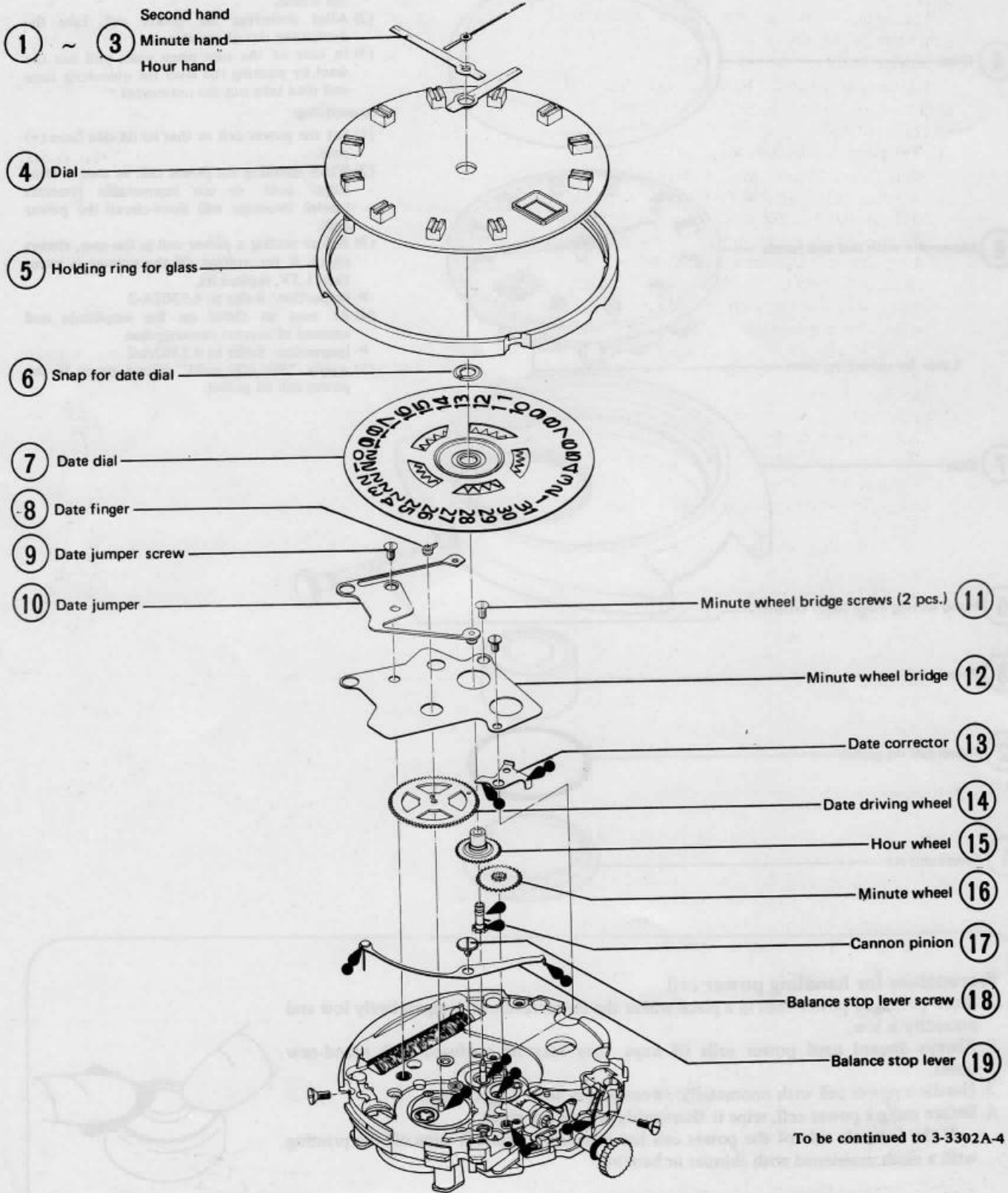
Precautions for handling power cell

1. Store packaged power cells in a place where the temperature is comparatively low and humidity is low.
2. Always discard used power cells (if kept, they may be confused with brand-new ones).
3. Handle a power cell with nonmetallic tweezers. (or wear finger cots).
4. Before using a power cell, wipe it thoroughly with a dry cloth.
If the (+) pole side of the power cell has something printed, wipe off the printing with a cloth moistened with thinner or benzene.

Never throw a power cell in a fire or conduct its direct soldering. If overheated, it will explode.



3302A Calendar Mechanism



3302A Calendar Mechanism

Precautions for Reassembling

1) Reassembling and adjusting the balance stop lever

Take special note of the play of balance stop lever in the slot of the setting lever. This is designated by the arrows A and B.

Adjust the relation between the balance stop lever spring and the projections of balance wheel as follows:

(1) Referring to Fig. 3.1, with the hand-setting stem in a drawn-out condition (a condition of second setting), and with the rectangular slot of the balance stop lever along with play of the setting lever moved in the direction of the arrow (A), adjust the relation between the balance stop lever spring and the projections of the balance wheel by bending the balance stop lever spring so that the balance stop lever spring is prevented from pressing against the balance wheel.

(2) Likewise, with play of the balance stop lever moved in the direction of the arrow (B), adjust the above relation as follows:

When the projections of the balance wheel numbers eight, proceed as shown in Fig. 3.2;

to make sure of this adjustment of second setting, repeat starting and stopping and ascertain if the balance wheel is stopped by the engagement of the projection and the balance stop lever.

When the balance stop lever is in a condition A, its spring must not contact the balance wheel; in a condition B, clearance "l" must be about 0.5 to 2 times the thickness of the balance stop lever spring.

2) Reassembling the date jumper

The tips of the date corrector and the date jumper are positioned as shown in Fig. 3-3.

3) Reassembling the holding ring for glass

The holding ring for glass is assembled (as shown in Fig. 3-4) so that its notch fits in with the tip of the lever for unlocking stem of the movement. (The notch is made for the lever for unlocking stem.)

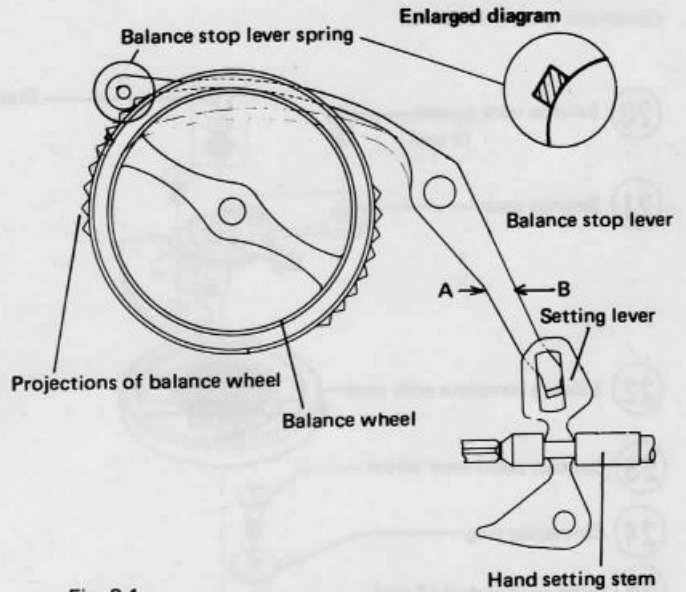


Fig. 3-1

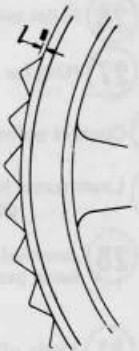


Fig. 3-2

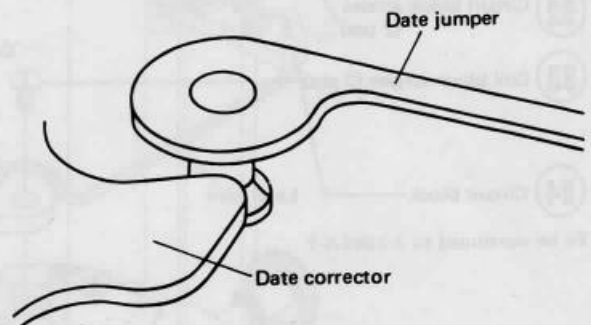


Fig. 3-3

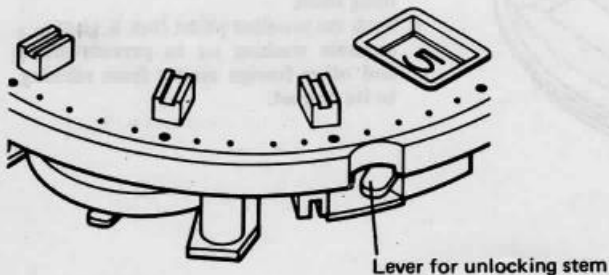


Fig. 3-4

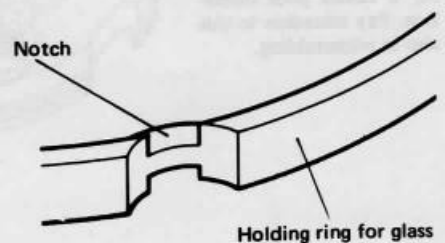
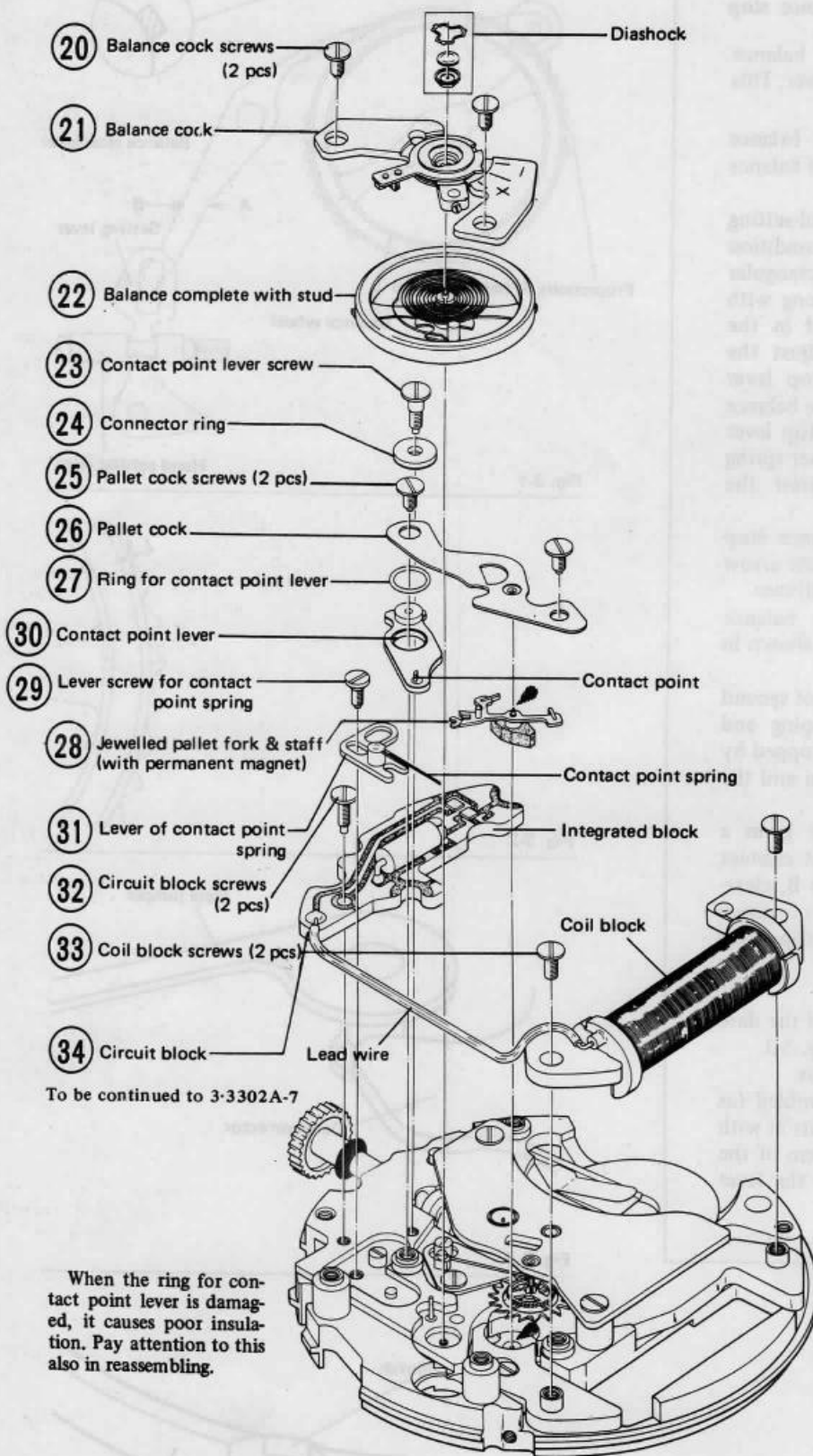


Fig. 3-5

3302A Controlling Mechanism and Integrated Circuit

Continued from 3-3302A-2



To be continued to 3-3302A-7

When the ring for contact point lever is damaged, it causes poor insulation. Pay attention to this also in reassembling.

Disassembling:

(Balance cock)

- (1) When removing the balance cock, be careful not to damage the contact point spring.
- (2) Be sure to use an eyelupe to properly position the notch of the roller table of the impulse roller and the contact point spring, keeping them from contacting each other.
- (3) Remove the power cell to bring the motion of the balance wheel to a stop. Then, by turning the balance wheel an angle of about 60 degrees, the notch of the roller table and the contact point spring will meet each other.
- (4) Some balance cocks have spacer-rings for adjusting their shake. Be careful not to lose them.

Disassembling:

(Contact point lever and lever of contact point spring)

- (1) Carefully handle the contact point of the contact point lever to prevent damaging it.
- (2) Carefully handle the contact point spring to prevent damaging or deforming it.
- (3) Disassemble the contact point lever and the lever of the contact point spring as follows:
 - a. Unscrew the contact point lever and the lever of the contact point spring.
 - b. Slightly raise the contact point lever.
 - c. Slightly raise the lever of the contact point spring.
 - d. Remove them simultaneously with tweezers.

Disassembling (Coil block):

- (1) Be careful not to hold the coils (coiled wire) with tweezers or similar tool, since this will invite a disconnection or degraded insulation of the coil.
- (2) When bringing out the lead wires from the slot of the main plate, be careful not to break their covering.
- (3) When handling the coil block, be careful not to break the coiled wire.
- (4) Washing procedures
 - a. Do not wash the circuit block
 - b. Avoid washing the contact point lever and the lever of the contact point spring along with other parts; they may be damaged or deformed. Always wash them separately.
 - c. If the lever of contact point spring is rotated in washing, the spring may become deformed. Avoid washing it in this manner.
 - d. Wash the contact point lever and the lever of contact point spring in a freon solution immediately before reassembling them.
 - e. Wash the jewelled pallet fork & staff in a separate washing jar to prevent chips and other foreign matter from sticking to its magnet.

3302A Controlling Mechanism and Integrated Circuit

Reassembling precautions

1) Reassembling the circuit block

When pushing the lead wire into the slot of the main plate, use a tool whose tip is rounded to avoid damaging the wire coating.

Example: Peg wood (Fig. 3.6)

2) Reassembling the lever of contact point spring and contact point lever

As shown in Fig. 3.7, temporarily set the lever of contact point spring. Now set in the contact point lever by passing it under the lever of contact point spring, then complete the seating of both levers.

Note: Staining of the contact point lever and contact point spring will affect watch performance. If they are washed in a freon solution immediately before their assembly, the watch performance will be further improved. Always wash in a freon solution.

3) Reassembling the connector

Reassemble the connector so that its gold-plated side faces the bottom.

4) Washing and reassembling the jewelled pallet fork & staff.

The jewelled pallet fork & staff is provided with a permanent magnet. If it is washed along with other parts, chips and other foreign matter will stick to it. Wash it separately, and after washing, be careful not to allow dust and other particles to accumulate on it. Adhesive tape - whose tackiness is not too strong - is an effective means of removing foreign matter from the magnet.

5) Checking engagement of the pallet jewels

After reassembling the jewelled pallet fork & staff, be sure to check it for the engagement of its pallet jewels (Fig. 3.8) and for its neutral point.

► Inspection: Refer to 4-3302A-4

Note: Do not heat the permanent magnet (to a temperature exceeding 100°C).

6) Preadjusting timing

Before reassembling the balance complete, preadjust its timing.

As shown in Fig. 3.9, preadjust the relation between the contact point pin and the contact point spring.

► For details refer to 4-3302A-5, Repair and Inspection.

Procedures

- (1) Set the fork slot of the pallet toward the exit jewel.
- (2) Position the contact point lever.
- (3) Position the contact point pin.

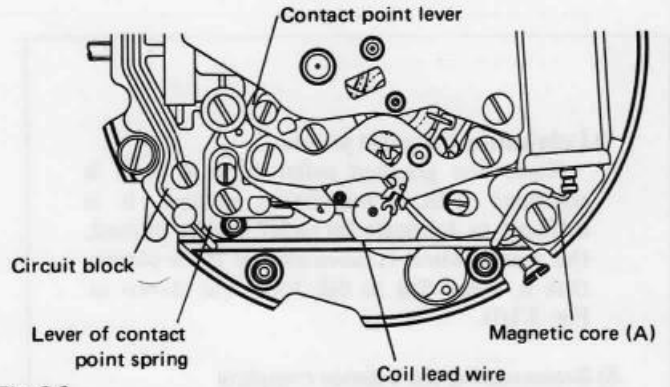


Fig. 3-6

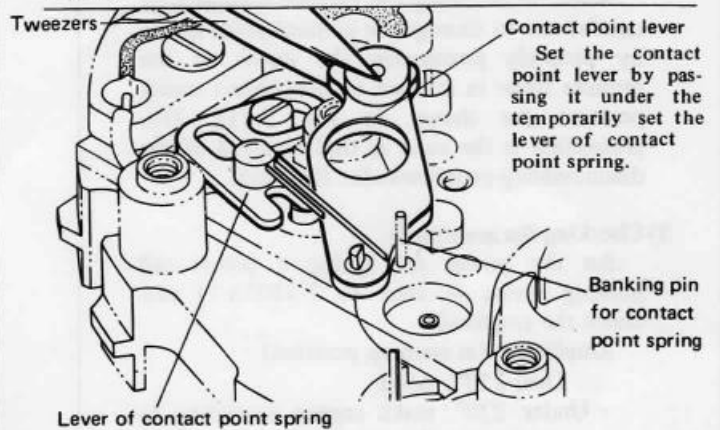


Fig. 3-7

If chips and dust cling to the magnet, the watch may sometimes stop.

Foreign matter sticking to the magnet.

The pallet jewel must not strike against the bottom of the escape wheel's tooth.

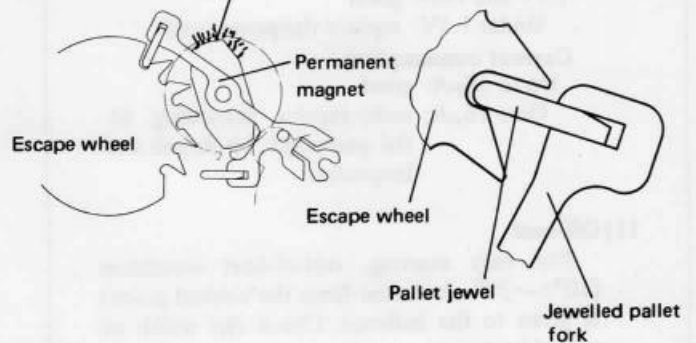


Fig. 3-8

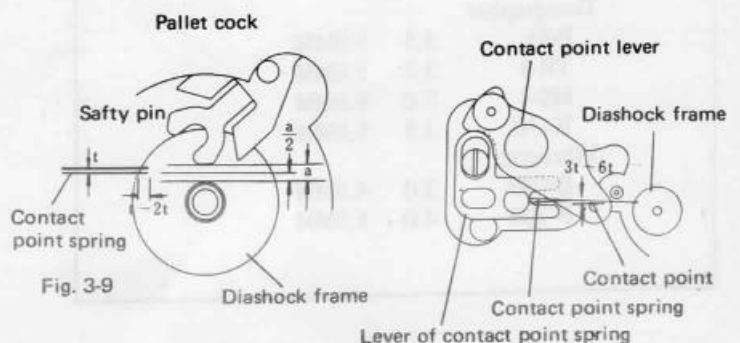


Fig. 3-9

3302A Controlling Mechanism and Integrated Circuit

7) Lubricating the pallet jewels

Since the jewelled pallet fork & staff is equipped with a permanent magnet, it is difficult to lubricate its pallet jewels. Instead, the escape wheel is lubricated at three places; that is, every 5th to 6th tooth (as shown in Fig. 3.10).

8) Reassembling the balance complete

When reassembling the balance complete be careful not to damage the contact point spring by properly positioning the notch of the impulse roller in relation to the contact spring position (as shown in Fig. 3-11). This precaution is the same as that required of the disassembling procedures for this item.

9) Checking the amplitude

Set the power cell (using a power cell holding spring – refer to 2-3302A-2) and check the amplitude.

Amplitude: (at stem up position)

Over 220°: good

Under 220°: make repairs according to the paragraph on Repair and Inspection.

10) Checking on current consumption and voltage

Be sure to check on current consumption and power cell voltage.

Power cell voltage

1.5V and over: good

Under 1.5V: replace the power cell

Current consumption

Up to 16 μ A: good

Over 16 μ A: make repairs according to the paragraph on Repair and Inspection

11) Off-beat

For easy starting, out-of-beat condition (10°~20° clockwise from the neutral point) is given to the balance. Check the width of out-of-beat.

The timing machine tape should show as under.

Timegrapher

P-61	3.5	5.0MM
TR-3	3.5	5.0MM
MS-4	7.0	9.5MM
IC-70	3.5	5.0MM

Vibrograph

B-100	3.0	4.5MM
B-200	4.0	5.5MM

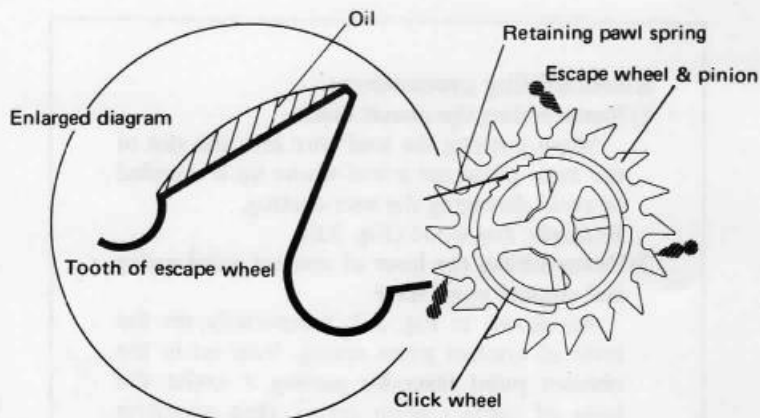


Fig. 3-10

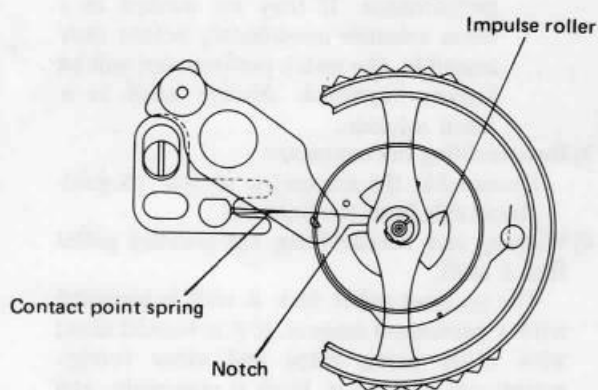


Fig. 3-11

3302A Train Wheel

Continued from 3-3302A-4

When disassembling and reassembling the escape wheel, be careful not to damage or deform the retaining pawl spring.

- (1) Magnetic cores B and C usually need not be disassembled.
- (2) To prevent the neutral point of the jewelled pallet fork and staff from being shifted by strong shocks, the rectangular slot of magnetic core B is coated with a bonding agent.
- (3) Before adjusting the neutral point of the jewelled pallet fork and staff, or before disassembling magnetic core B, gently pry open and remove the bonding agent so as to avoid deformation of the magnetic core.

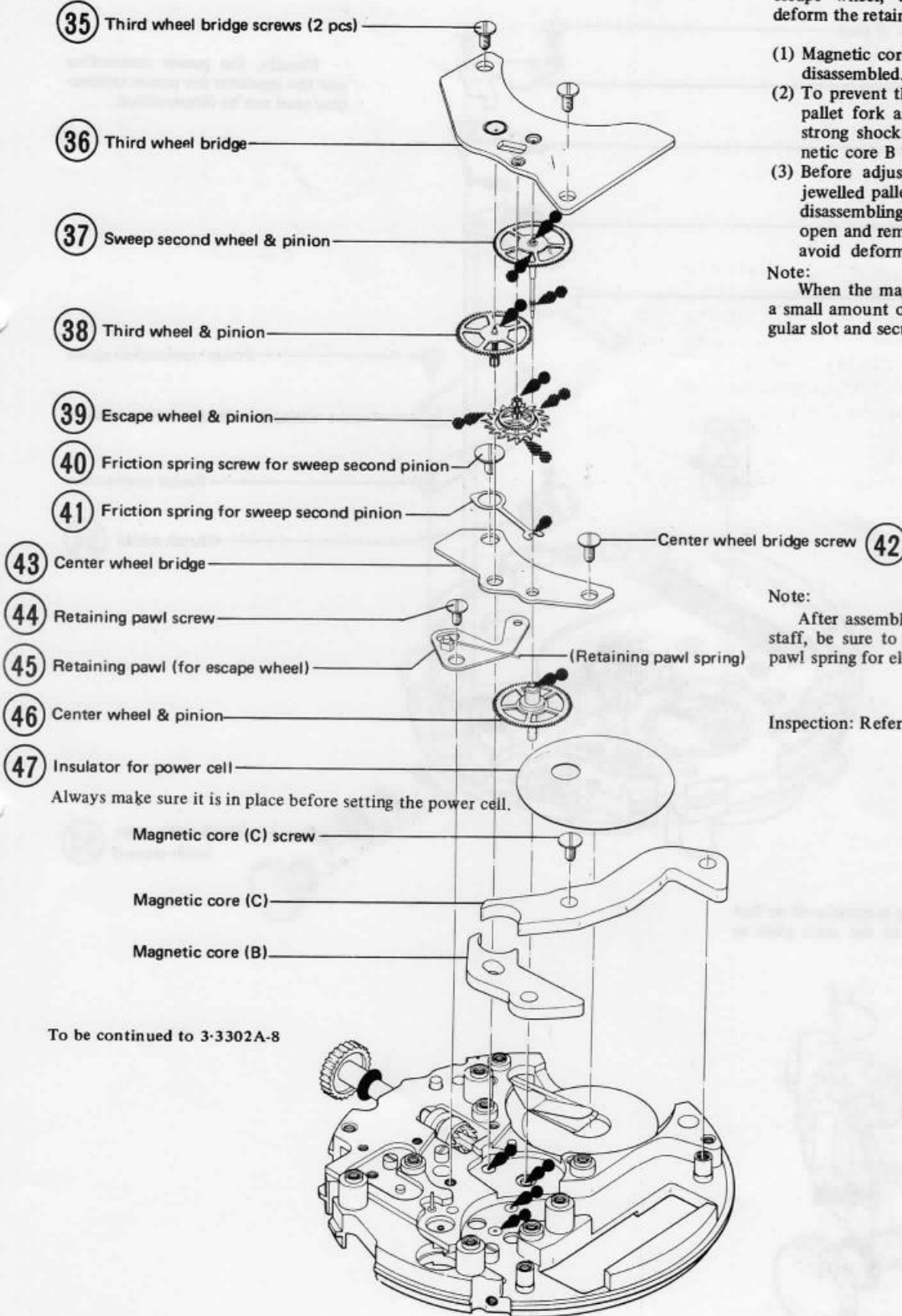
Note:

When the magnetic core B has moved, apply a small amount of bonding agent to the rectangular slot and secure the core.

Note:

After assembling the jewelled pallet fork and staff, be sure to check and adjust the retaining pawl spring for elevation, position, and strength.

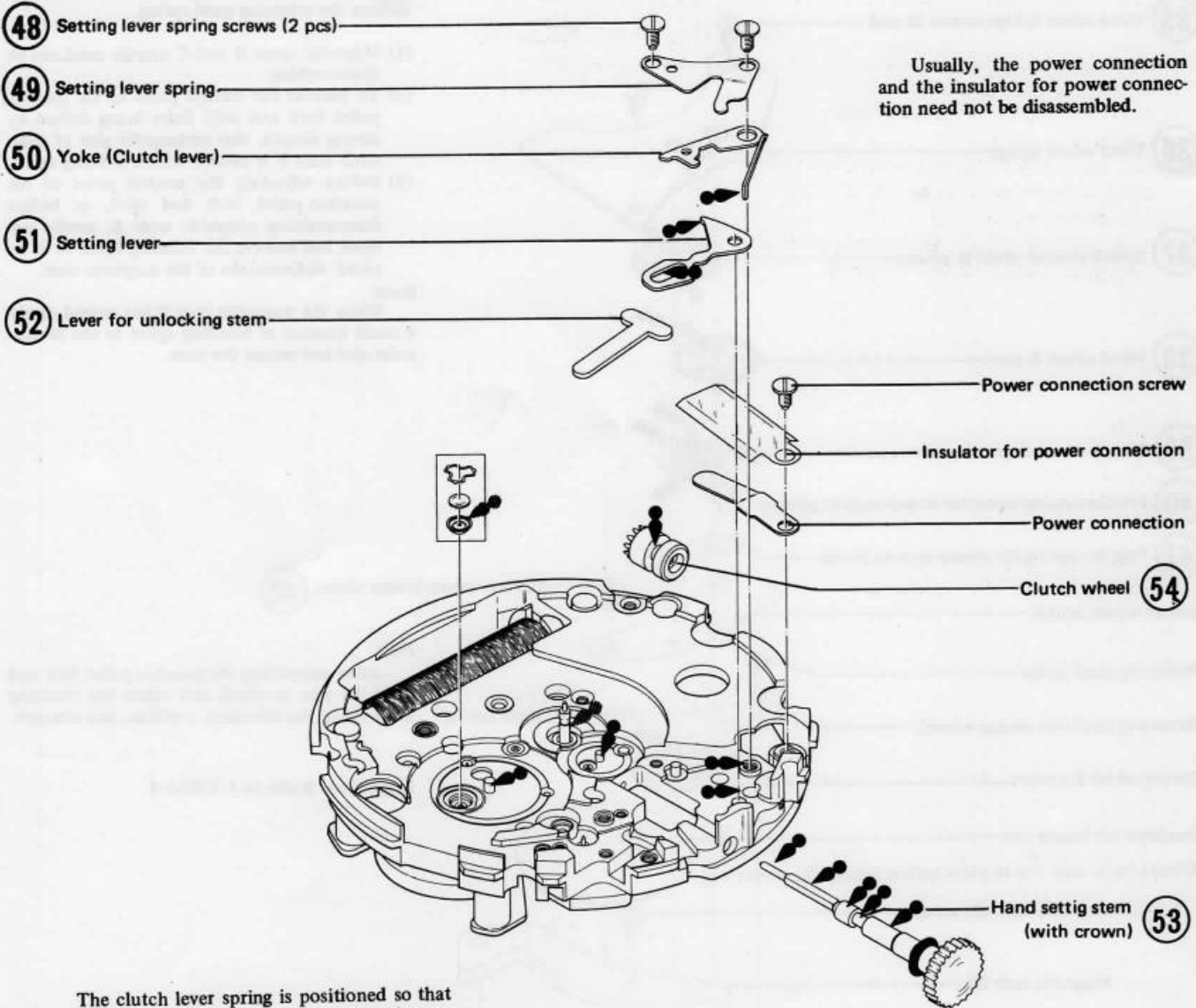
Inspection: Refer to 4-3302A-4.



To be continued to 3-3302A-8

3302A Setting Mechanism

Continued from 3-3302A-7



The clutch lever spring is positioned so that it catches the perimeter of the main plate as shown in Fig. 3.12

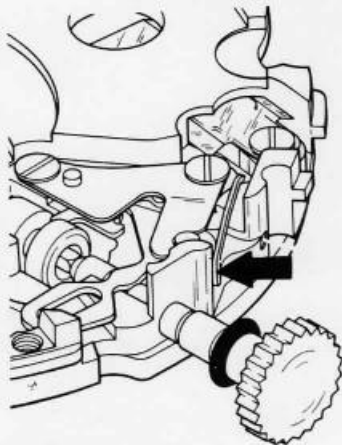


Fig. 3-12

3302A Inspecting Power Cell Voltage & Inspecting Current Consumption

A. Inspecting power cell voltage

Ascertain if the voltage is normal.

Procedures

1) Set the multimeter (for handling the tester refer to 2-3302A-1)

Applicable range of tester: DC 3V

2) Measurement (Fig. 4.1)

Lead plug red (+): (+) surface of power cell

Lead plug black (-): (-) surface of power cell

Results

1.5V and over: power cell is normal

(1.5V~1.6V)

under 1.5V: replace power cell

For replacing procedures, refer to Disassembling and Reassembling procedures.

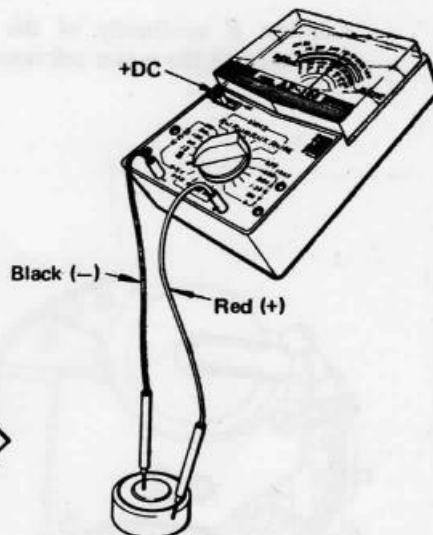
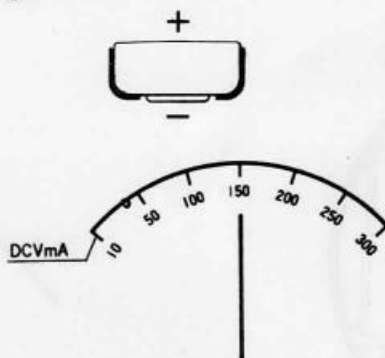


Fig. 4-1

B. Inspecting current consumption

Take out the movement and ascertain if it is carrying a proper amount of current.

Procedures

1) Set the tester (for tester handling procedures refer to 2-3302A-1)

Applicable range: DC 0.03mA

2) Measurement

Lead plug red (+): (+) surface of power cell

Lead plug black (-): top of 3rd wheel bridge or lower plate

Note: Take measurements with the balance wheel in motion.

Results

up to $16\mu\text{A}$: normal

over $16\mu\text{A}$: abnormal; follow the procedures given in the Guide to Repairs.

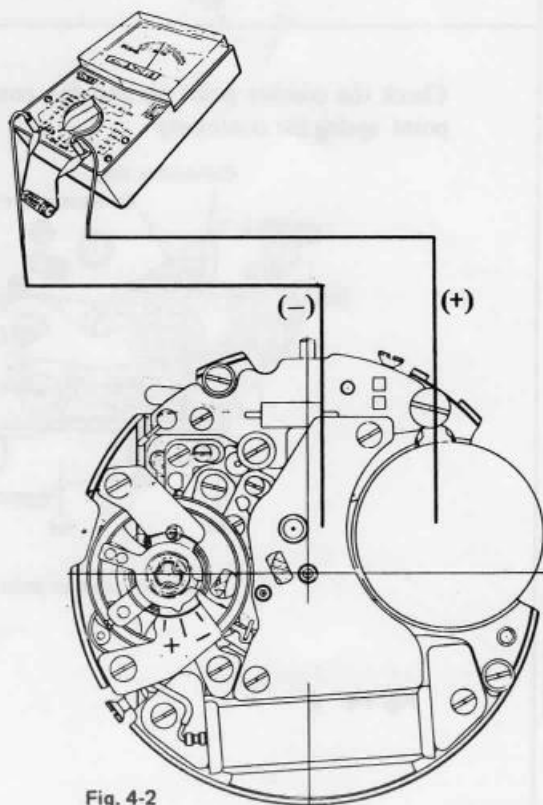
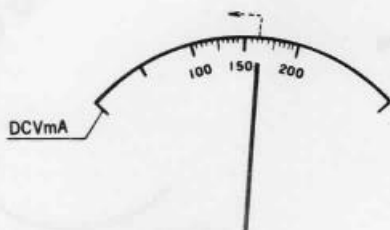


Fig. 4-2

3302A Inspecting the Integrated Circuit Section

Procedures (Inspection)

C. Inspecting continuity of the coil block

Confirm if continuity of the coil block is normal (with the power cell removed)

- 1) Set the tester (refer to Handling Procedures for tester) Applicable range: OHMS Rx100
- 2) Measurement
 - Lead plug red (+): connection of coil lead wire and circuit pattern (Fig. 4-3(b))
 - Lead plug black (-): lower plate (Fig. 4-3(a))

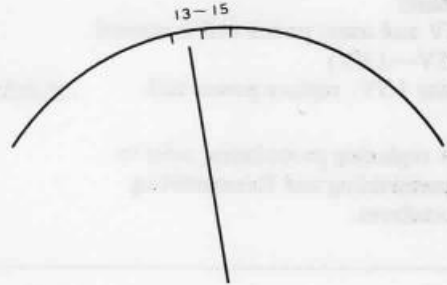
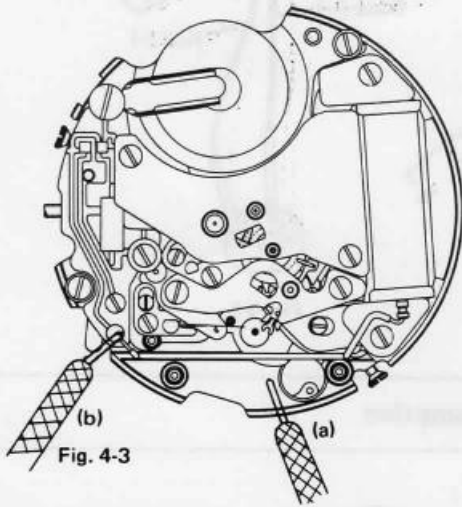


Fig. 4-3

D. Inspecting continuity of the contact point circuit and electronic

Check the contact point pin and the contact point spring for continuity

6. 1) Remove the balance cock from the movement. Using a power cell holding spring, secure the power cell to this movement. Note: regarding the power cell holding spring, refer to 3.3302A-2.
- 2) Be sure the jewelled pallet fork is on the driving side (the side where the fork slot of the pallet is to the entry jewel's Fig. 4-5).
- 3) Using metal tweezers or a similar tool, connect the contact point spring with the contact point.

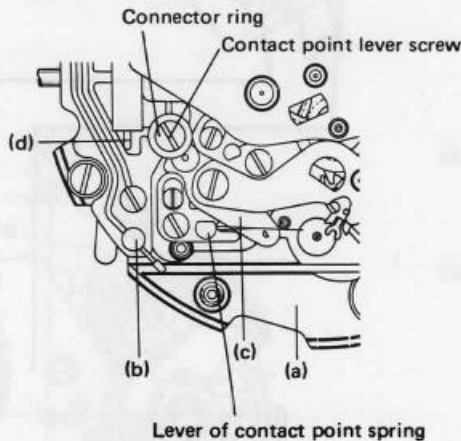


Fig. 4-4

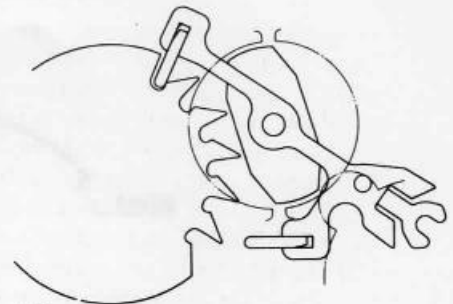


Fig. 4-5

Results		Adjustment and repair
<ul style="list-style-type: none"> → ● Meter reads 13 to 15 (1.3 to 1.5kΩ) → ● Meter reads values other than 13 to 15 (1.3 to 1.5kΩ) a) Meter reads ∞ – (Disconnection of coil) b) Meter reads 0 – (poor insulation of coil) <p>Check on continuity of the coil block by detaching it from the movement.</p> <ul style="list-style-type: none"> 1) Meter reads 13 to 15 (1.3 to 1.5kΩ) (Coating of coil lead is broken; coil is short-circuited to main plate) 2) Meter reads 0 – (Poor insulation of coil wiring) 	<p>Normal</p> <p>Abnormal</p> <p>Abnormal</p>	<ul style="list-style-type: none"> → ● Proceed to D, the next inspection step. → ● Repair or replace the coil block. → ● Repair the short-circuited part with electrical insulating tape or other effective means. → ● Repair or replace the coil block.
<ul style="list-style-type: none"> → ● The moment they contact each other, the jewelled pallet fork and staff moves toward the exit jewel. → ● Despite their contacting each other, the pallet does not move. If they are brought into contact by slightly bending the contact point spring, the pallet will move. – (The contact point spring and the contact point make poor contact with each other.) → ● Even if they are brought into contact with each other, the pallet will not move a bit. 1) If both the contact point lever (c) and the main plate (a) together are touched simultaneously by tweezers, the pallet will move. – (The contact point and contact point spring are making poor contact with each other.) 2) The assembly will not move despite procedure 1). It will move if both the circuit block pattern (d) and the main plate (a) are touched simultaneously with tweezers. – (The contact point lever is in poor contact with the integrated circuit.) 3) The pallet will not move despite procedure 2). – The integrated circuit is out of order. 	<p>Normal</p> <p>Abnormal</p> <p>Abnormal</p> <p>Abnormal</p> <p>Abnormal</p>	<ul style="list-style-type: none"> → ● Proceed to the next step – inspecting the mechanical section. → ● Wash the contact point lever and the lever of contact point spring. If this procedure proves fruitless, replace them. Note: Wash them in a freon solution, a detergent for exclusive use with electronic component parts. → ● Tighten the loose contact point lever screw or wash stain from the connector. → ● If the coil block is in order, replace the circuit block by removing the solder fixing (b).

3302A Inspecting the Machinery Section

Procedures (Inspection)

E. Inspecting the neutral point of jewelled pallet fork and staff

1. Ascertain if the neutral point of the jewelled pallet fork and staff is correctly positioned. If it is offset, it will not be able to produce enough amplitude, causing the watch to run down or preventing it from keeping correct time.

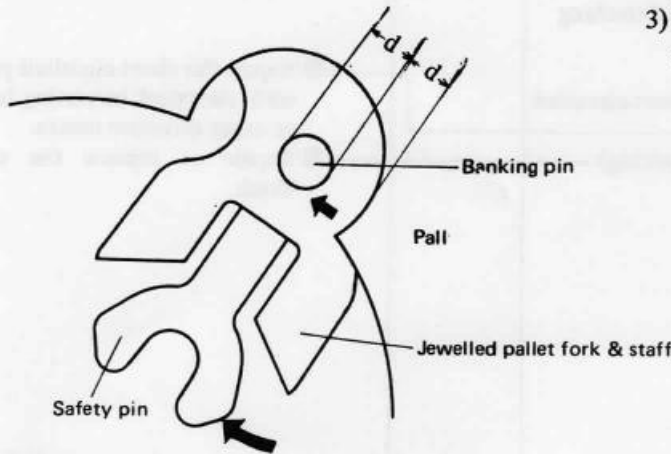


Fig. 4-6

2. 1) Detach the power cell from the movement.
- 2) Hold the tail (the part near the slot corner) of the pallet with nonmagnetic tweezers and move it gently in the \rightarrow direction (see Fig. 4.6) by the amount of "d" which corresponds to the banking pin size. Then release the tail from the tweezers (Fig. 4.6).
- 3) Follow the same procedures for the entry pallet jewel and the exit pallet jewel.

F. Inspecting the retaining pawl

1. Check the retaining pawl for its position and force. If the position and force are out of order, the following malfunctions will result:
 - 1) If the position is out of order, the escapement will develop a malfunction.
 - 2) If the force is too large, loss of the starting torque of train wheel will increase and the amplitude will decrease.
 - 3) If the force is too weak, there is a possibility of the train wheel turning in reverse.

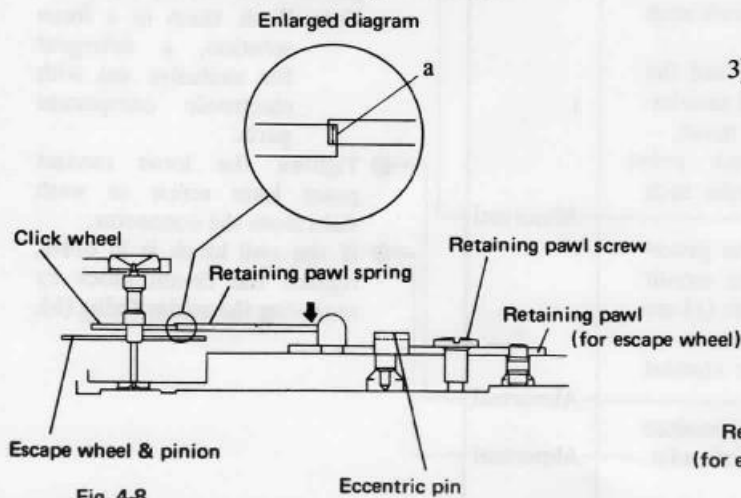


Fig. 4-8

2. 1) Inspection in vertical direction —————
Amount of engagement of retaining pawl spring with click wheel (dimension shown in Fig. 4.8 (a)).
- 2) Inspection in horizontal direction —————
Clearance between the tip of retaining pawl spring and the click wheel (dimension shown in Fig. 4.10 (b)).
Note: When inspecting, be sure that the pallet jewel and the tooth of escape wheel are in the condition shown in Fig. 4.11.
- 3) Inspection of force of the retaining pawl —————
Inspect the level in accordance with Fig. 4.10 (c).

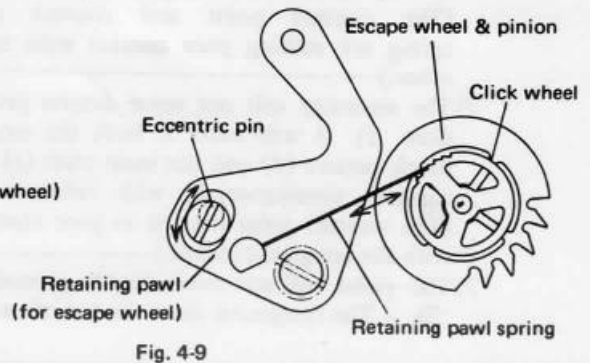
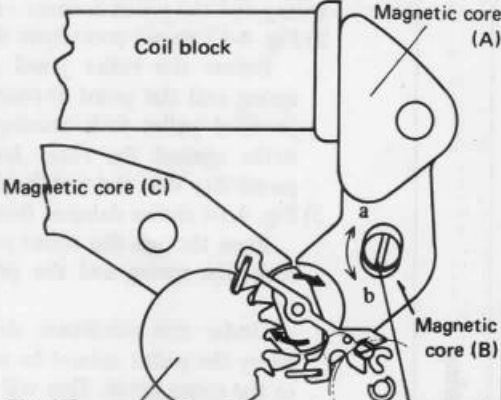



Fig. 4-9

Results	Adjustment and repair
<p>● The pallet will return to its original position. ————— Normal</p> <p>● The assembly will not return to its original position. ————— Abnormal</p> <p>Note: To prevent displacement of the neutral point due to strong shocks and so on, the part near the adjusting pin for magnetic core B is coated with a bonding agent. When adjusting the neutral point, remove the bonding agent and turn the adjusting pin. After this adjustment, secure the adjusting pin with a bonding agent or similar means.</p>	<p>● Proceed to the next inspection step F.</p> <p>● Adjust magnetic core B by turning the adjusting pin for magnetic core (Fig. 4.7).</p> <p>1) If the entry pallet jewel does not return, turn the adjusting pin in the "a" direction.</p> <p>2) If the exit pallet jewel does not return, turn the adjusting pin in the "b" direction.</p>  <p>Fig. 4-7 Escape wheel & pinion Eccentric pin</p>
<p>→ ● When dimension (a) is more than half the thickness of the click wheel ————— Normal</p> <p>→ ● When dimension (a) is less than half the thickness of the click wheel ————— Abnormal</p> <p>→ ● When dimension (b) ranges from the thickness to double the thickness of the retaining pawl spring ————— Normal</p> <p>→ ● When dimension (b) takes a value other than acceptable tolerance of the spring ————— Abnormal</p> <p>→ ● When dimension (c) ranges from 0 to thickness of the retaining pawl spring ————— Normal</p> <p>→ ● When dimension (c) takes a value other than the one ranging from 0 to thickness of the retaining pawl spring ————— Abnormal</p>  <p>Fig. 4-10 Fig. 4-11</p>	<p>→ ● Adjust by bending at the arrow position (in Fig. 4.8) of the retaining pawl spring upward or downward.</p> <p>→ ● Adjust by loosening the retaining pawl screw and by turning the eccentric pin.</p> <p>Note: After completely tightening the retaining pawl screw, confirm if the adjustment is effective.</p> <p>→ ● Adjust by bending the retaining pawl spring close to mounting post. (in Fig. 4.9)</p> <p>Check the retaining pawl spring for position and force at more than four places; every 5 to 6 teeth of the click wheel.</p>

3302A Inspecting the Timing

Procedures (Inspection)

1. Check the following;

In what relation of the fork slot of the pallet and roller jewel does the contact point spring meet the contact point?

The above mentioned is a very important checking, called "timing".

1) Fig. 4.12 shows normal timing.

With balance in counter clockwise rotation, the moment the roller jewel enters the fork, the spring and the point contact each other.

2) Fig. 4-13 shows premature timing

Before the roller jewel enters the fork, the spring and the point contact each other to drive jewelled pallet fork causing the roller jewel to strike against the fork. As a result, there is a possibility that the watch will stop.

3) Fig. 4.14 shows delayed timing

Even though the roller jewel has entered the fork, the spring and the point do not contact

Under this condition, driving energy delivered by the pallet cannot be sufficiently conveyed to the roller jewel. This will cause a malfunction of the pallet such as poor amplitude, large error of the escapement and so on.

2. 1) With the balance complete with stud removed, confirm if the contact point spring, contact point, and banking pin for contact point spring are in position; that is, if they are positioned as shown in Figs. 4.15 and 16.

2) Remove the power cell and incorporate the balance complete with stud.

3) Manually turn the balance wheel clockwise about 90 degrees from the position of rest.

4) While slowly turning the balance in reverse direction, ascertain if the spring contacts the point when the roller jewel strikes against the fork of the jewelled pallet fork (which moves slightly).

Note: Exercise the utmost care not to bend or deform the balance stop lever spring during inspection.

G. Inspecting the timing

Normal timing

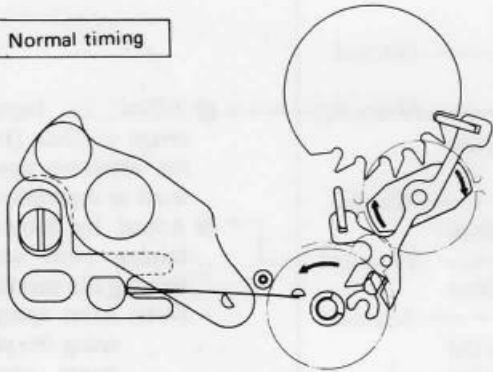


Fig. 4-12

Premature timing

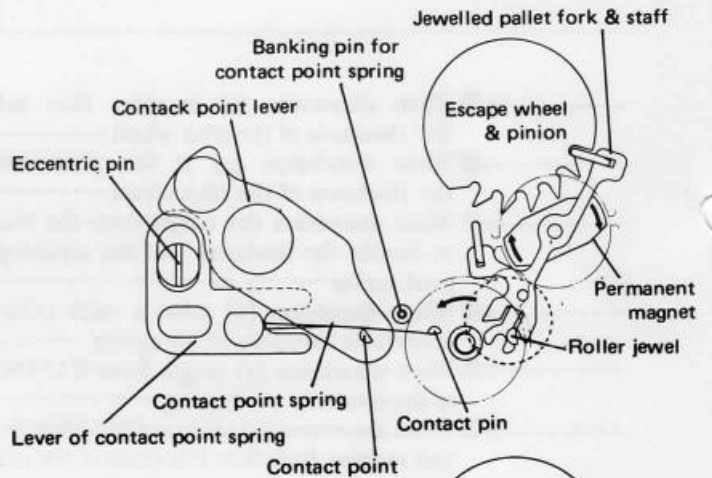


Fig. 4-13

Delayed timing

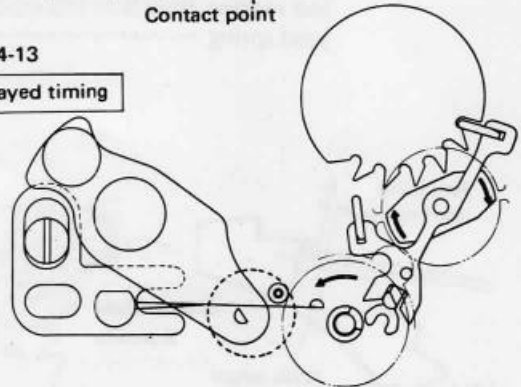
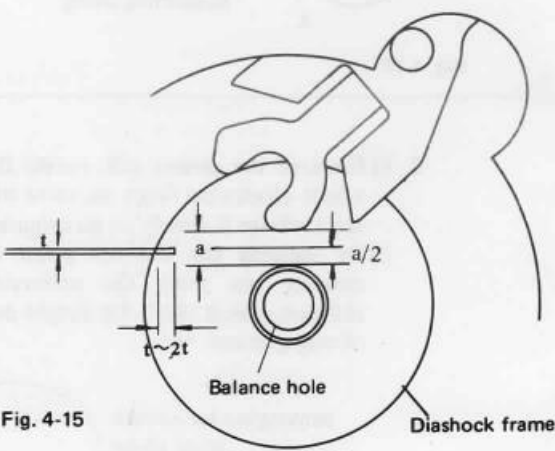
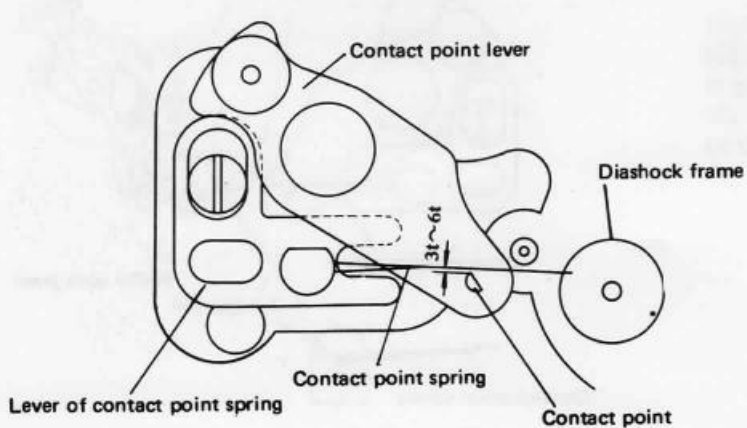
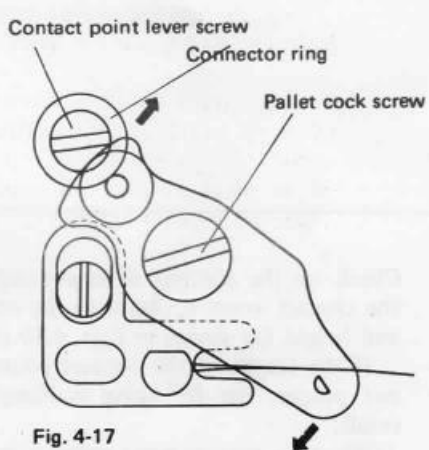


Fig. 4-14

Results	Adjustment and repair
<ul style="list-style-type: none"> ● When the contact point spring contacts the contact point, the jewelled pallet fork moves slightly. ————— Normal timing ● Before the pallet moves, the spring contacts the point. ————— Premature timing ● Even though the pallet moves a little, the spring will not contact the point. ————— Delayed timing 	<ul style="list-style-type: none"> ● By slightly loosening the pallet cock screw (on the contact point lever side) and the contact point lever screw (one-half to one turn), move the contact point lever in the arrowed direction (as shown in Fig. 4.17). ● Turn the contact point lever in a reverse direction in adjusting premature timing.
<p>Preliminary inspection</p>  <p>Fig. 4-15</p>  <p>Fig. 4-16</p>	 <p>Fig. 4-17</p> <p>Note 1) The position of the contact point spring is determined so that it is on a line bisecting distance "a" between the rim of the hole of the diashock frame and the point of the safety pin when the jewelled pallet fork and staff is brought toward the exit pallet jewel's side (as shown in Fig. 4.15). Now the tip of the contact point spring is projected into the diashock frame interior by an amount twice as long as (t), the thickness of the spring.</p> <p>Note 2) The clearance (Fig. 4.16) between the contact point spring and contact point is three to six times the thickness of the contact point spring (6/100 to 10/100mm).</p>

3302A Inspecting the Contact Point Spring

Procedures (Inspection)

H. Inspecting the supporting spring

Check on the following clearances (Fig. 4.18):

- Clearance a – between the contact point spring and supporting spring.
- Clearance b – between the contact point spring and contact point.
- Clearance c – between the contact point spring and banking pin for contact point spring.

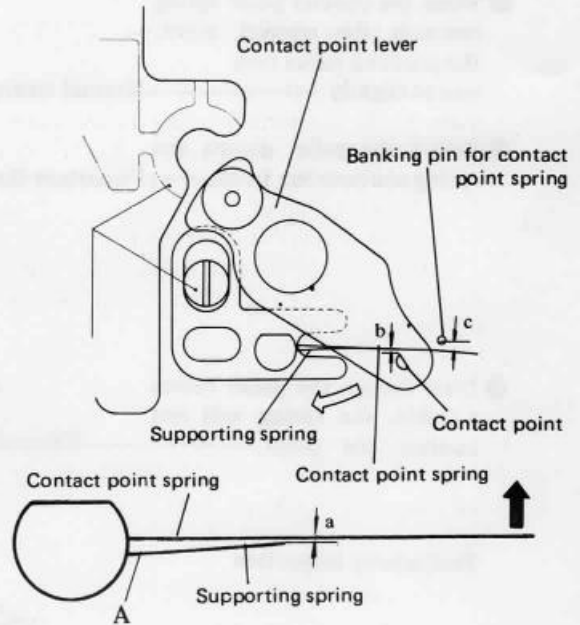


Fig. 4-18

I. Inspecting the length of contact point spring

Check on the amount of engagement "l" of the contact point spring with the contact pin and height (as shown in Figs. 4.19 and 4.20).

If the length of the contact point spring is not proper, the following malfunctions will result:

- 1) When the contact point spring is too long
Current consumption will be increased, while power cell life will be shortened. Rotary friction of the balance wheel will be increased so that the amplitude will be poor.
- 2) When the contact point spring is too short
The contact point spring and contact pin will develop tension, causing the spring to be bent, the watch to stop, and so on. When it is still shorter, it will develop an idling motion, ceasing to work,

2. 1) Remove the power cell, rotate the balance wheel clockwise from its state of rest, and then release it slowly to its original position.
- 2) By viewing the contact point spring and contact pin from the underside of the balance, check them for height and amount of engagement "l".

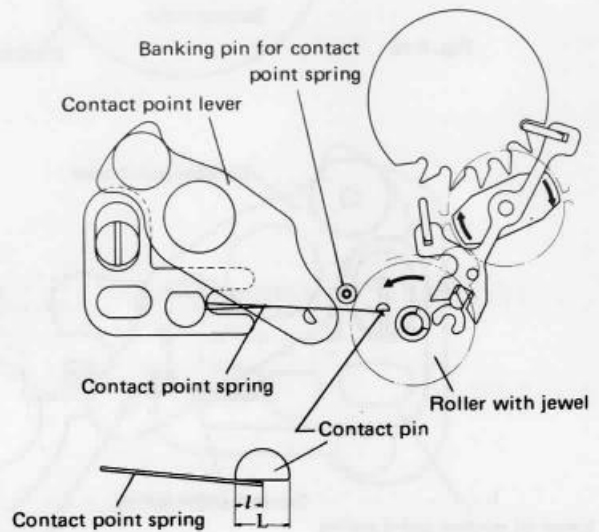
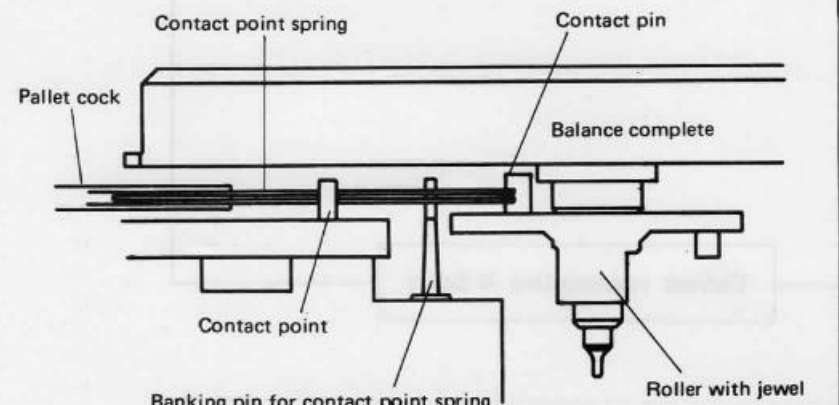
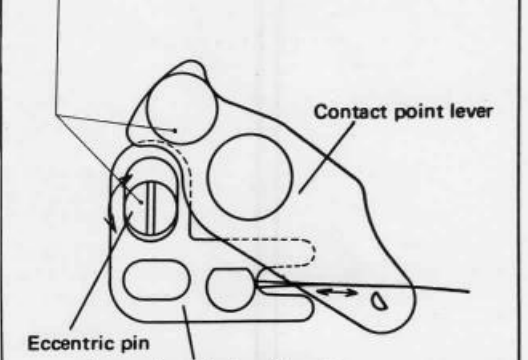
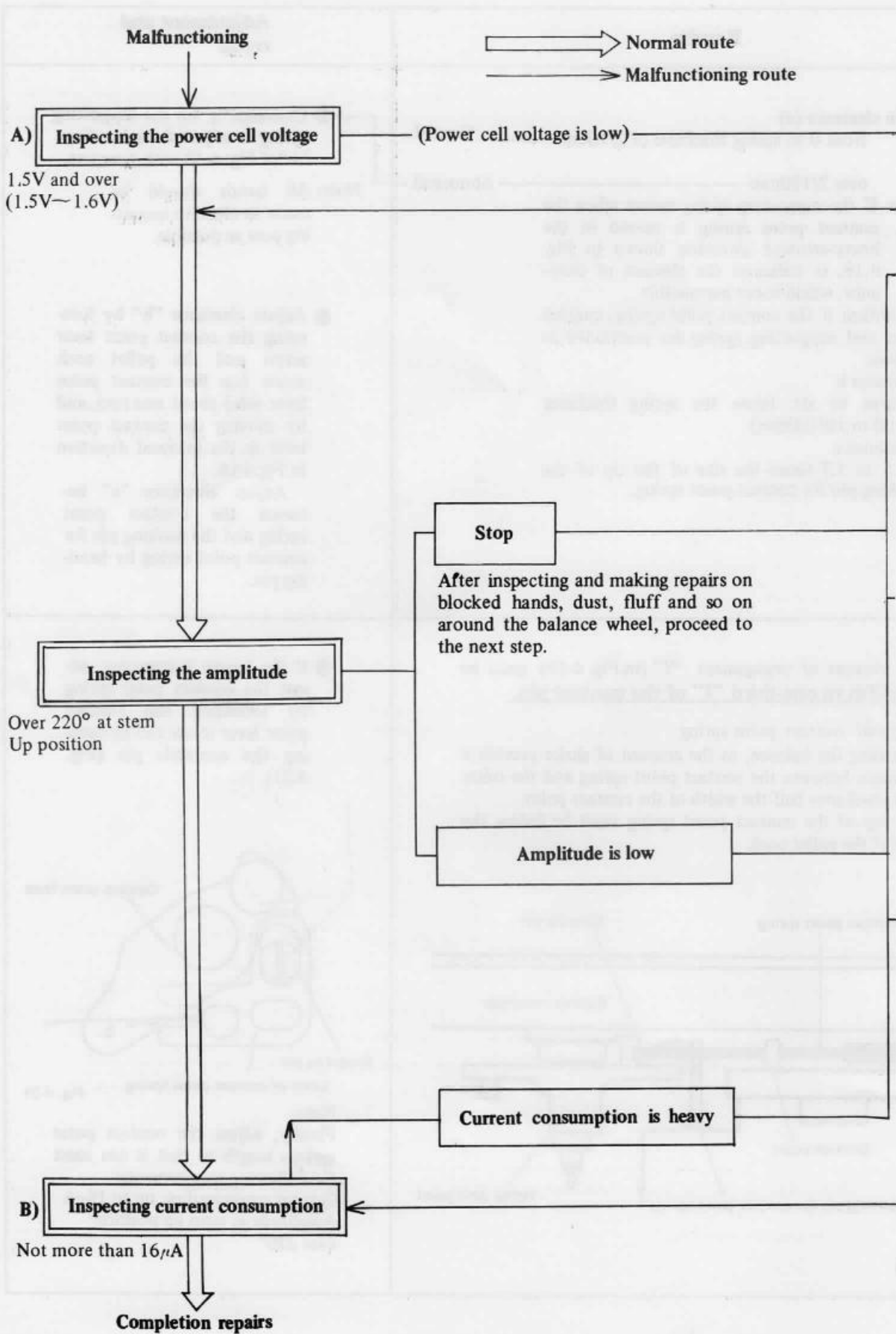
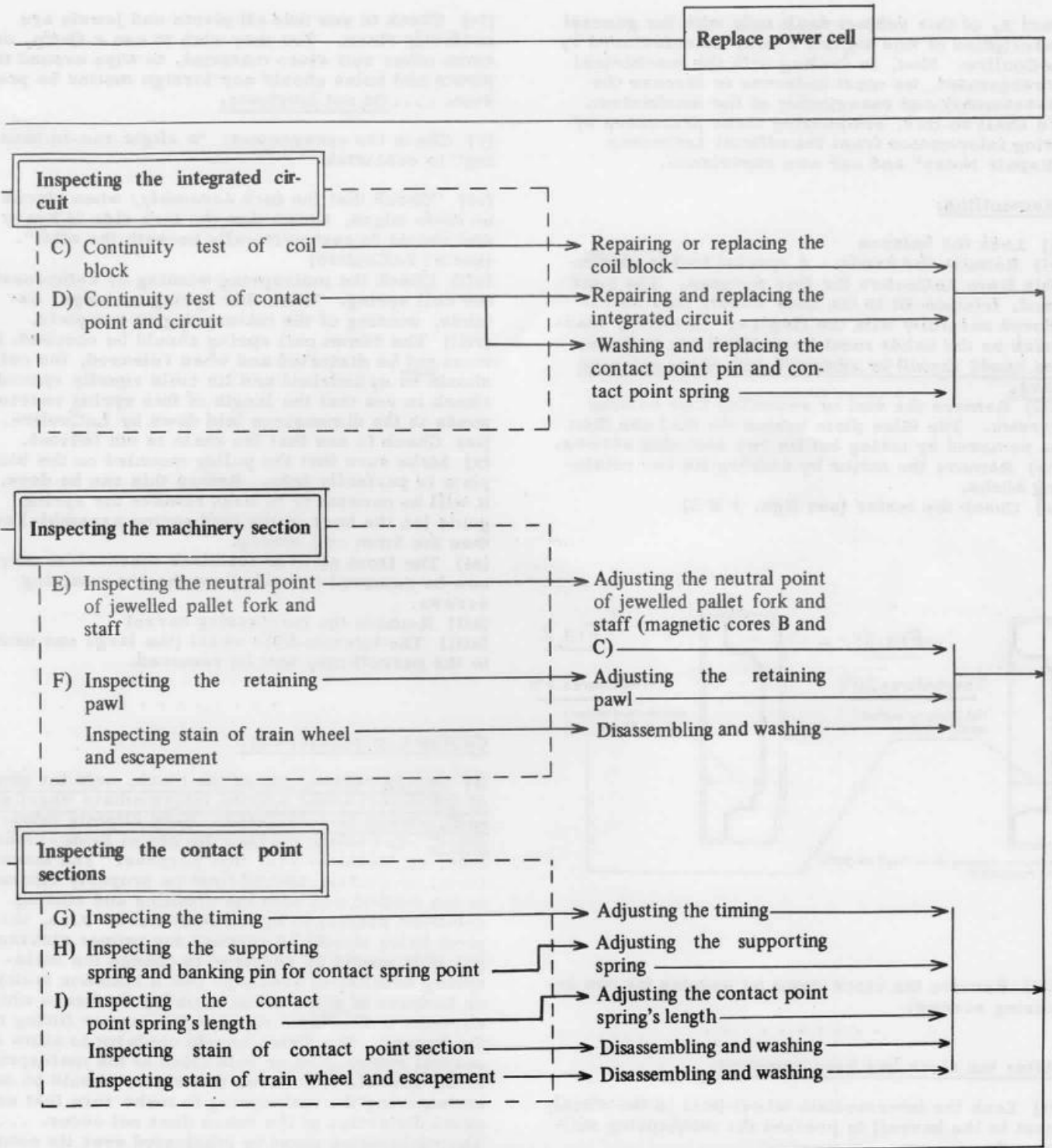


Fig. 4-19

Results	Adjustment and repair
<ul style="list-style-type: none"> ● When clearance (a) from 0 to spring thickness of 2/100m ——— Normal over 2/100mm ——— Abnormal <p>Note: If the supporting spring moves when the contact point spring is moved in the heavy-arrowed direction shown in Fig. 4.18, it indicates the absence of clearance, which is not permissible.</p> <p>Confirm if the contact point spring, contact point and supporting spring are positioned as follows:</p> <ul style="list-style-type: none"> ● Clearance b Three to six times the spring thickness (6/100 to 10/100mm) ● Clearance c 1.5 to 1.7 times the size of the tip of the banking pin for contact point spring. 	<ul style="list-style-type: none"> ● Clearance "a" for the supporting spring is adjusted by bending "A" of Fig. 4.18 with tweezers. <p>Note: All bends should be made as close to mounting post as possible.</p> <ul style="list-style-type: none"> ● Adjust clearance "b" by loosening the contact point lever screw and the pallet cock screw (on the contact point lever side) about one turn, and by moving the contact point lever in the arrowed direction in Fig.4-18. <p>Adjust clearance "c" between the contact point spring and the banking pin for contact point spring by bending pin.</p>
<ul style="list-style-type: none"> ● The amount of engagement "l" (in Fig. 4-19) must be <u>one-fifth to one-third "l" of the contact pin.</u> ● Height of contact point spring By raising the balance, to the amount of shake provide a clearance between the contact point spring and the roller with jewel over half the width of the contact point. The top of the contact point spring must be below the level of the pallet cock.  <p>Fig. 4-20</p>	<ul style="list-style-type: none"> ● If the length is improper, adjust the contact point spring by loosening the contact point lever screw and by turning the eccentric pin (Fig. 4.21).  <p>Fig. 4-21</p> <p>Note: Finally, adjust the contact point springs length so that it can meet the following requirements: Current consumption: up to 16mA Amplitude at stem up position: over 220°</p>

3302A Guide to Repairs





For inspecting the train wheel and escapement, and for inspecting and adjusting the calendar mechanism, follow procedures similar to those for common mechanical watches.