TECHNICAL INFORMATION

CITIZEN QUARTZ

Cal. No. C 010

CITIZEN

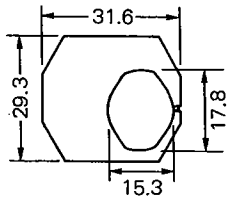
CONTENTS

■1. OUTLINE

This caliber is a combination quartz watch for men which enables clear recording and palying back. By incorporating the memory circuit (RAM) that was realized by the ultra-LSI, the most advanced technology of today, we were successful in providing this watch with record and playback functions.

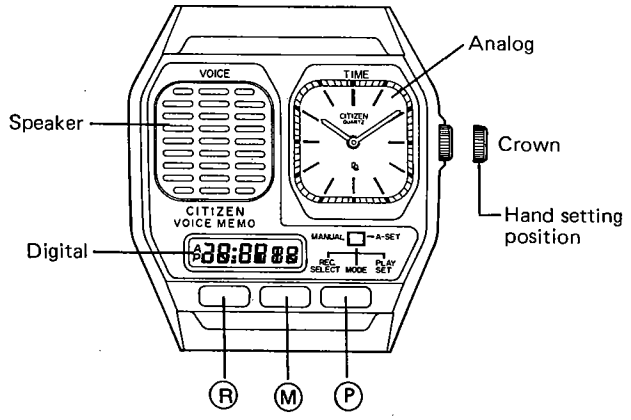
Additionally, with the ultra-LSI technology, we've developed the small-sized module for wrist watches that consumes less electric power than others.

■2. SPECIFICATIONS

Caliber No.		C010-01	
Type		Combination quartz watch (Analog part: without center second Cal. 2020A)	
Movement (mm)		 Thickness: 8.8^{t} (measured when the power cell part is included)	
Accuracy		±20 sec./month at normal temperatures	
Oscillation		32,768 Hz	
Display method		FE-type nematic LC (liquid crystal) & 2-split matrix drive	
Integrated circuit		C/MOS–LSI (5 units)	
Effective temp. range		0°C ~ +55°C	
Converter		Bipolar step motor	
Adjustment of time rate		Digital : Trimmer condenser Analog: Adjustment is impossible due to DFC method employed	
Measurement of time rate		Digital : a range of 2 seconds Analog: a range of 10 seconds	
Display functions	Analog	Hour & minute (without center second)	
	Digital		
	Normal time	Hour, minute, second & AM/PM	
	Calendar	Month, date & day	
	Alarm	Hour, minute, AM/PM & AL (OFF AL)	
	Recording	REC • sec. (when recording) PLY • sec. (when playing back) Temp. range in which recorder can be used: 5°C ~ 40°C	
Additional functions		Record and playback functions: 6 seconds Pause function Display of the time limit (sec.) for recording Fully automatic calendar (February ends on 28th) Display of the time limit (sec.) for playback Sound monitor Previous condition restoration Automatic return	
Power cell		≪Digital≫	≪Analog≫
	Parts No.	280-41 (2 units)	280-39 (1 unit)
	Cell code	SR43W	SR626SW
	Size (mm)	11.5ϕ x 4.2t	6.8ϕ x 2.6t
	Voltage	1.55V	1.55V
	Capacity	125mAH	26mAH
	Lifetime	3 years Recording: Once a day Playback: Once a day	3 years Alarm: Once a day
Value of current		Digital: 1.8μA Analog: 1.3μA	
Value of coil resistance		2.8 ~ 3.4 KΩ	
Remarks			

■3. HANDLING INSTRUCTIONS

(1) Nomenclature



Ⓡ button (REC) : Recording, calling the correction mode out, selection of digits to be corrected.

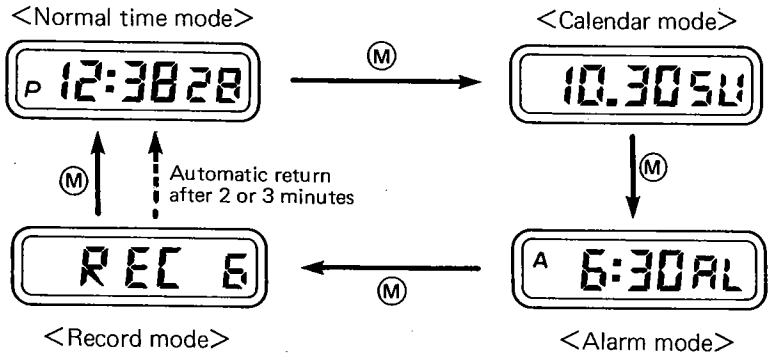
Ⓜ button (MODE) : Switching of the mode, previous condition restoration.

Ⓟ button (PLAY) : Playback, correction, sound monitor, recording monitor.

Crown : Setting hands with a pull of the crown out to its first clicking position.

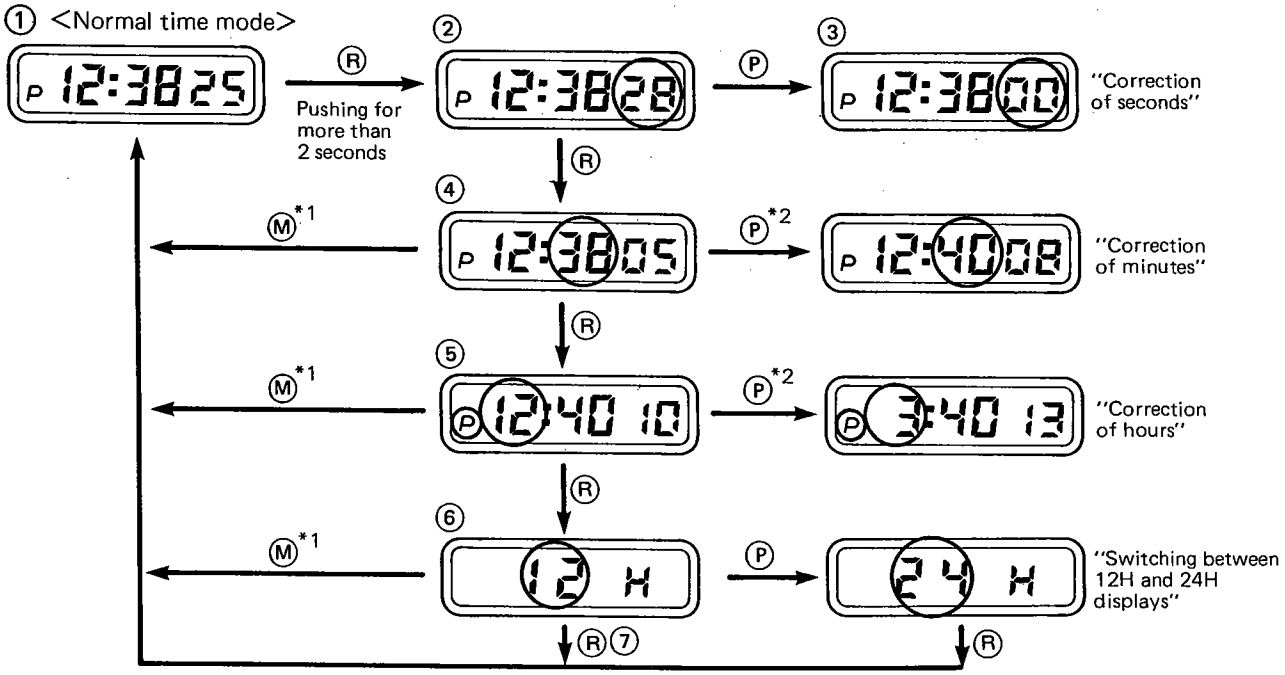
(2) Switching of the mode [Digital part]

One mode is switched to another with every push of the Ⓜ button.



(3) Correction of time [Digital part]

* Circled figures are flashing.



<How to correct time>

[Analog part]

Hour and minute hands can be set by turning the crown while it remains pulled out in the first clicking position. Pushing the crown in starts the running of the hands.

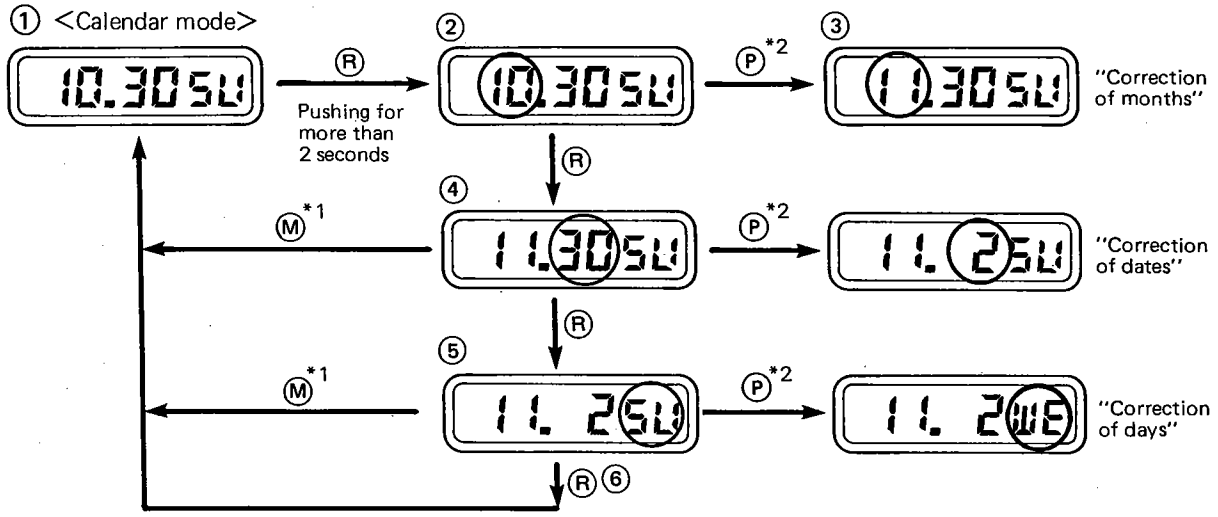
[Digital part]

1) The normal time mode is obtained with a push of the Ⓜ button.
2) A continuous push of the Ⓡ button for more than 2 seconds creates the time correction mode.
3) Correction of seconds is possible by pushing the Ⓟ button. (If correction is made when figures of more than 30 are displayed, the minute display increases by one minute.)
4) The minute correction mode is obtained with a push of the Ⓡ nutton. Then, correct minutes by pushing the Ⓟ button.
5) The hour correction mode is obtained with a push of the Ⓡ button. Then, correct hours by pushing the Ⓟ button.
6) The 12H/24H correction mode is obtained with a push of the Ⓡ button. Then, switch from 12H to 24H, or vice versa by pushing the Ⓟ button.
7) The normal time mode returns with a push of the Ⓡ button, and thus correction of time is finished.

Note 1. Whichever correction mode is displayed, a push of the Ⓜ button immediately restores the normal time mode (*1). If any of the correction modes is left as it is for 2 or 3 minutes without a push of the Ⓜ button, the normal time mode returns automatically.

Note 2. Quick correction is possible with a continuous push of the Ⓟ button (*2).

(4) Correction of calendar [Digital part]

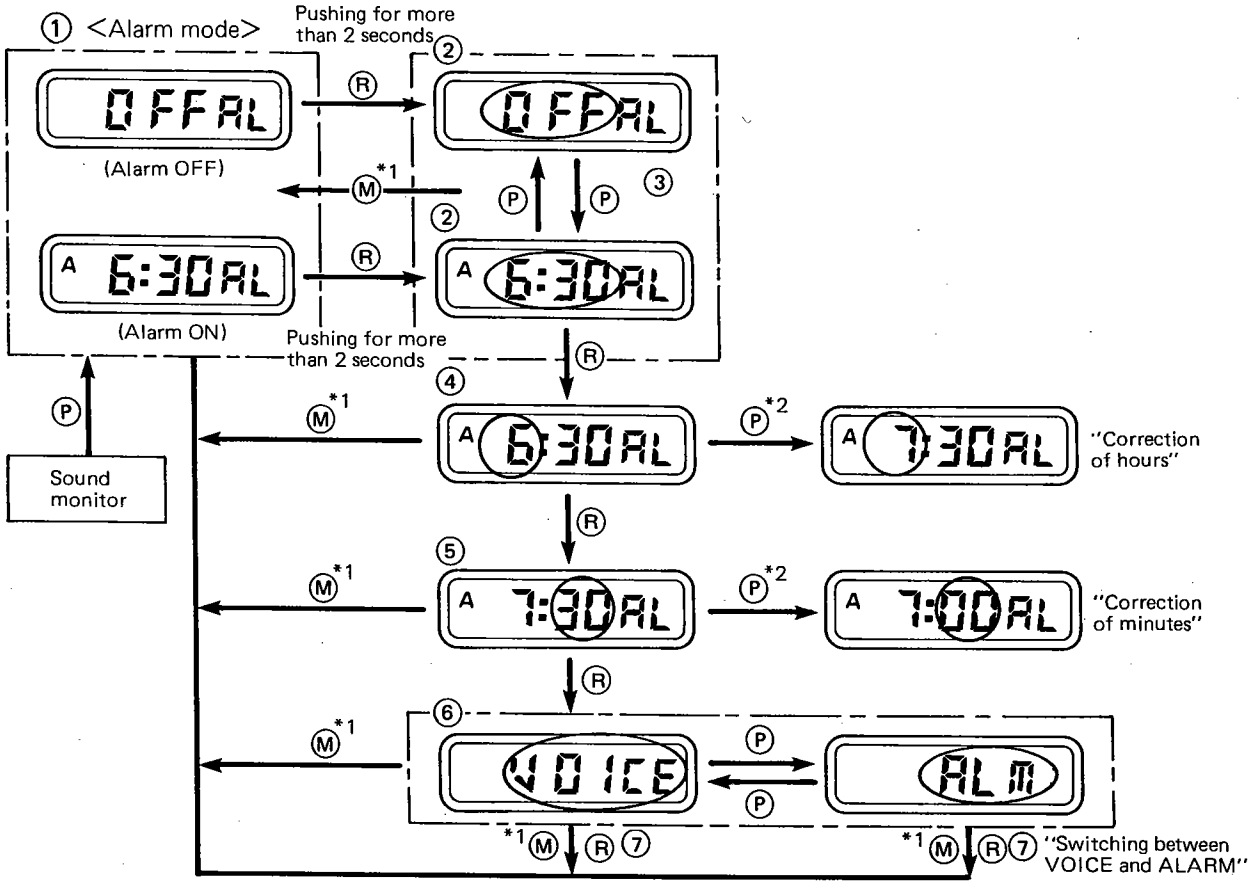


<How to correct calendar>

1) The calendar mode is obtained with a push of the Ⓜ button.
2) A continuous push of the Ⓡ button for more than 2 seconds creates the month correction mode.
3) Correction of months is possible by pushing the Ⓟ button.
4) The date correction mode is obtained with a push of the Ⓡ button. Then, correct dates by pushing the Ⓟ button.
5) The day correction mode is obtained with a push of the Ⓡ button. Then, correct days by pushing the Ⓟ button.
6) The calendar mode returns with a push of the Ⓡ button. Thus, correction of calendar is completed.

Note 1. Whichever correction mode is displayed, a push of the Ⓜ button immediately restores the calendar mode (*1). If any of the correction modes is left as it is for 2 or 3 minutes without a push of the Ⓜ button, the calendar mode returns automatically.
Note 2. Quick correction is possible with a continuous push of the Ⓟ button. (*2)
Note 3. In a leap year, date correction is necessary to display February 29th.

(5) Correction of alarm [Digital part]



<How to correct alarm>

1) The alarm mode is obtained with a push of the Ⓜ button.
2) A continuous push of the Ⓡ button for more than 2 seconds creates the alarm correction mode.
3) Alarm is turned on or off with a push of the Ⓟ button.
4) When correcting the alarm time, alarm should be turned on at first. The hour correction mode of alarm is obtained with a push of the Ⓡ button. Then, correct hours by pushing the Ⓟ button.
5) The minute correction mode of alarm is obtained with a push of the Ⓡ button. Then, correct minutes by pushing the Ⓟ button.
6) The switching mode between VOICE and ALM is obtained with a push of the Ⓡ button. Then, switch between the two by pushing the Ⓟ button.
7) The alarm mode returns with a push of the Ⓡ button. Thus, correction of alarm is completed.

Note 1. Whichever correction mode is displayed, a push of the Ⓜ button immediately restores the alarm mode (*1). If any of the correction modes is left as it is for 2 or 3 minutes without a push of the Ⓜ button, the alarm mode returns automatically.
Note 2. Quick correction is possible with a continuous push of the Ⓟ button. (*2)
Note 3. Alarm time is also linked to the 12H/24H displays.
Note 4. Alarm has priority over the recording and playback operations.

<Selection between VOICE and ALM>

VOICE and ALM are as follows:

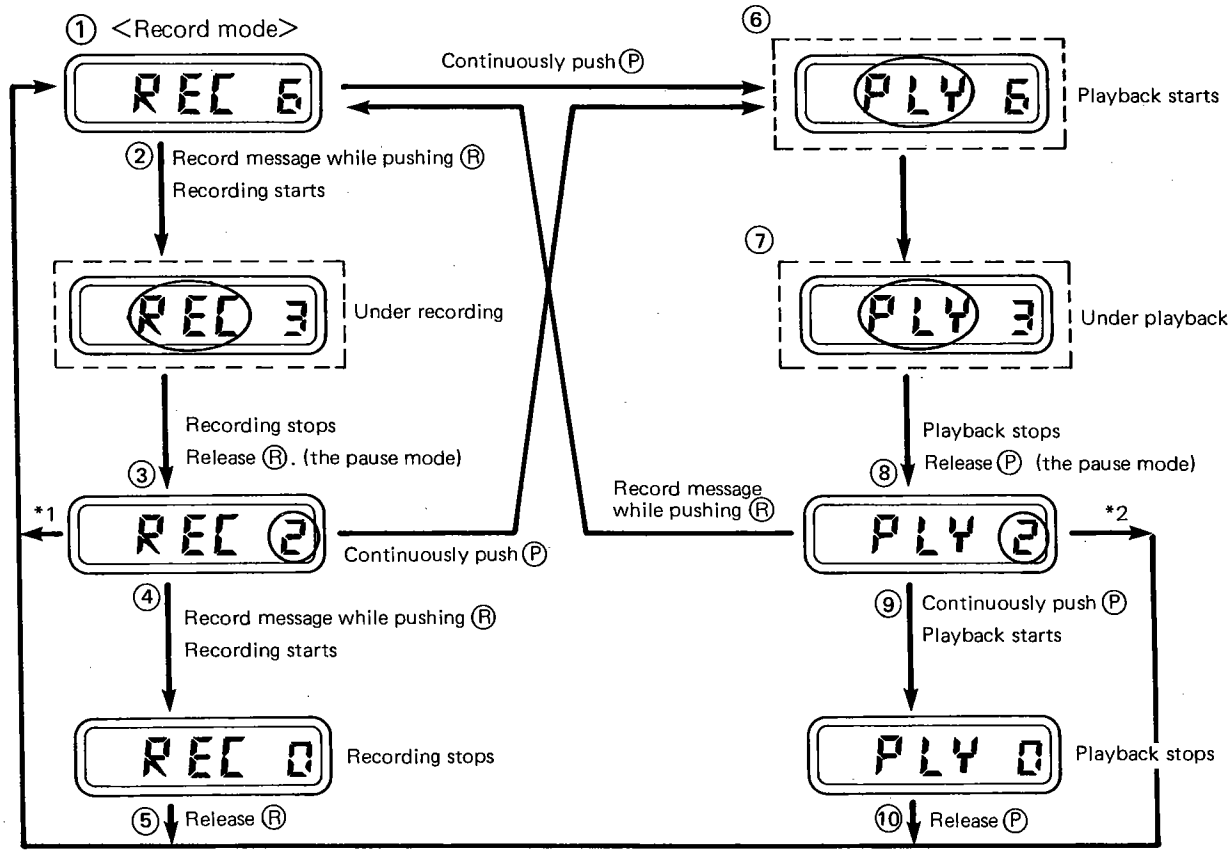
VOICE: melody (4 sec.) + playback (6 sec.) + melody (15 sec.)
ALM : melody (15 sec.)

<Sound monitor>

If the Ⓟ button is pushed down in the alarm mode, either VOICE or ALM which has already been selected when correcting alarm will be monitored.

Note 1. Alarm and sound monitor stop sounding with a push of any button.

(6) Recording and playback procedure



<Recording procedure>

1) The record mode (REC 6) is obtained with a push of the Ⓜ button.
2) Record the message while pushing the Ⓡ button. Talk in a usual way about 10 cm apart from the microphone (speaker). The letters "REC" flash while recording, which indicates that the recorder operates. The time limit for recording counts down from six seconds to zero.
3) When the recording is finished, release the Ⓡ button. If the displayed time limit for recording flashes, recording is still available. (the pause mode)
4) Record the message once again while pushing the Ⓡ button.
5) When the letters "REC" stop flashing and are displayed continuously, and when the time limit for recording reaches zero, the recording function is suspended. Release the Ⓡ button, and the record mode (REC 6) returns.

<Playback procedure>

6) If the Ⓟ button is continuously pushed down in the record mode (REC 6), the message which has already been recorded will be played back.
(It is possible to play back the message in any mode other than the record mode, however, the display which indicates that the message is being played back is not available.)
7) The letters "PLY" flash while the message is played back. Synchronized with the time limit for recording, the time limit for playback counts down from 6 seconds to zero.
8) When correcting the message which has already been played back in the midst of the playback, release the Ⓟ button first to create the pause mode and then record a new message while pushing the Ⓡ button.
9) If the Ⓟ button is continuously pushed down once again, the message which has already been recorded will be played back.
10) When the letters "PLY" stop flashing and are displayed continuously, and when the time limit for playback reaches zero, the playback function is suspended. Release the Ⓟ button, and the record function is restored.

<Notes on recording and playback>

Note 1. The recorded message is erased simultaneously with the start of the recording procedure.

Note 2. If the pause mode for recording is left as it is for about one minute, the record mode (REC 6) returns automatically (*1).

Note 3. If the pause mode for playback is left as it is for about 10 seconds, the record mode (REC 6) returns automatically (*2).

Note 4. If the message is recorded using too quiet a voice, it may sometimes be difficult to hear when playing back. When recording is over, make sure that the message has been well recorded.

Note 5. When the power cell comes to the end of its life, or after the power cell is replaced with a new one, the recorded message is erased.

■4. NOTES ON REPLACING POWER CELL

- This watch employs 3 units of silver oxide power cells, one of which is mounted in the analog part and the remaining two, in the digital part.
- When replacing the power cells, be sure to replace all three with new ones, all at the same time.
- After new power cells are mounted, never fail to reset all displays.
- If they are not reset, non-existing displays may sometimes be presented.

<How to reset all the display>

After replacing the power cells, keep pushing the buttons Ⓡ, Ⓜ and Ⓟ simultaneously for about one second.

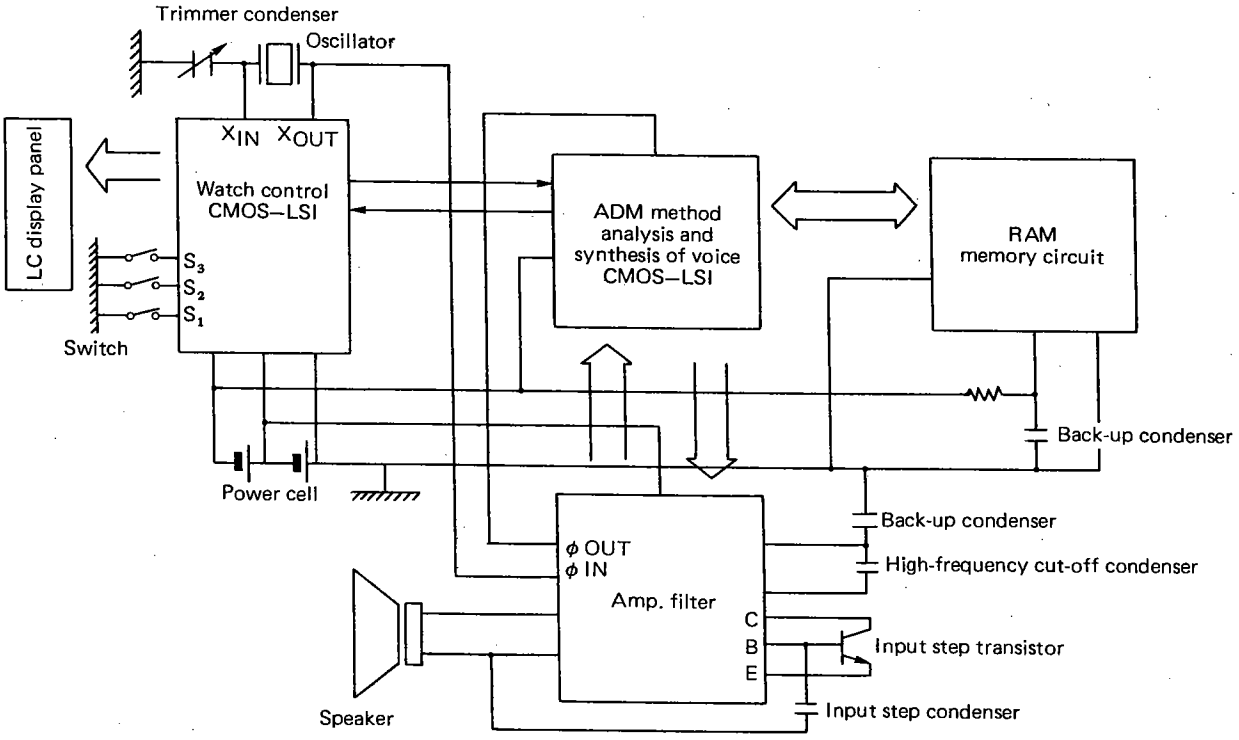
If each of the three buttons is released, all the displays will appear, and the normal time mode returns in two seconds. Thus, resetting of all the displays is finished, and the following are on display.

Time mode : AM 12 h. 00 min. 00 sec.
Calendar mode : January 1st, Sunday
Alarm mode : OFF
Record mode : REC 6

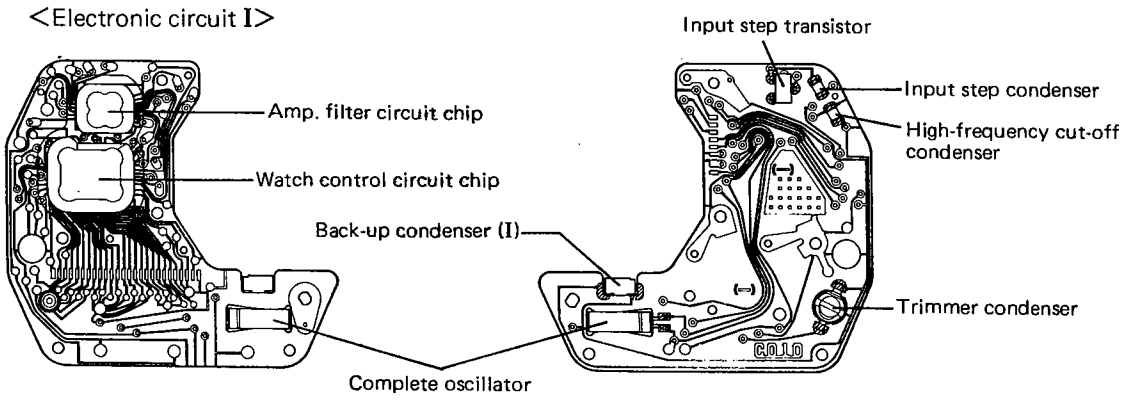
■5. CONSTITUTION OF MOVEMENT

This watch (Cal. C010) consists of the analog part (Cal. 2020A) and the digital part.
There is no linkage between the analog and digital parts. For details of the analog part, refer to the technical materials for Cal. 2020A.
Explanation of the digital part will be given below.

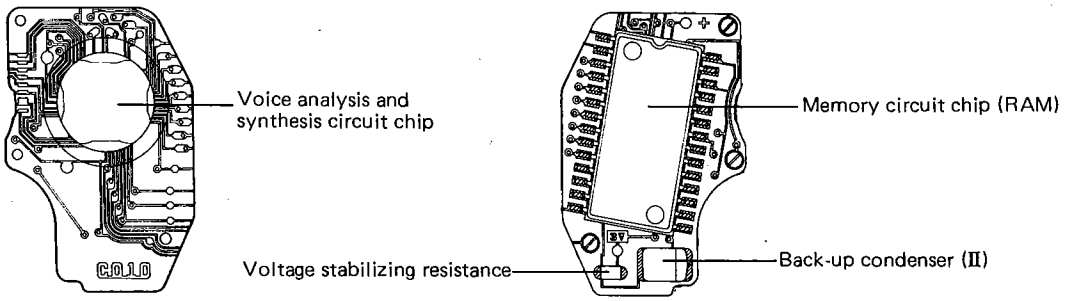
(1) Constitutional diagram of the entire digital part



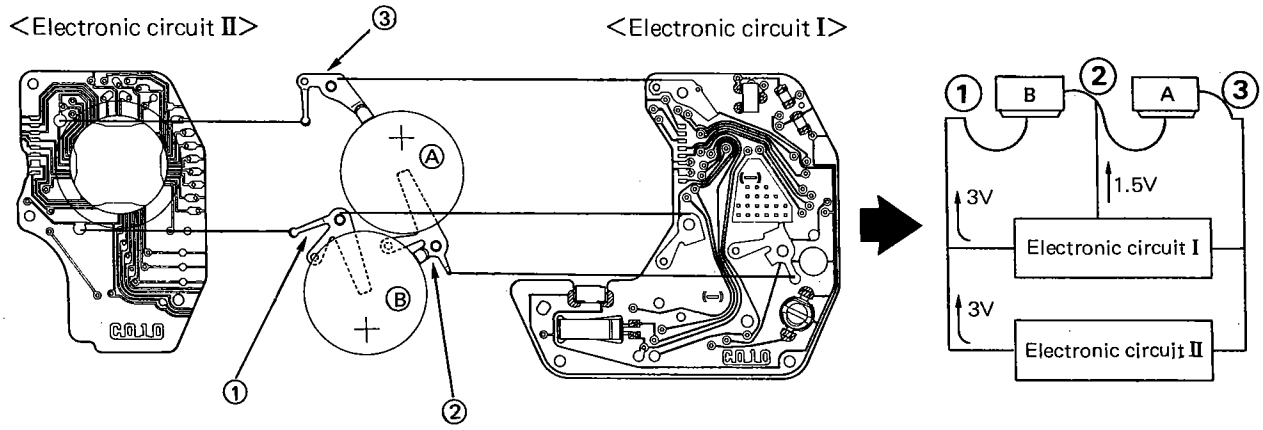
(2) Constitution of electronic circuit



<Electronic circuit II>



(3) Applied voltage system



As shown in the above diagram, the electronic circuits I (Watch control circuit + Amp. filter circuit) and II (Voice analysis and synthesis circuit + Memory circuit), both of which compose the digital part, are generated by mutually different voltages.

Therefore, power cells Ⓐ and Ⓑ are connected in series using the power cell connector springs I ① and II ② and the power cell holder ③, and thus voltage is applied to each circuit.

<Voltage needed to generate each cirucit>

- Electronic circuit I
  - Watch control circuit — 1.5 V (Power cell Ⓐ) (When generating the LC display panel, 3 V (Power cells Ⓐ + Ⓑ) are necessary.)
  - Amp. filter circuit — 1.5 V & 3 V (Power cell Ⓐ & Power cells Ⓐ + Ⓑ)
- Electronic circuit II
  - Voice analysis and synthesis circuit — 3 V (Power cells Ⓐ + Ⓑ)
  - Memory circuit RAM — 3 V (Power cells Ⓐ + Ⓑ)

(4) ADM method-employed IC for voice analysis and synthesis CMOS–LSI

With the aid of the ADM (Adaptive Delta Modulation) method, this IC enables voice analysis and synthesis. Voice analysis is made with the conversion of voice signals (voice waveforms) into digital signals, while voice synthesis is carried out by converting analyzed digital signals into voltage signals.

<Voice signal analysis by means of ADM method>

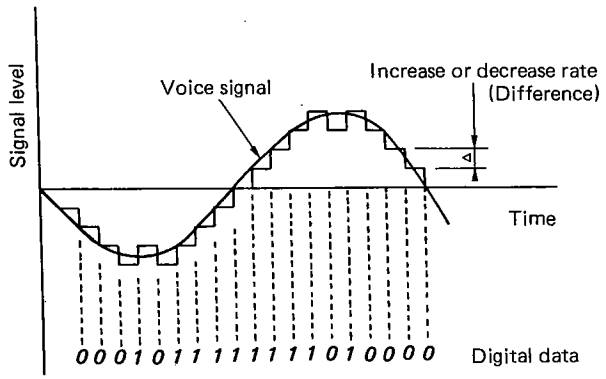


Fig. 1

Voice signals (voice waveforms) are sampled by using a sufficiently high frequency (sampling frequency: approx. 11 kHz).

The voice signal value right after sampling is compared with the one obtained from previous sampling, every 0.1 m second.

If the value obtained from sampling surpasses the one of the previous sampling, it is identified with "Digital code 1", and if it comes below the previous sampling value, it is identified with "Digital code 0".

Thus, changes in the voice signals are explained in the form of digital codes, as shown in the diagram to the left.

The above-mentioned process is named voice analysis. Analyzed data (digital signals) are transmitted to the different IC from this, namely the memory circuit called RAM (Random Access Memory), and stored in the circuit. In short, the voice is digitally recorded.

<Voice signal synthesis by means of ADM method>

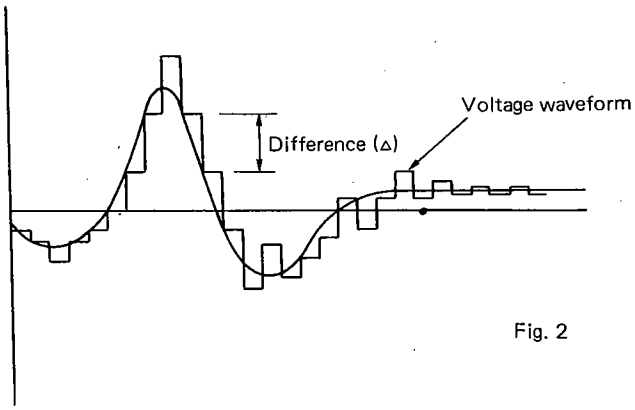


Fig. 2

When playing back, digital signals are output from the memory circuit RAM to the voice synthesis circuit.

The voice synthesis circuit converts digital signals into voltage, every 0.1 m second.

If the digital signal is "1", it is converted into plus voltage, while it is converted into minus voltage when it is identified with "0".

As shown in Fig. 2, a continuous output of the digital signal "1" extends the increase rate (difference Δ) of the ⊕ voltage, and a continous output of the digital signal "0", the decrease rate (difference Δ) of the ⊖ voltage.

On the other hand, the difference (Δ) will decrease if digital signals "1" and "0" are interchangeably output.

If the increase or decrease rate of voltage (difference Δ) is kept constant at the time of synthesis, the digital signal cannot keep up with the drastic change in the voice signal, and thus the overload noise is created, as shown in Fig. 3.

<Overload noise>

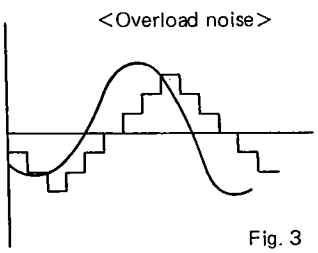


Fig. 3

<Granular noise>

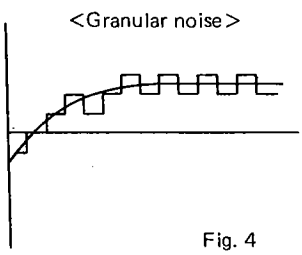


Fig. 4

On the other hand, when the voice signal that does not almost change is transmitted, short waveform of difference (△) will remain, thus causing the granular noise, as shown in Fig. 4.

Consequently, by keeping a certain rate of difference (△), noise reduction and tone-quality improvement are achieved.

In this way, the digital signal is converted into the voltage signal (voltage waveform) which has low noise and that is improved in sound quality to the level of the live voice.

<Creation of sampling frequency>

Sampling frequency is created to indicate how many times the change in voice signals is sampled and is digitally displayed, in a second. In other words, the sampling frequency is used to set the number of bits per second on which sound quality is dependent.

The sampling frequency is established based on the oscillation by both the watch control circuit and the voice analysis and synthesis circuit.

If the sampling frequency is made higher, it becomes easy to follow the voice signal, and thus sound quality improves, however, the time limit for recording shortens.

If the sampling frequency is made lower, the time limit for recording becomes longer. However, sound quality will deteriorate because it becomes difficult to follow the voice signal.

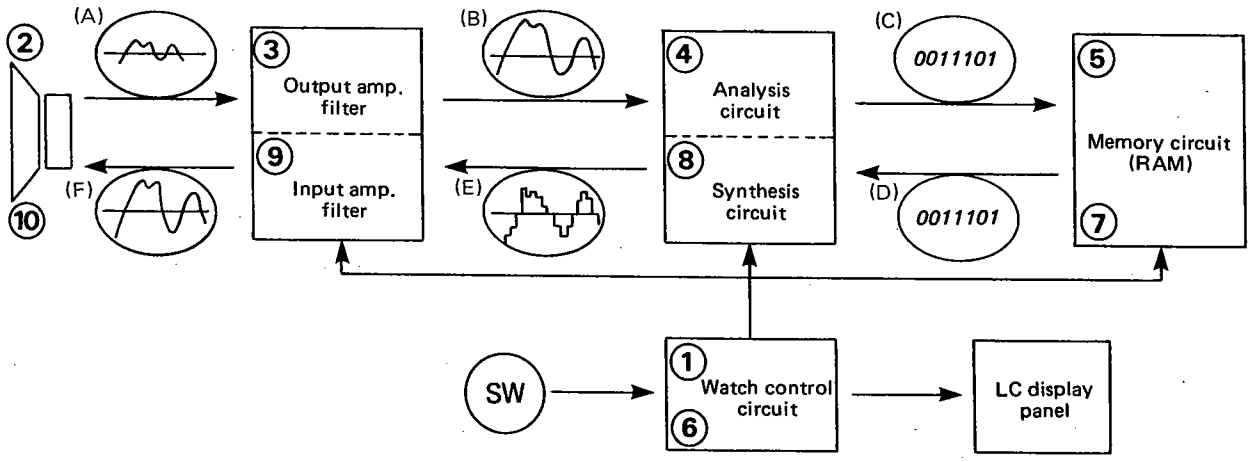
In this watch, the sampling frequency is set at 10.9 kHz so that high quality sound can be heard. As a result, time limit for recording or playback is restricted to a 6 second period.

The equation given below shows the relation between the sampling frequency and time limit for recording or playback.

$$\text{Sampling frequency} = \frac{\text{Memory capacity (64 k bit)}}{\text{Time limit for recording}}$$

■6. SYSTEM FOR RECORDING AND PLAYBACK

<System for recording and playback>



(1) Recording system

1) A push of the REC button in the recording mode causes the watch control circuit to output the control signal that is transmitted to the input and output amp. filters, the voice analysis and synthesis circuits and the memory circuit. Thus, the recording becomes available.
2) Talk into the speaker in a usual manner when you record your message. At this time, the speaker serves as the microphone, converting voice into the subtle electric signal (A).
3) The input amp. filter amplifies the subtle electric signal (A) which travels in from the speaker, cutting off the high frequency element which creates noise. (B)
4) The analysis circuit converts the amplified electric signal into the digital displays like "0" and "1", with the aid of the ADM method. (C)
5) Then, the digital codes "0" and "1" are stored in the memory circuit (RAM).

(2) Playback system

6) A push of the PLY button in the recording mode causes the watch control circuit to output the control signal that is transmitted to the input and output amp. filters, the voice analysis and synthesis circuits and the memory circuit. Thus, playback becomes available.
7) The memory circuit reads the digital codes which have been stored in it. (D)
8) The synthesis circuit synthesizes the digital codes in the tiered analog waveform (E).
9) The output amp. filter restores the analog waveform to the voice waveform, amplifying it. (F)
10) The amplified voice waveform drives (vibrates) the speaker, thus playing back the voice.

<Functions of the main IC>

(1) Concerning the memory circuit

Storing the data (digital codes) in the memory circuit (memory) is defined as "Write". Fetching the data stored in the memory circuit is called "Read". "Write" and "Read" are collectively called "Access".

The memory circuit is comprised of RAM (Random Access Memory) and ROM (Read Only Memory). They have a use of their own.

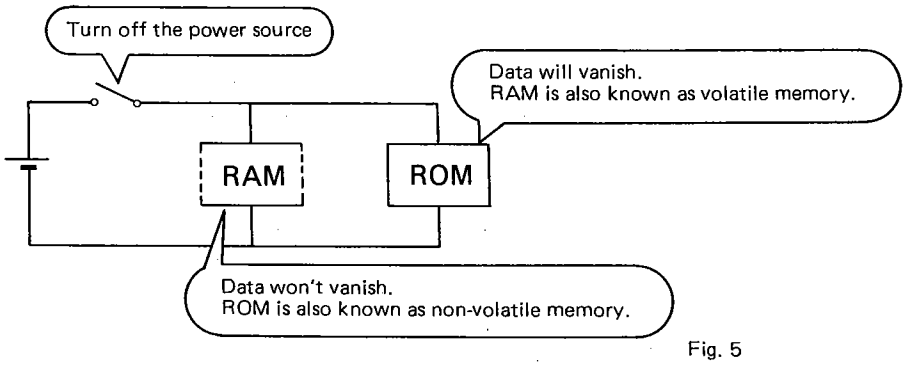


Fig. 5

Below are the differences between the RAM and the ROM.

RAM can read and write anytime without delay, which is explained by its other name RWM (Read Write Memory). If special measures are not taken, the stored data (digital codes) will vanish by turning off the power source, as shown in Fig. 5.

Meanwile, the ROM is a memory circuit exclusively used for reading. Once data are written, they can be read without delay. The ROM does not allow writing except when special measures are taken, and it takes time for writing. On the contrary, the ROM won't lose data which have been stored in it, even though the power source is turned off.

ROM	Stored data won't vanish, even though the power source is turned off.
RAM	Reading and writing of data are easily possible.

This watch Cal. C010 employs the memory circuit RAM which freely reads and writes data, in consideration of its own functions of recording and playback.

The RAM is a CMOS Static RAM which has a capacity of 64 k bits per chip, and it was first realized by the ultra-LSI, the most advanced technology of today. By adopting the ultra-LSI technology, a small-sized module for the wristwatch was achieved that consumes less electric power. The Static RAM (SRAM) uses one unit of FF (Flip Flop) to store 1 bit (minimum unit used to show amount of information, 1 bit means 1 digital code) of data. In other words, 1 bit of the Static RAM equals one unit of the Flip Flop.

The RAM employed by this watch has a memory capacity of 64 k bits, which means that it consists of about 64,000 units of Flip Flop. Accordingly, the RAM is able to store and read about 64,000 bits of digital codes ("0" and "1").

■7. NOTES ON DISASSEMBLY AND ASSEMBLY OF MOVEMENT

(1) Two units of screws with stage and electronic circuit II

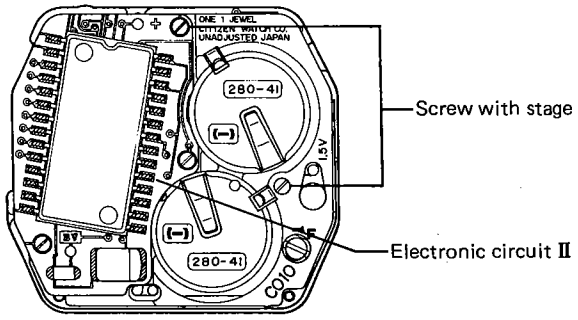


Fig. 6

As shown in Fig. 6, this watch uses two units of screws with stage. These screws secure the electronic circuit II to the supporter for plate complete and also secure the power cell straps for checking (which fix 2 units of power cells respectively) to the supporter.

Attention should be paid to three other screws which fix the electronic circuit. One of the three is a screw with stage, and the remaining two are the commonly used screws. If the three are not mounted in the right position, they will be shorted when the power cell straps for checking are mounted. Accordingly, the watch won't run. Be sure to confirm that the screw with stage has been mounted in the right position.

(2) Connection of electronic circuits I and II

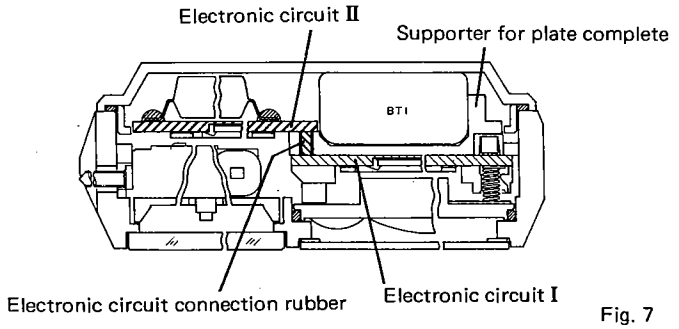


Fig. 7

The electronic circuit I is connected with the electronic circuit II, as shown in Fig. 7, by the electronic circuit connection rubber which is positioned by the supporter for plate complete.

Be careful not to forget to mount the electronic circuit connection rubber when assembling the movement.

(3) Power cell connector springs (I), (II) and power cell holder

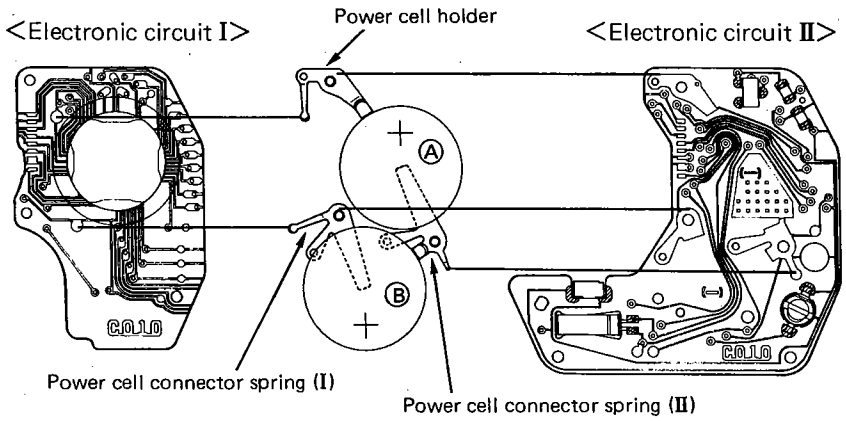


Fig. 8

The power cell connector spring (I), (II) and the power cell holder connect power cells Ⓐ and Ⓑ in series, as shown in Fig. 8, and apply voltage to the electronic circuits I and II.

Each of the above-listed three is positioned by the dowel of the LC display panel supporter.

Be sure to confirm that they are in the correct position when assembling. Further, confirm that each of the three contacts with each pattern of the electronic circuits I and II in the correct way.

(4) Switch spring and insulator sheet

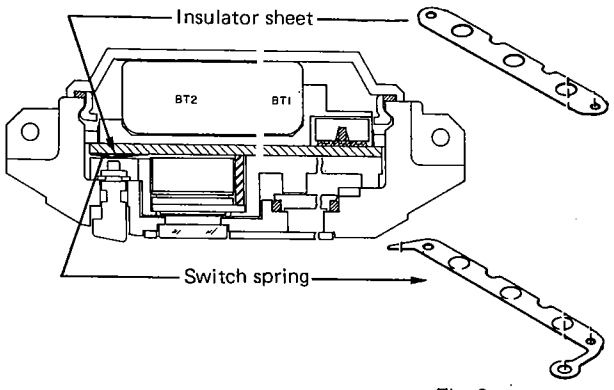


Fig. 9

The switch spring is positioned by three dowels of the LC display panel supporter, and the insulator sheet, by two dowels of the LC display panel supporter. Mount the switch spring first and then the insulator sheet on the LC display panel supporter using the dowels.

If the assembling order is reversed, the switch spring comes in contact with the pattern of the electronic circuit I. Be careful not to mount them by mistake.

When checking the switch mechanism after the module is completed, do not push the switch spring with a sharp tool like tweezers, or it may break, because it is as thin as 40μ. In addition, the switch won't operate properly.

(5) Handling speaker

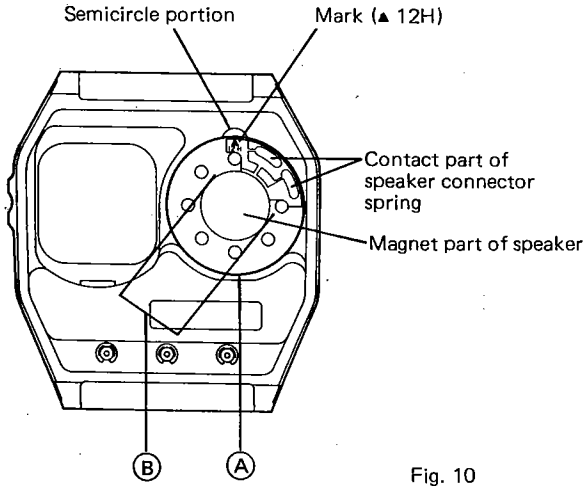


Fig. 10

1) Removal of the speaker

   Pry up the section Ⓐ shown in Fig. 10 with the screwdriver, and the speaker is removed from the case. If the screwdriver slips out of place, the cone (vibrating plate) of the speaker may be damaged. Handle the speaker with care.

   The speaker is provided with 7 holes. Do not insert the tweezers into these holes to remove the speaker. Insertion of the tweezers makes a hole in the cone (vibrating plate).

2) Handling the speaker singly

   When handling the speaker singly, either pick up the section Ⓑ shown in Fig. 10 with the tweezers or take up the circumference of the speaker with fingers. Be sure to handle the speaker with a stall on a finger, or it may be rusted.

   Place the speaker with the cone (vibrating plate) facing up. If it is placed with the cone facing down, the cone may be deformed.

   The speaker has the magnet incorporated in it. Use the non-magnetic tweezers.

3) Mounting the speaker

   Mount the speaker packing with silicon oil applied around it, into the case.
   Place the speaker so that the mark (▲ 12H) on the speaker may come to a semicircle portion provided on the case. Then, fix the speaker to the case by pressing the magnet part of the speaker.

   If the speaker is fixed to the case at random, the speaker connector spring won't contact with the contact portion (pattern) of the speaker, thus causing a defective operation of recording and playback.

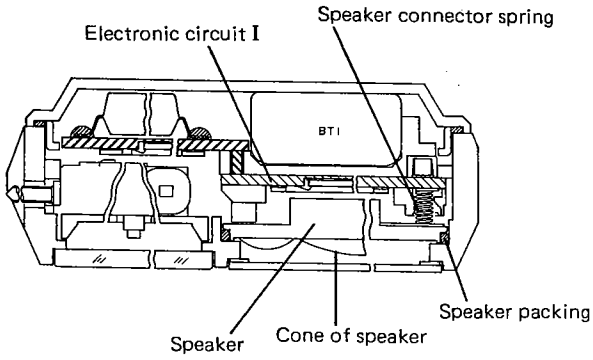
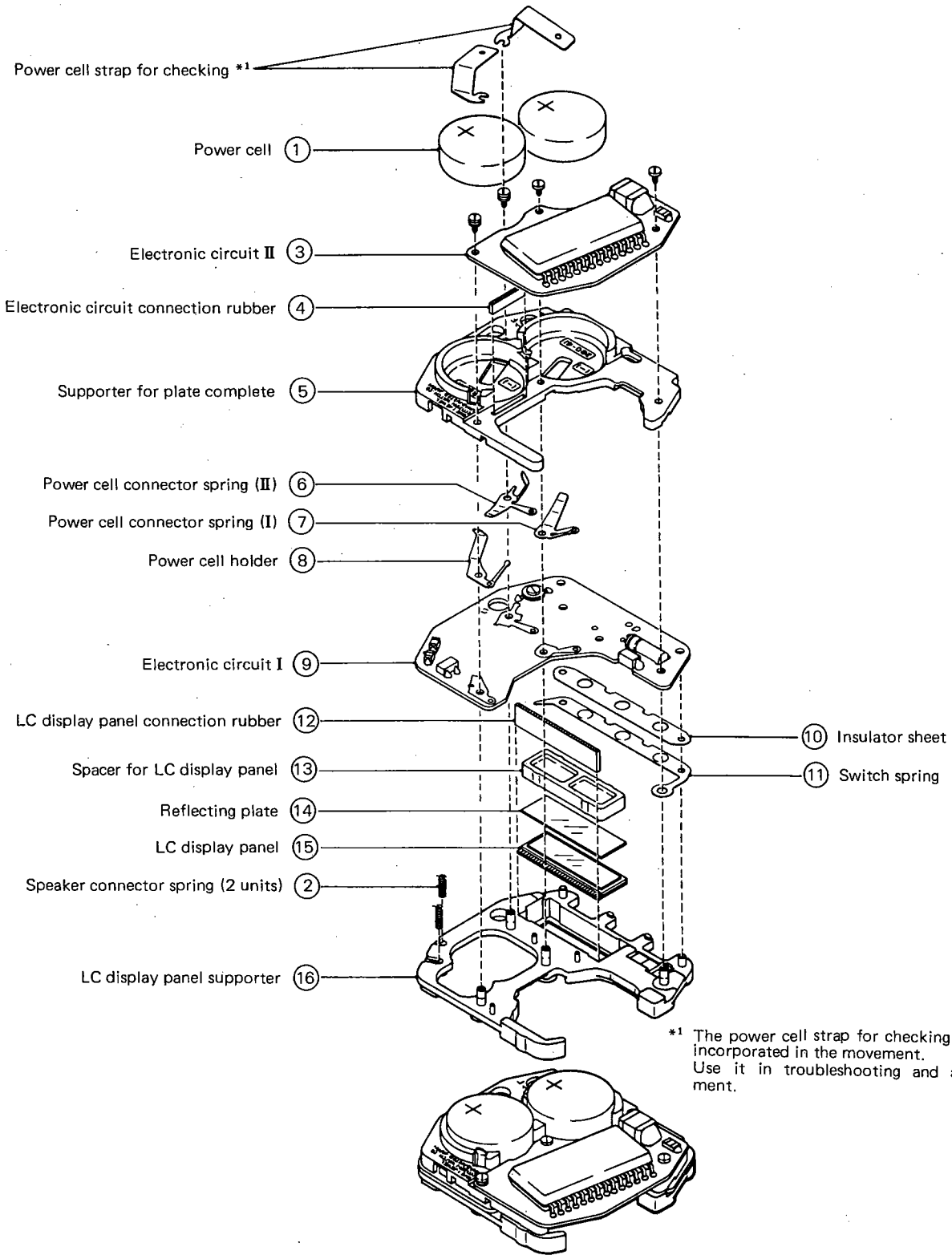


Fig. 11

■8. DISASSEMBLY AND ASSEMBLY OF MOVEMENT

(1) Digital block

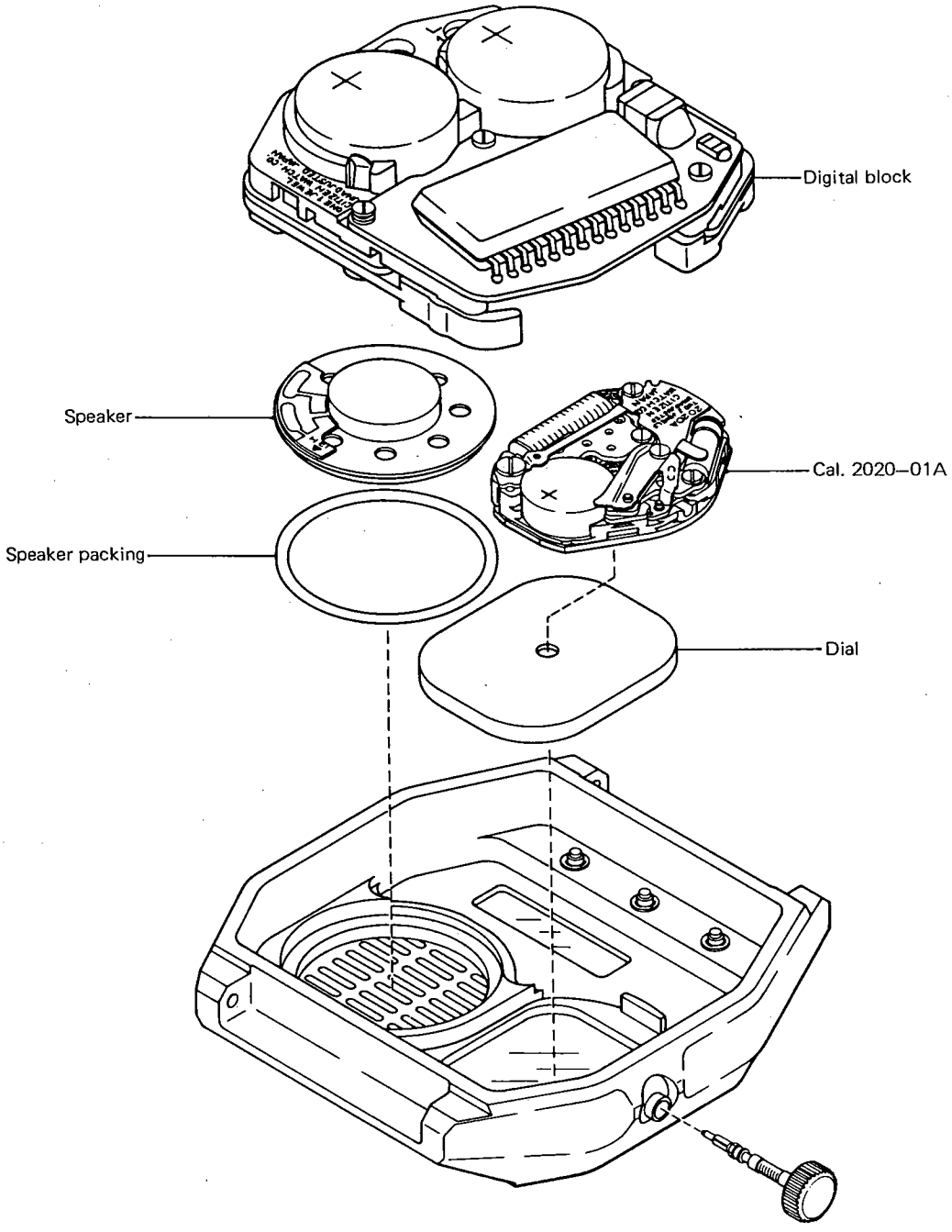
Disassembling procedure : ① → ⑯
Assembling procedure : ⑯ → ①



*1 The power cell strap for checking is not incorporated in the movement. Use it in troubleshooting and adjustment.

(2) Analog block and speaker

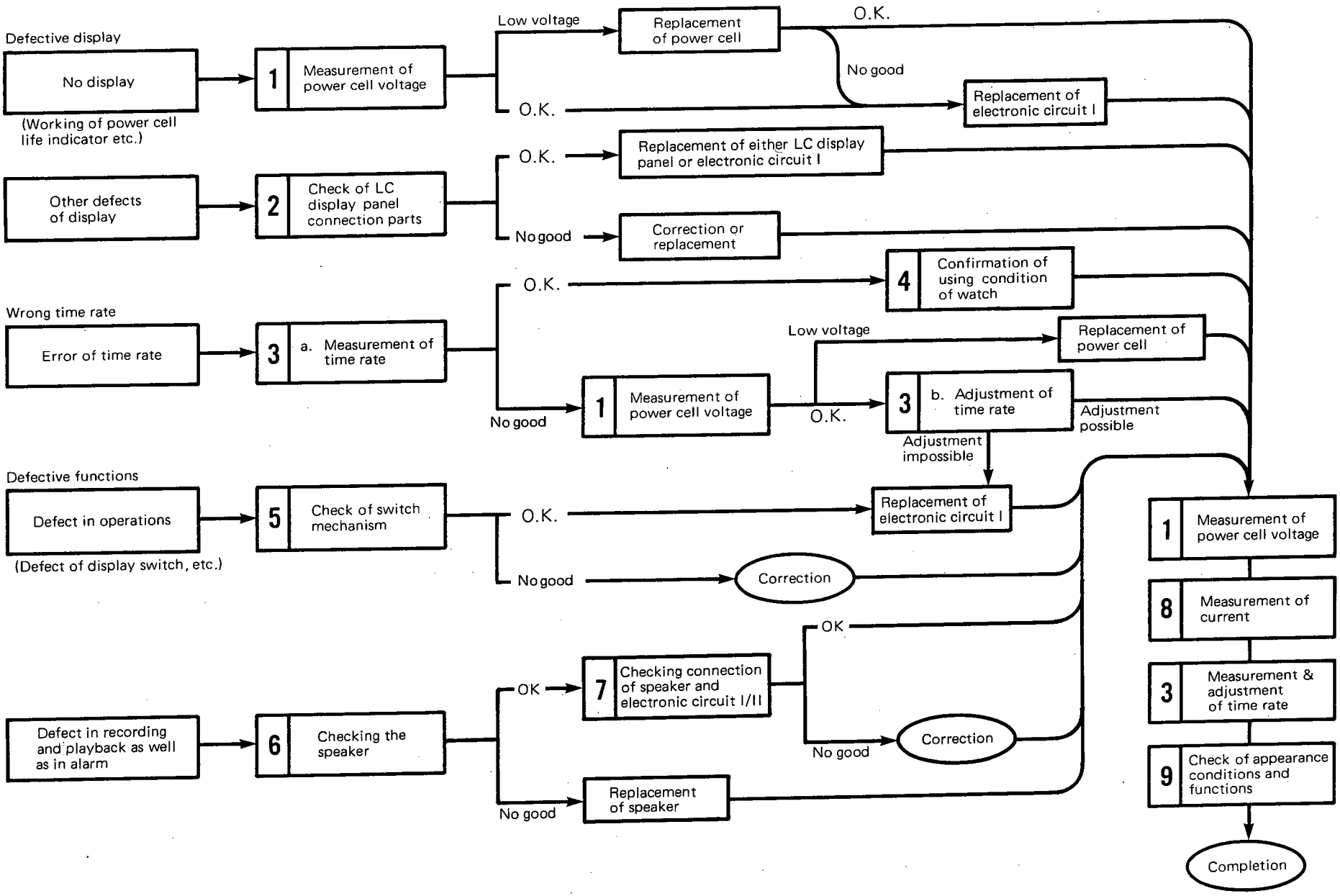
- For disassembly and assembly of the analog block, refer to Cal. 2020–01A.
- Normal disassembly and assembly do not include the removal of the speaker.

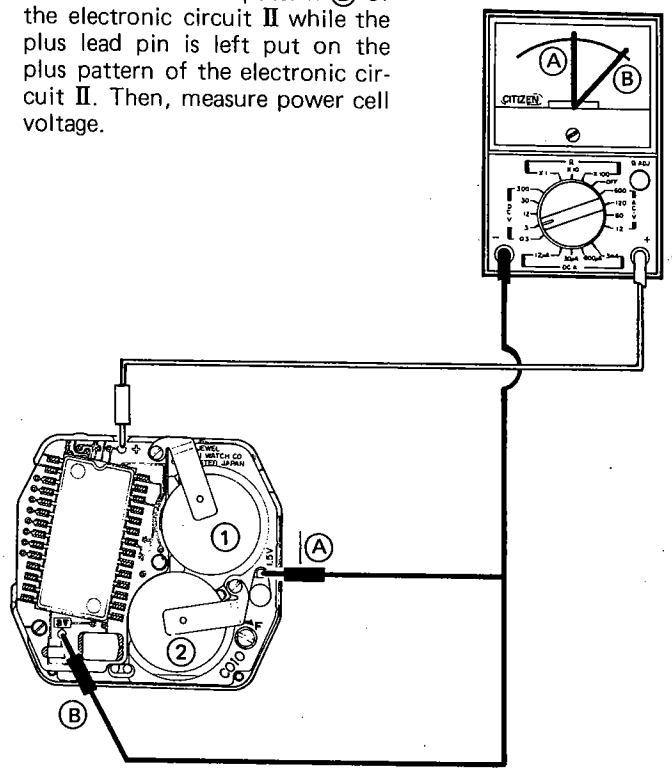
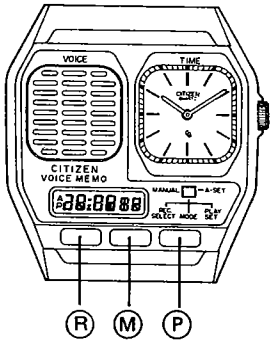


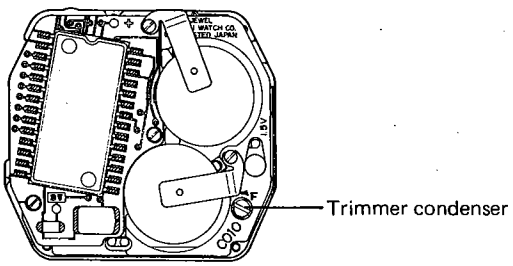
9. Troubleshooting and Adjustment

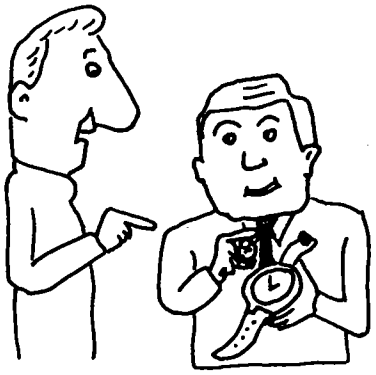
< Flow chart of troubleshooting and adjustment >

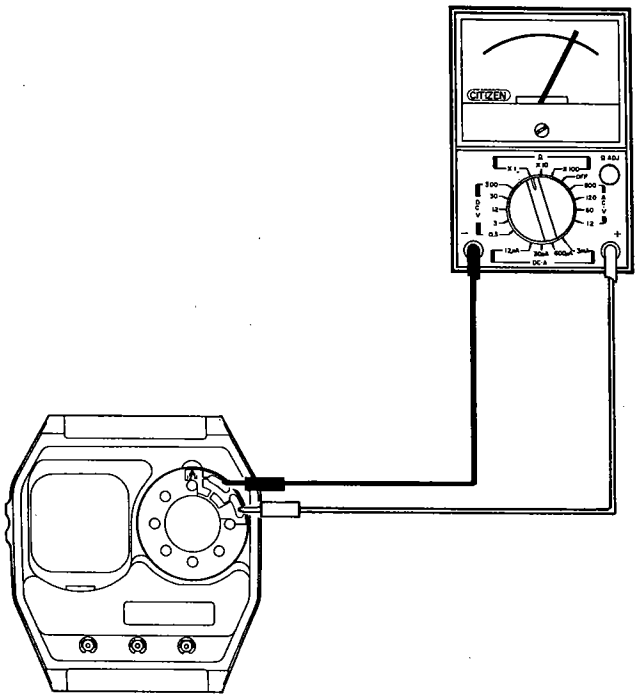
Note : For the troubleshooting and adjustment of the analog block, refer to Cal. 2020A. Below are the explanations about the digital block.



Checking items	How to check	Result and treatment
1 Checking power cell voltage	Mount the power cell strap for checking on the movement. Then, measure power cell voltage according to the following procedure. (1) Put the plus lead pin of the tester on the plus pattern of the electronic circuit II and the minus lead pin, on the minus pattern Ⓐ of the electronic circuit I. Then, measure power cell voltage. (2) Put the minus lead pin of the tester on the minus pattern Ⓑ of the electronic circuit II while the plus lead pin is left put on the plus pattern of the electronic circuit II. Then, measure power cell voltage. <Tester range: D.C. 3V> 	1. Over 1.5V → Power cell ① is non-defective. 1.5V is correctly applied to the electronic circuit I. Under 1.5V → Measure power cell voltage according to the item (2) explained to the left. 2. Over 3V → Power cells ① and ② are nondefective. 1.5V and 3V are correctly applied to the electronic circuits I and II, respectively. Under 3V → Measure the power cells separately for voltage. 3. Measuring power cells ① and ② separately; Respective voltage of power cells ① and ② is over 1.5V. → Check the connection part. Voltage of either one of the power cells ① and ② is under 1.5V. → Replace both ① and ② at the same time.
2 Checking connection part of LC display panel	(1) Check the lighting of all the segments All displays are reset with a simultaneous push of the buttons Ⓡ, Ⓜ and Ⓟ, and they keep lighting for approx. 2 seconds. At this moment, confirm which segment is defective. 	

Checking items	How to check	Result and treatment
	(2) Check the LC display panel, LC display panel connection rubber and electronic circuit I for conductivity. ●Make sure that the LC display panel, LC display panel connection rubber and electronic circuit I have all been properly mounted. ●Check that each conductive part (between the plate pattern and the LC display panel connection rubber, and also between the LC display panel connection rubber and the LC display panel) has no dust, dirt, cuts, cracks or scratches.	Bad mounting → Mount again Dust or dirt → Remove it Cuts, cracks, scratches or warps → Replace the defective part with a new one
3 Measurement and adjustment of time rate	(1) Measurement of time rate ●Measure time rate after fixing the power cells with the power cell strap for checking. In case the module has been mounted in the case, measurement should be made in the calendar mode (I.I.SU) or the recording mode (REC 6). In this watch, the microphone is away from the LC display panel as the buttons are provided on the front side, and thus it is difficult to receive the electric field effect from the LC display panel. The above-stated two modes are strong and stable in terms of the electronic field. ●Measure time rate with the MEASURE TIME of the tester set at 2 seconds. ●Set the MEASURE TIME to 10 seconds when measuring the analog part, as it employs D.F.C. (2) Adjustment of time rate ●Make an adjustment by turning the trimmer condenser clockwise.  	

Checking items	How to check	Result and treatment
4 Confirming using conditions	Make sure in which environment the customers use this watch checking the following points; ●Whether they handle it properly or not. ●Whether they use it beyond the effective temperature range. ●How long it has been since they have set the watch. 	
5 Checking switch mechanism	To learn which is defective, the push buttons or the movement, check the movement separately at first. (1) Checking the movement; ●Push the convex part of the switch spring with the flat portion of the screwdriver and bring it into contact with the pattern of the electronic circuit I to confirm the switch function. ●Confirm that the pattern of the electronic circuit has not peeled off and also confirm that the switch spring has not been deformed or cracked.	The switch function is available. → Check the push buttons. The switch function is not available. → Remove dust or dirt attached on the connection parts. The pattern has peeled off. → Replace the electronic circuit I. The switch spring has been deformed or cracked. → Replace the switch spring.

Checking items	How to check	Result and treatment
6 Checking speaker	(1) Checking coil resistance of the speaker; ●Mount the speaker into the case and put the lead pin of the tester on the speaker pattern which is in contact with the speaker connector spring. Then, measure coil resistance. <Tester range: x 1Ω  (2) Checking the speaker's appearance; Check the following points: ●Whether the cone (which is covered with cellophane) of the speaker has no cracks. ●Whether the speaker coil has been attached to the cone. ●Whether the lead wire of the speaker coil has not been broken. ●If there is no dust or dirt on the speaker pattern which is in contact with the speaker connector spring. ●If the cone of the speaker has not been deformed.	100 ~ 140Ω → Coil resistance of the speaker is nondefective. Beyond the above range → Replace the speaker. Cracks → Replace the speaker. The speaker coil has come off. → Replace the speaker. The lead wire has been broken. → Replace the speaker. Dust or dirt → Remove. The cone has been deformed. → Replace the speaker.

Checking items	How to check	Result and treatment
7 Checking connection parts of speaker and electronic circuits I/II	(1) Checking the connection parts of the speaker and the electronic circuits I/II, Conductivity is preserved between the speaker and the electronic circuit I by 2 units of speaker connector springs which are positioned on the LC display panel supporter.	

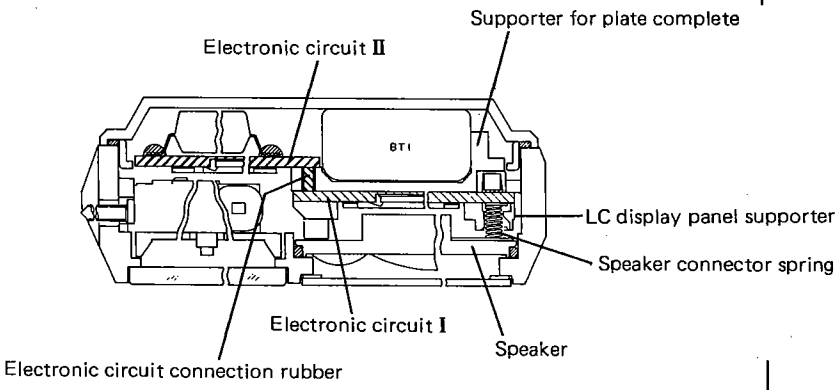
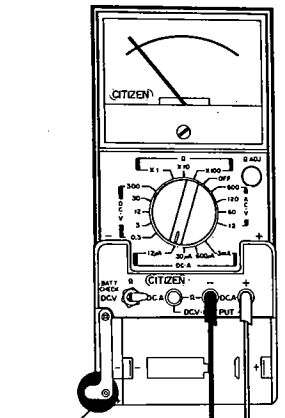


Fig. 12.

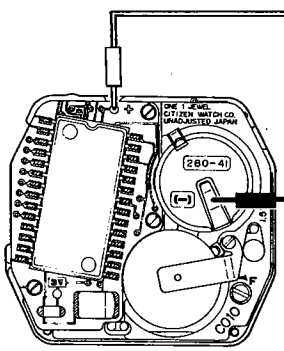
●Confirm that the speaker connection rubber has been properly mounted in the LC display panel supporter.	Bad mounting → Mount again.
●Check that each conductive part (among the pattern of the electronic circuit I, speaker connector spring and the speaker pattern) has no dust or dirt. Check also that the pattern has not peeled off.	Dust or dirt → Remove. The pattern has peeled off. → Replace it.
●Check if the speaker connector spring has not been bent.	The speaker connector spring has been bent. → Reform it.
●Confirm if the speaker has been properly mounted in the case.	Bad mounting → Mount again.
(2) Checking the connection between the electronic circuit connection rubber and the electronic circuits I/II; ●Confirm that the electronic circuit connection rubber has been mounted on the electronic circuits I/II.	Bad mounting → Mount again.
●Check that each conductive part (between the electronic circuit connection rubber and each pattern of the electronic circuits I/II) has no dust, dirt or cuts. Check also that the pattern has not peeled off.	Dust or dirt → Remove. Cuts or cracks, or the pattern has peeled off. → Replace the defective part with a new one.

Checking items	How to check	Result and treatment
8 Measurment of current	(1) Measuring current consumed by the entire watch; a) As shown in the illustration, mount one of the power cells near the trimmer condenser, and the other, on the adapter of the tester. Then, convert the tester into an ammeter. b) Put the minus lead pin of the tester on the power cell connector spring II, and the plus lead pin, on the plus pattern of the electronic circuit II to measure current consumed by the entire watch.	**Under 1.8μA** → Nondefective. **Over 1.8μA** → Remove the electronic circuit II and measure current.

<Tester range: D.C. 12μA>



Power cell



<Notes on measuring current>

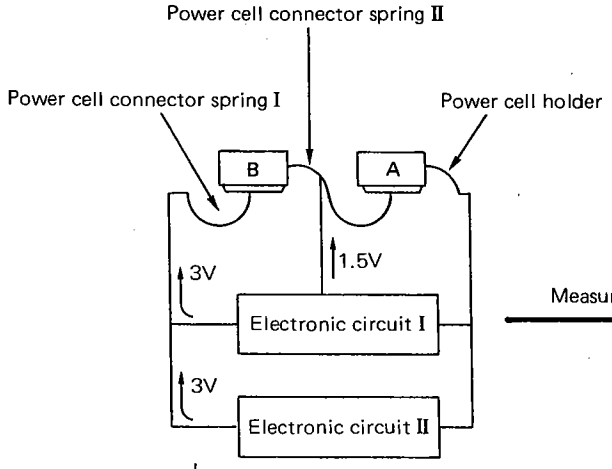


Fig. 13

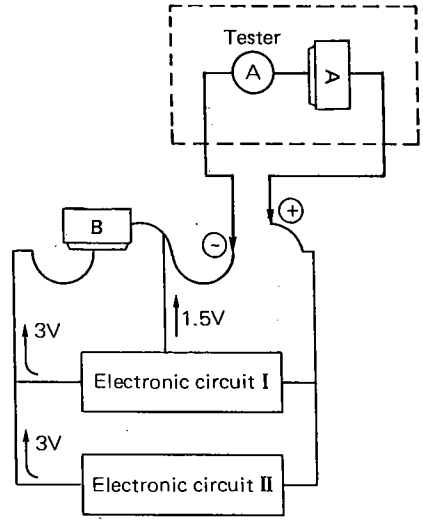
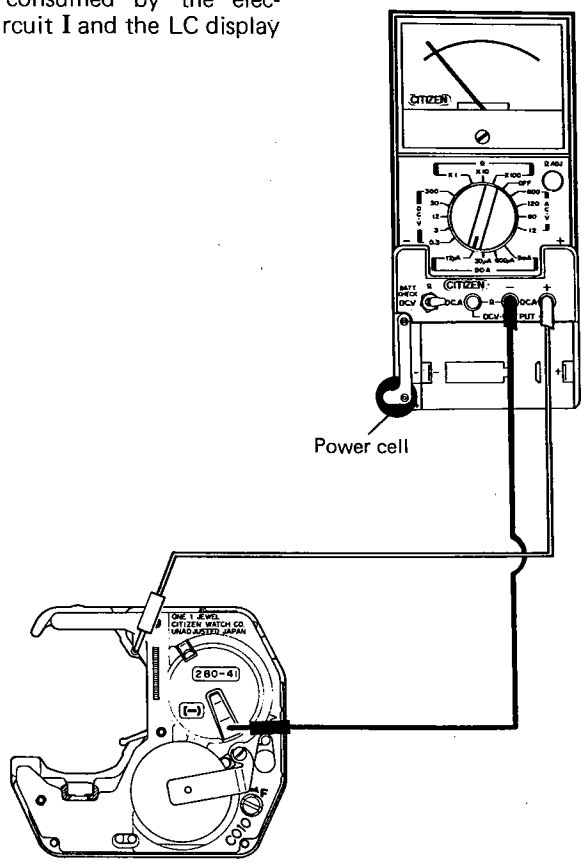
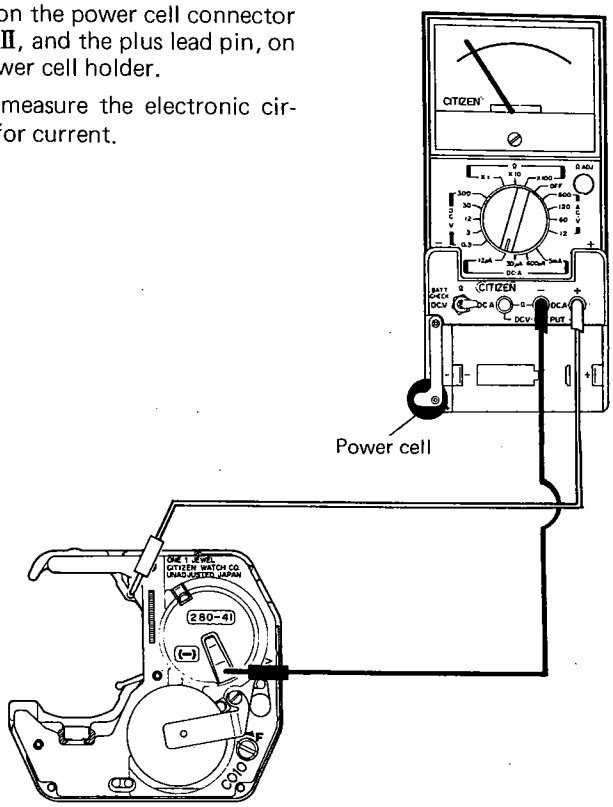


Fig. 14

Checking items	How to check	Result and treatment
	●In this digital block are 2 units of silver oxide power cells (1.5V) connected in series, thus applying 1.5V and 3V to the electronic circuits I and II, respectively, as shown in Fig. 13. Fig. 14 shows current measurement stated in the preceding item (1). Power cell Ⓑ is mounted in the watch and power cell Ⓐ, on the adapter of the tester. Current consumed by the entire watch is measured after the tester is set to an ammeter (Ⓐ). If the power cells Ⓐ and Ⓑ are reversely mounted, the 1.5V applied to the electronic circuit I won't flow into the tester (Ⓐ), thus reducing current. As a result, current consumed by the entire watch cannot be measured. To avoid the wrong measurement of current consumed by the entire watch, the tester (ammeter Ⓐ) has to be connected to the power cell connector spring II and the power cell holder. (For full details, refer to the item 5-(3). Applied voltage system.) (2) Measuring current with the electric circuit II left removed from the movement; Remove the electronic circuit II from the movement. Put the minus lead pin of the tester on the power cell connector spring II, and the plus lead pin, on the power cell holder. Then, measure current consumed by the electronic circuit I and the LC display panel. <Tester range: D.C. 12μA>  	**Under 1.4μA** → Replace the electronic circuit II. **Over 1.4μA** → Measure the electronic circuit I for current.

Checking items	How to check	Result and treatment
	(3) Measuring current consumed by the electronic circuit I; Further remove the LC display panel from the movement from which the electronic circuit II has already been removed. Put the minus lead pin of the tester on the power cell connector spring II, and the plus lead pin, on the power cell holder. Then, measure the electronic circuit I for current. <Tester range: D.C. 12μA>  	**Under 1.3μA** → Replace the LC display panel. **Over 1.3μA** → Replace the electronic circuit I.
9 Checking appearance and functions	(1) Check that there is no dust or dirt inside the watchcase. (2) Check that all the segments have been provided. A simultaneous push of the buttons Ⓡ, Ⓜ and Ⓟ causes all the segments to light up for approx. 2 seconds. At this moment, confirm that all the segments have been provided. (3) Checking the recording and playback functions; Check that the recording and playback functions operate properly. Noise checking is possible by recording silence and playing it back. (4) Checking the sound monitor, Confirm that the sound (VOICE or ALM) selected during correcting the alarm is monitored by pushing the button Ⓟ in the alarm mode. Further, confirm that the sound stops with a push of any button during monitoring the sound. (5) Checking the operation of the push buttons; Check the following points: ● If the push buttons are smoothly operated. ● If the mode-change or each correction procedure of hour, calendar and alarm is carried out by operating the push buttons.	

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