TECHNICAL INFORMATION

CITIZEN QUARTZ

Cal. No. 944※※

CITIZEN

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§1. OUTLINE

This is a digital watch with quartz crystal oscillation, which has been developed based on the mechanism of Cal. No. 9420/9460-series watches and with addition of a pacemaker.

With this pacemaker newly incorporated, this caliber will be suited especially to the lovers of sports including the jogging and the like.

§2. FEATURES

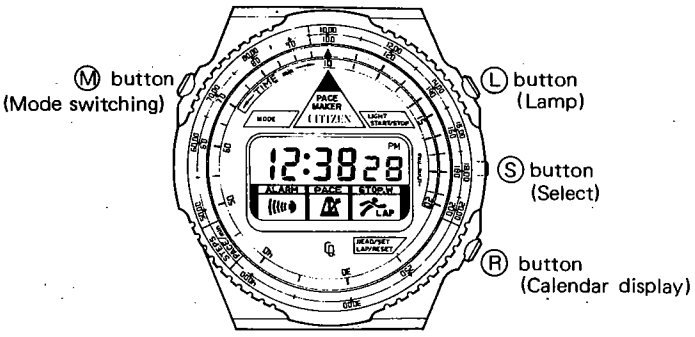
1) With addition of pacemaker, the application of this watch will be extended not only to the sports activities including the jogging or the like but to a musical instrument such as a metronome, etc.

2) For the stopwatch function, the 5-minute timing is possible through a coaction with the pacemaker.
This timer function plus the pacemaker and alarm functions will enhance the capacity of the watch in the field of sports activities.

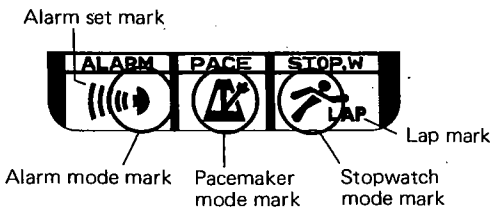
§3. SPECIFICATIONS

Caliber No.		9440A
Size of module		28mmϕ (max. 29mmϕ) x 5.65 mm^t
Accuracy		±15 sec./month at normal temperature
Oscillation		32,768Hz
Display system		FE (Field Effect) type nematic LC (Liquid Crystal), 2-division multiplex driving
Integrated circuit		C/MOS-LSI (1 unit)
Effective temperature range		±0 ~ +55°C (+32 ~ +131°F)
Adjustment of time rate		D.F.C.
Setting of time and calendar		Push-button of method
Power cell (Lithium cell) (MnO_2/Li)		Parts No.: 280-203 Cell code: CR2316 Nominal voltage: 3V Capacity: 100mAH Size: 23mmϕ x 1.6mm^t Life time: About 5 years (5 sec. lamp 30 sec. alarming per day, 15 min. pacemaker per week)
Additional functions		●12-/24-hour switching function ●Auto-return function ●Instant manual return function ●Illumination lamp ●Fully automatic calendar function (incl. leap year) ●5-minute timer (Stopwatch)
Display functions	Time display	Hour: minute second (12-hour AM/PM display)
	Alarm display	Hour: minute ON/OFF (12-hour AM/PM display) Alarm mode mark & alarm set mark
	Pacemaker display	Pace numbers (000 ~ 239) & pacemaker mode mark
	Stopwatch display	Minute "Sec." 1/100 sec. (less than 60 min.) Hour: minute second (more than 60 min., 12-hour counting) Stopwatch mode mark & lap mark
	Calendar display	Month, date, day (0, 1, 2 and 3 displayed for setting leap year at correction of time)

External view with display



●Display of function

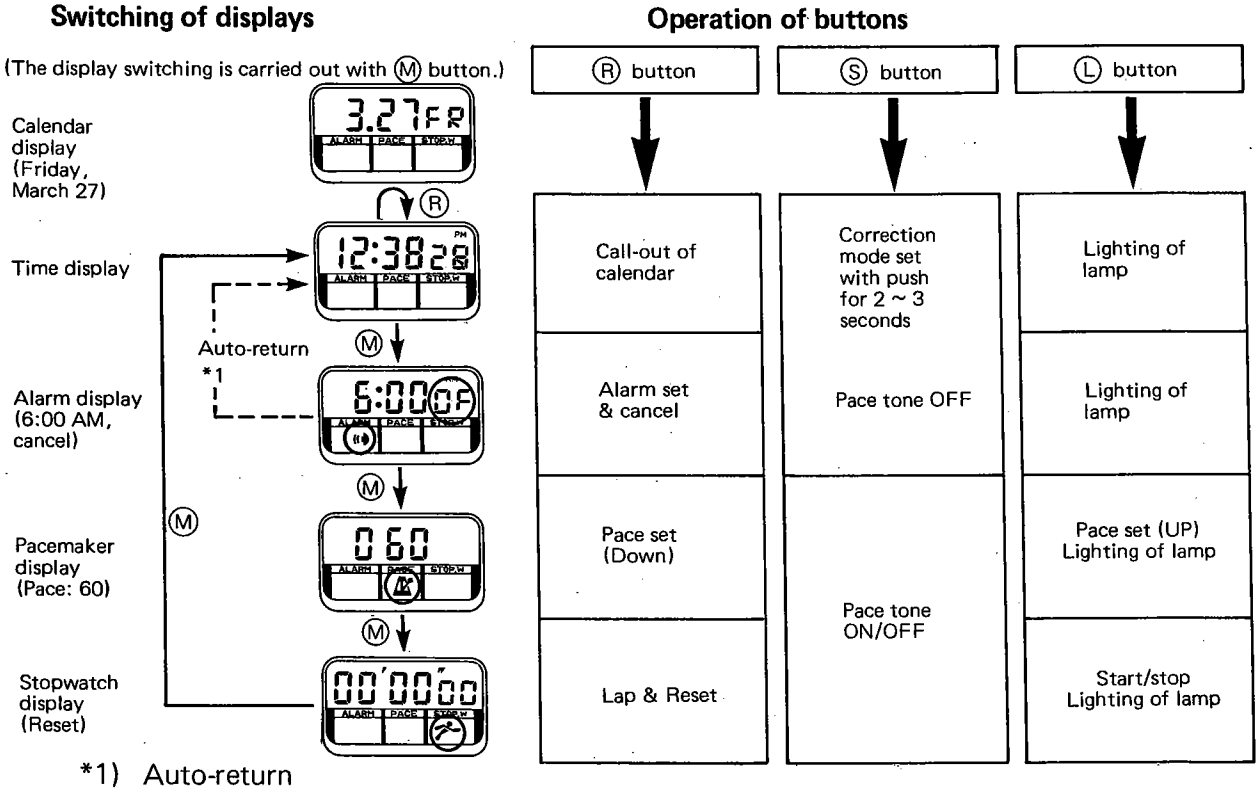


*The marks other than the above are printed on the light diffusing plate.

Others	Alarm glass vibrating system

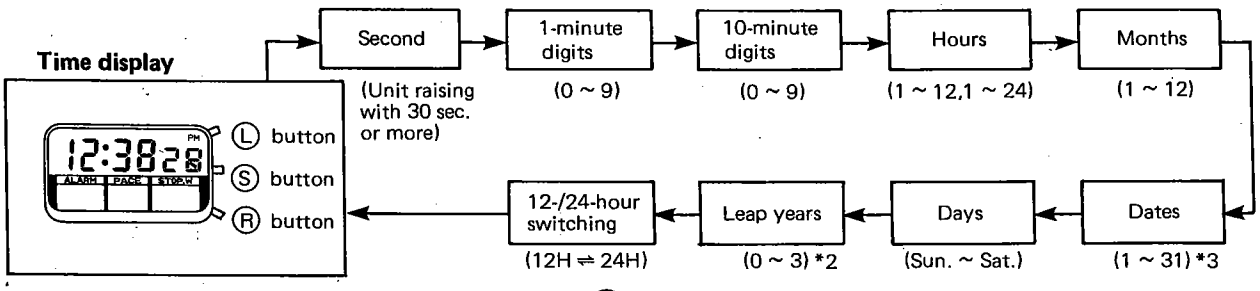
§4. HANDLING INSTRUCTIONS

4-1. Display switching method and function of each button (The flashing is shown by ○)



*1) Auto-return
The time display is reset automatically in 1 or 2 minutes.

4-2. Setting of time and calendar (Ⓢ button: For call-out of setting area; Ⓡ button: For setting)



The setting mode is secured with puch of Ⓢ button for 2 ~ 3 seconds under time display.

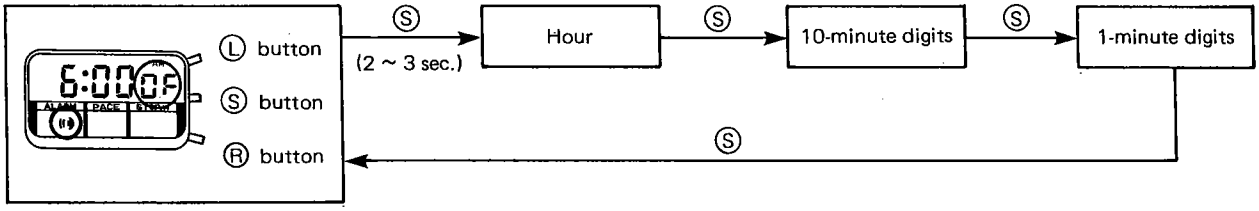
The setting area shifts as shown in the above diagram with every push of Ⓢbutton. The setting is carried out via Ⓡ button.

- The setting area is shown with flashes. (The flashing is given only to 0 when setting the leap year.)
- Instant manual return: The time display can be given with push of Ⓛ button in any setting mode.
- Auto-return: The time display is reset automatically in 1 ~ 2 minutes from any setting mode.

*2) Setting of leap year
The leap year is set by the residual which is obtained by dividing the number of the dominical year by 4. For example, the year "1981" is set by "1". And the leap year is set by "0".

*3) If the non-existing date, e.g., "April 31" is set, the date turns automatically into the next day, i.e., May 1.

4-3. Setting of alarm time (The flashing is shown by ○).



- The "set" and "cancel" of the alarm change alternately under the alarm display with every push of Ⓡ button, and are shown by " ON" and " OFF" respectively.
- Both the "instant manual return" and "auto-return" are identical to those in the setting of time and calendar. However, the instant manual return is reset to the alarm display and the auto-return to be reset to the time display respectively.

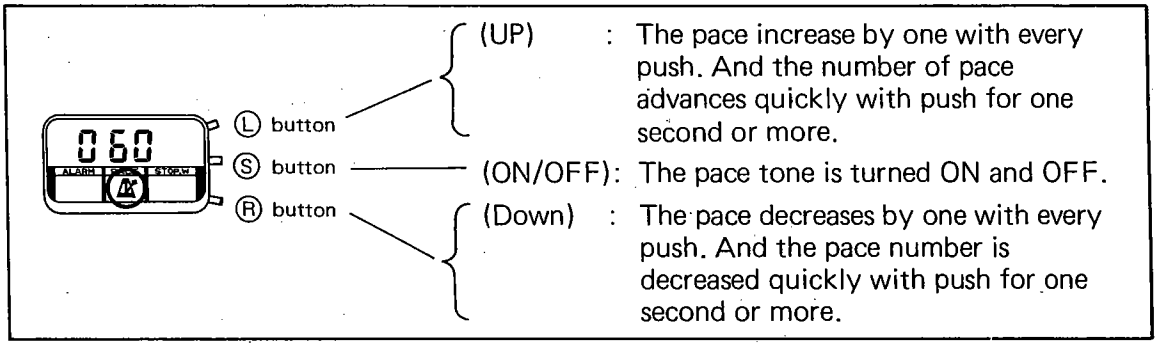
4-4. How to operate pacemaker

The pacemaker function is incorporated into this watch to be applied suitably to the jogging and other sports acitivities.

For example, the pace is set to 120 when jogging with two steps every second. Thus the pace tone sounds 120 times per minute (twice per second) for making the pace.

Making of pace (Flashing is shown by ○)

The pace can be set to an optional number from 000 to 239.



- The pace tone can be turned ON and OFF even in other modes. (See 4-1.)
  *The pace tone ceases automatically in 10 ~ 20 minutes. (Auto-stop of pace tone)

4-5. How to operate stopwatch

1) Operation of button (See 4-1.)

The operation of button is identical to other conventional watches incorporating the stopwatch function. And the tone of confirmation is heard with every push of Ⓛ button.

2) Coaction with pacemaker (5-minute timer)

When the stopwatch is started under working of the pacemaker, the time split tone (alarming tone) sounds for 0.5 second and every 5 minutes to tell the user a lapse of time.

4-6. Alarm monitor

An alarm tone (continuous) rings when both Ⓛ and Ⓡ buttons are pushed simultaneously under the time display.

4-7. All-lighting

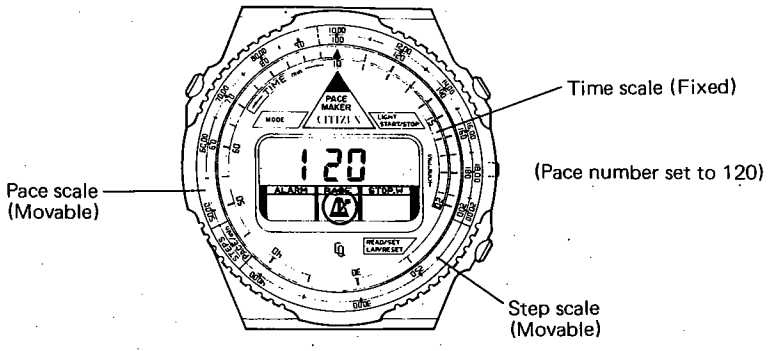
All display elements glow with a simultaneous push of Ⓜ, Ⓢ and Ⓡ buttons.

§5. HOW TO USE REGISTER RING

Some models of this caliber incorporate a register ring for calculation which is convenient for practice of the jogging, etc.

5-1. Parts of register ring

(Pace number set to 120)



5-2. Calculation of distance covered

(Example) The runner runs 20 minutes with pace 120 (one step with every pace tone).

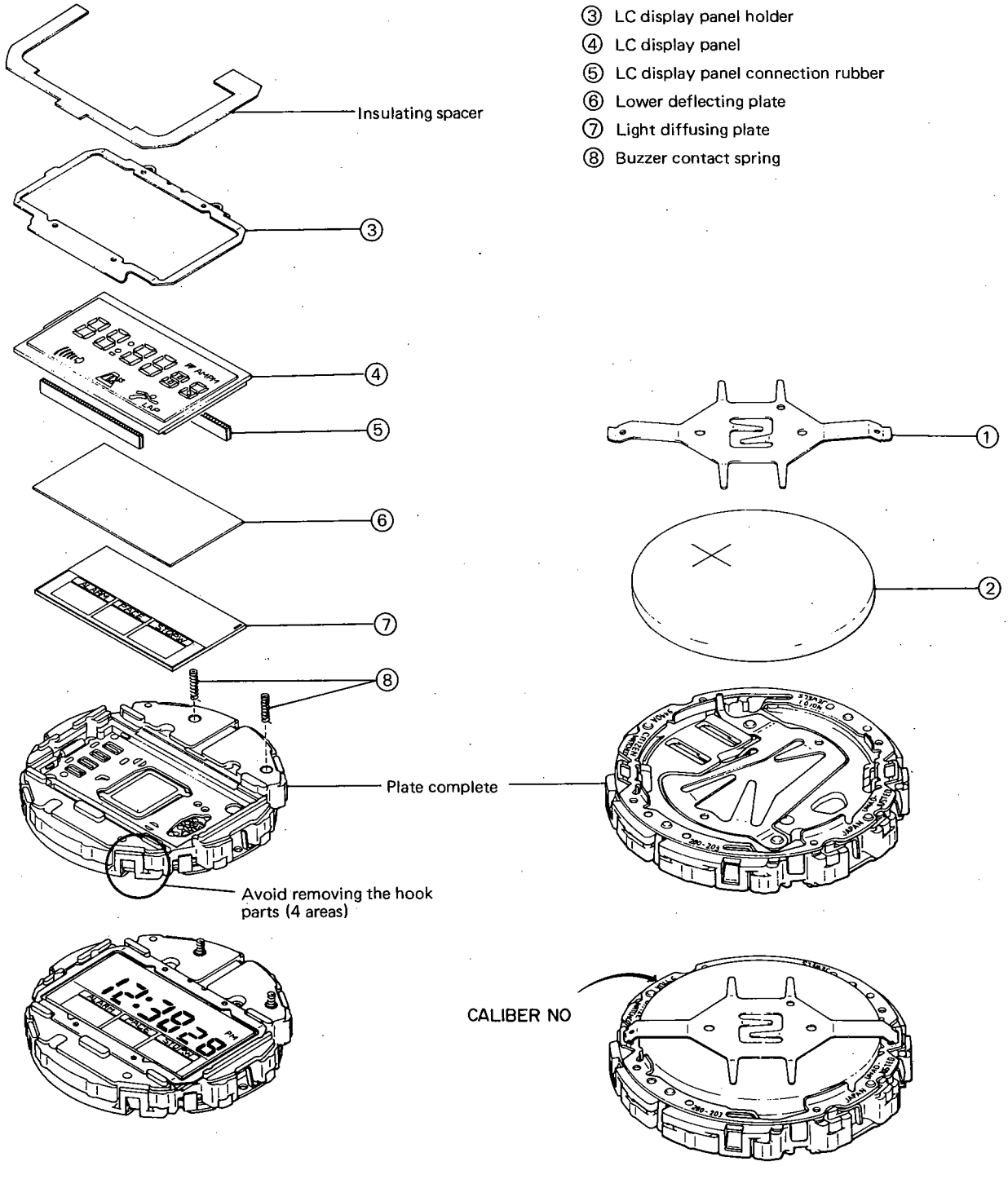
Procedure	Remarks
①	The "120" of the pace scale is set at "10" of the time scale.
②	The value of the step scale corresponding to "20" of the time scale reads "2400". This means 2400 steps.
③	The "10" of the time scale is set at "2400" of the step scale.
④	If the step of the runner is 1.5m, the time scale is converted into the space value. Thus the value of the step scale corresponding to "15" reads "3600". It is known that the runner has run 3600m.
⑤	In the case of a step of 2m, the "4800m" is obtained in the same procedure.

In addition to this example, an application is possible as a simple side rule which can be used for a calculation of pace setting and other purposes.

§6. DISASSEMBLY/ASSEMBLY OF MODULE

Disassembling procedure ① ~ ⑧
Assembling procedure ⑧ ~ ①

Names of parts
① Power cell strap
② Power cell
③ LC display panel holder
④ LC display panel
⑤ LC display panel connection rubber
⑥ Lower deflecting plate
⑦ Light diffusing plate
⑧ Buzzer contact spring

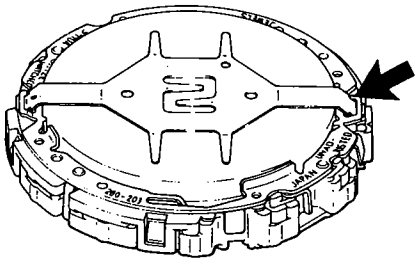


(LC display panel side)

(Power cell side)

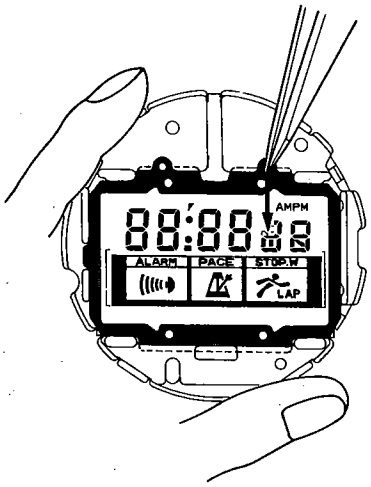
- **Notes on disassembly/assembly**

1) Replacement of power cell



As illustrated left, the power cell strap is removed by pressing it toward its center at one of the two hook parts with the tweezers or the like and then lifting it up a little bit.

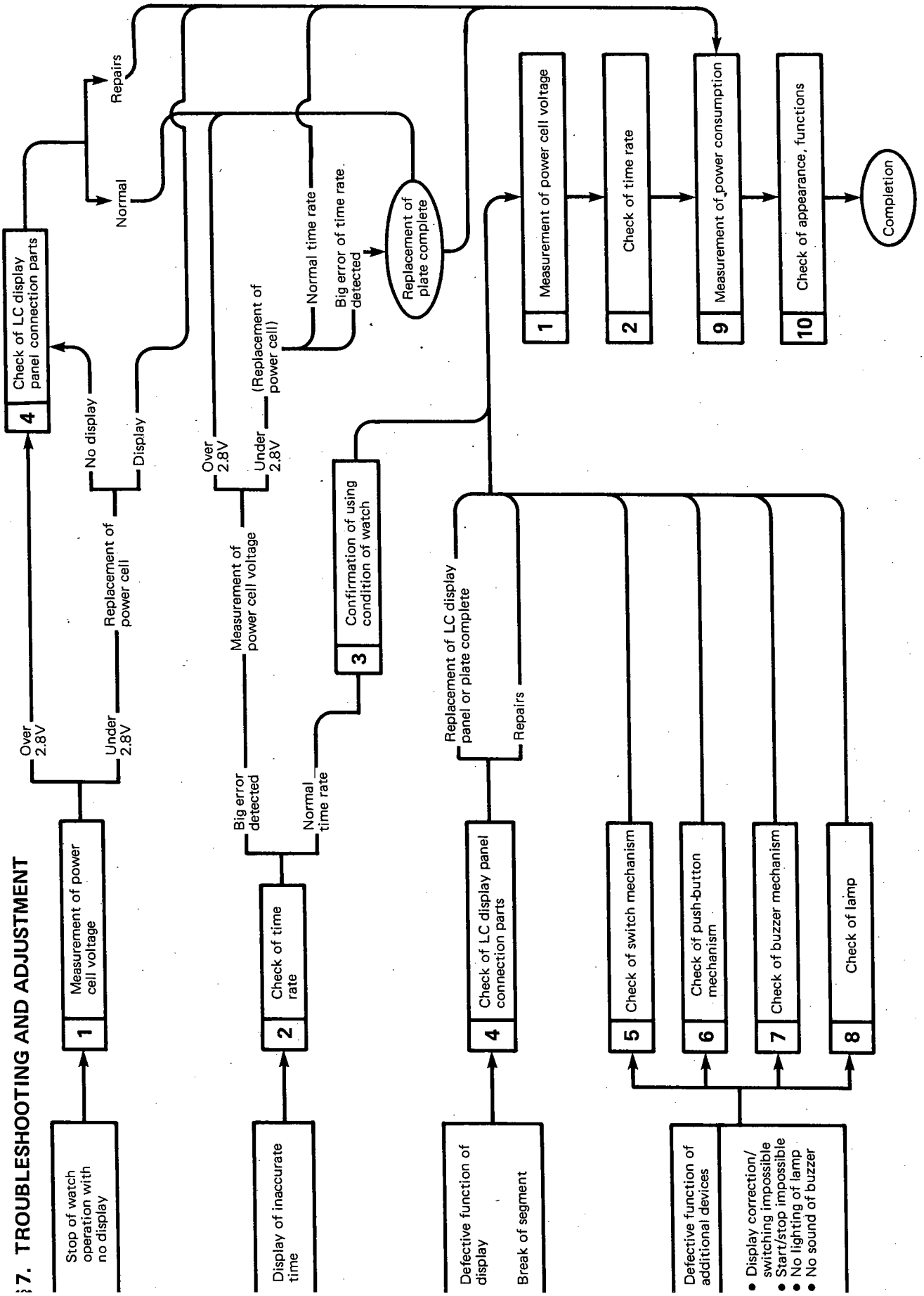
2) How to remove LC display panel holder

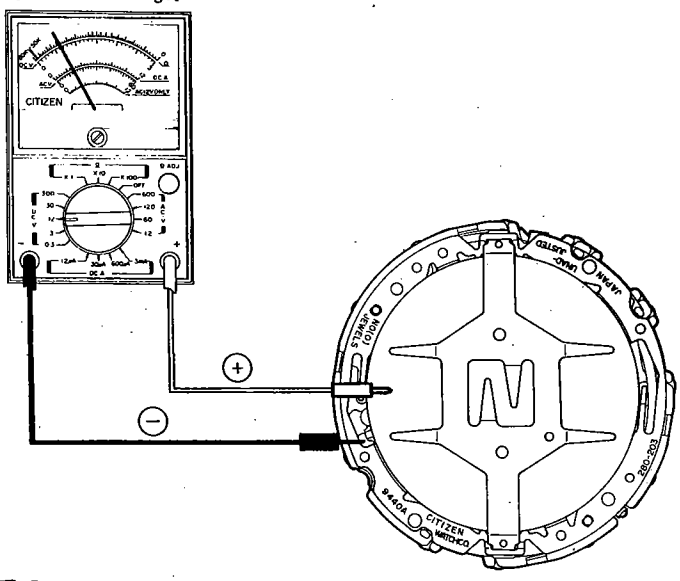
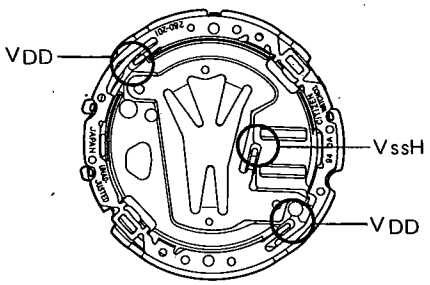
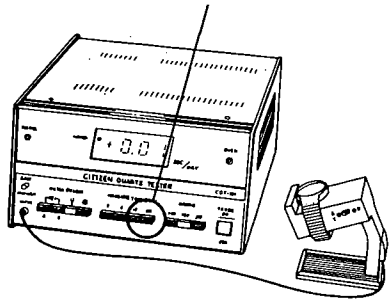


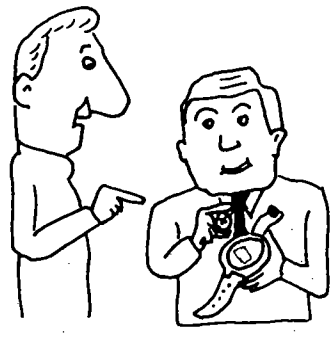
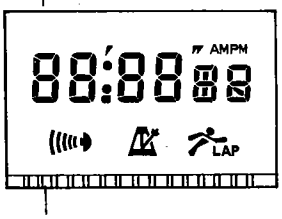
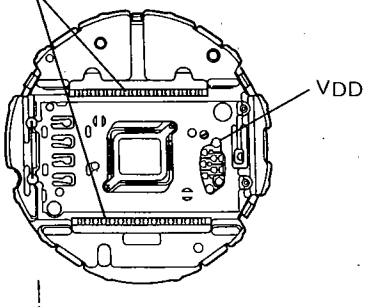
The LC display panel holder is fixed under the LC display panel supporter (a component parts of the plate complete) with its both ends inserted under the panel supporter.

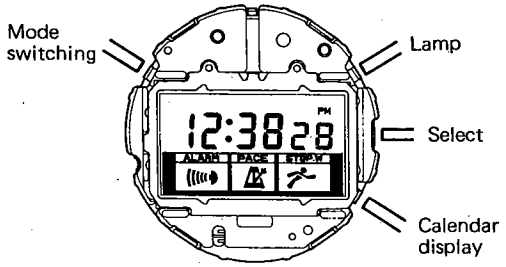
Thus the LC display panel holder is removed by pressing it light and at the same time shifting toward arrow as illusted and by the tweezers or the like.

7. TROUBLESHOOTING AND ADJUSTMENT

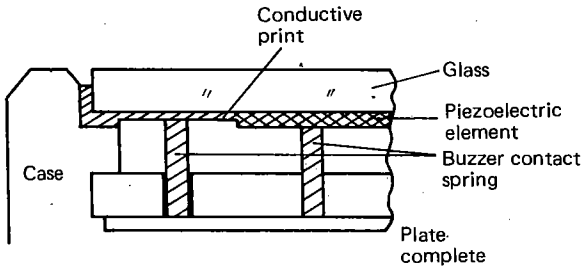


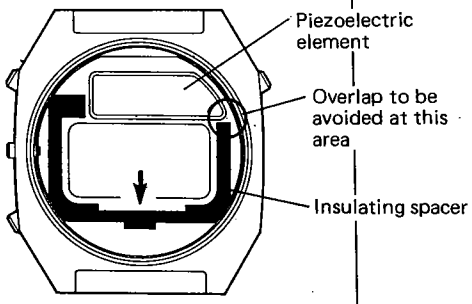
Checking items	How to check	Result and treatment
1 Measurement of power cell voltage	The voltage of the power cell can be measured with the power cell put into the movement. The range of the tester is set to DC12 V for measurement. [D.C. 12V Range]  	**Over 2.8V** →Normal **Under 2.8V** →Replacement of power cell
	 **This caliber uses a lithium cell. And one of the features of this cell is that the reset time to the original voltage is long when a short circuit is given between the plus and minus poles.** In this connection, the power cell must be left as it is for 5 minutes or so to receive the second measurement. Make sure that the lower bent area of the power cell connector spring has an assured contact to the patterns of the plate complete as shown in the diagram.	
2 Check of time rate	**For measurement of time rate, the measurement unit time button must be set to "10 seconds" or its integer-fold value.**  This is due to the fact that the signal which gives a compensation to the gain/loss of the time rate every 10 seconds is produced within the circuit. Accordingly if the measurement unit time is set to, e.g., 2 seconds, a correct measurement (numerical value) cannot be obtained. *The measurement of the time rate becomes hard if both the alarm and the pacemaker are switched ON. This must be especially kept in mind in case the time rate is measured with the movement in its single unit state and after the make of the power cell. The ON state of both the alarm and the pacemaker is cancelled with push of Ⓢ button.	Big error of time rate detected →Replacement of plate complete

Checking items	How to check	Result and treatment
3 Confirmation of using condition of watch		In case no defect is detected through the check of time rate, the following points must be confirmed with the user of the watch. 1. Whether the user had some misoperation to the watch. 2. Whether the user used the watch in an extreme change of temperatures. 3. How many days have passed since the time adjustment was given last to the watch? 4. And others.
4 Check of LC display panel connection parts	   Electrode parts VDD	1. Check of mechanism of LC display panel holder. ① Make sure that the LC display panel holder is free from any malformation and fixed with its tip inserted under the LC display panel supporter. ② Make sure that the LC display panel supporter is free from any malformation at the area to support the LC display panel. 2. Check of LC display panel connection rubber. ① Make sure that the connection rubber is free from the twist or the wave. ② Make sure that the connection rubber is free from the dust or stains. 3. Check of LC display panel ① Make sure that the electrode part of the LC display panel is free from the crack or the break. ② Make sure that the electrode part of the LC display panel is free from the dust stains. 4. Check of plate complete Check whether some dust or stains stick to the electrode of the plate complete which drives the LC display panel.

Checking items	How to check	Result and treatment
5 Check of switch mechanism	The following points are checked in the state of a movement. 1. Each switch spring is free from any malformation. 2. The function of each switch part works well when it is pressed with a driver or the like. In case some defect is detected with the operation of the switch part, an inspection must be given to the dust or stains sticking to the areas around each contact part. The plate complete must be replaced with new one in case the switch spring has some malformation or breakage and with no dust nor stains found around the contact part. The movement is nondefective if the operation of the switch part is smooth and normal. Thus the checking of push-buttons is finished.  	
6 Check of push-button mechanism	It is helpful for the subsequent checks to make sure the extent of the stroke of the push-button prior to excution of a check of the push-button itself. 1. The push-button is detached from the case in order to check wether the button is free from any malformation. 2. The dust attaching not only to the button itself but the button hole of the case must be cleared away completely. 3. Never fail to apply the silicone oil to each push-button. 	

Checking items	How to check	Result and treatment
7 Check of buzzer mechanism	The buzzer of this caliber features such constitution in that the piezoelectric element is stuck to the glass (an appearance parts) and then the glass is vibrated. As shown in the left diagram, two pieces of the buzzer contact spring are used. One of the two springs is connected to the conductive print part (VDD) of the glass and the other the piezoelectric element each through the plate complete. When assembling, the insulating spacer is put into the position shown in the right diagram. And the spacer is set with a slight pressure in the direction of the arrow.	



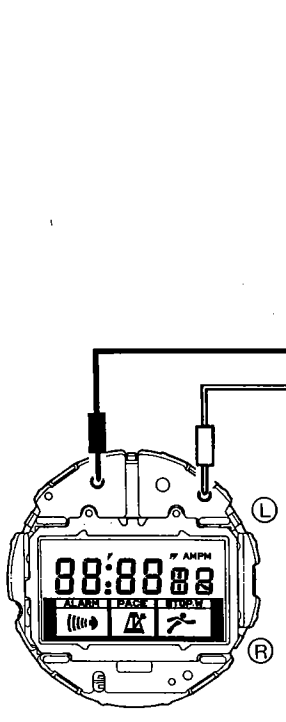


In case no alarm tone is produced, the following points are checked.

- The glass itself must be free from any crack of break.
- The piezoelectric element must be free from any crack or break.
- The buzzer contact spring must be free from any malformation.

In case no alarm ring is obtained yet although no fault is detected through the above checking, the tester is set at AC 12V range for checking the output signals sent from the buzzer contact spring as shown in the diagram.
In this case, the alarm monitor can be used conveniently with push of both Ⓛ and Ⓡ buttons.

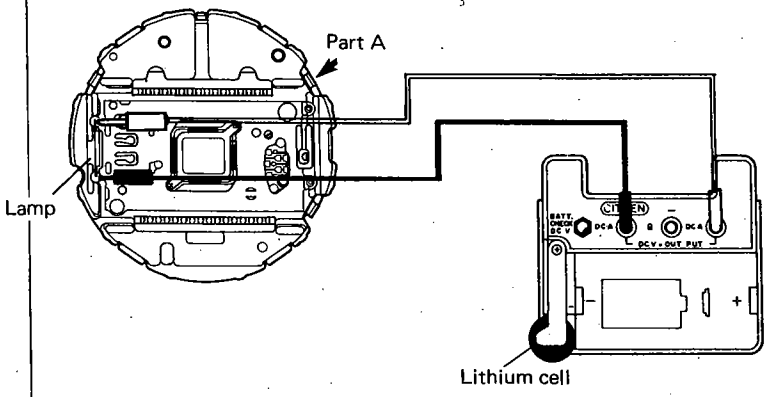
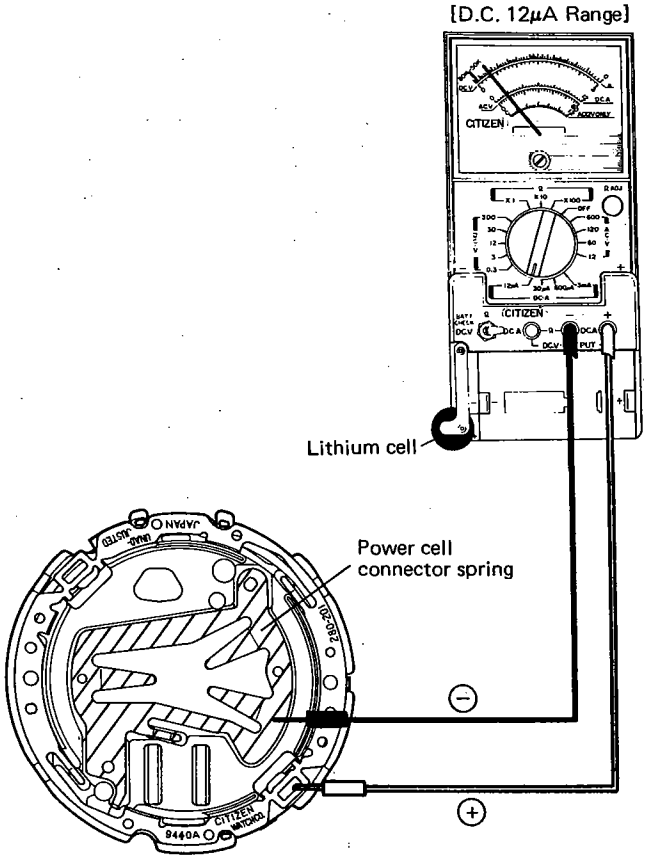
[A.C. 12V Range]

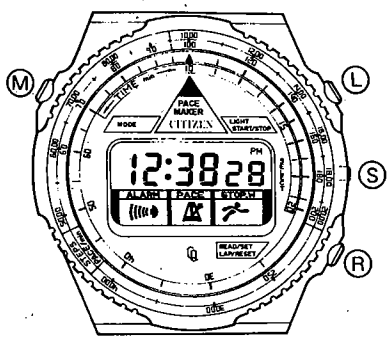


(Time display)

Tester's pointer deflecting
→ Normal

No deflecting
→ Replacement of plate complete

Checking items	How to check	Result and treatment
8 Check of lamp	 **As illustrated above, the leads from terminal OUTPUT of the tester's adaptor are applied to both ends of the lamp. In this case, no distincition is required between the plus and minus polarities.**	**Lighting** →Reexamination of part A **No lighting** →Replacement of plate complete
9 Measurement of power consumption	[D.C. 12μA Range]  ***The power consumption may sometimes become too much when the pacemaker is switched ON. In such case, the Ⓢbutton must be pushed.**	[Under normal state] **Under 2.0μA** →Normal [LC display panel removed] **Under 1.5μA** →Normal

Checking items	How to check	Result and treatment
10 Check of appearance conditions & functions	The following points are checked for a finished product. 1. Make sure that the alarm monitor functions well with a simultaneous push of both Ⓛ and Ⓡ buttons and also that the volume of the sound is proper. 2. Make sure that each push-button works in a smooth and accurate way. 3. Make sure that the surface of the LC display pannel is free from any dust or stains. 	

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