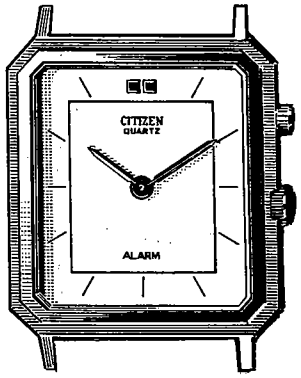
TECHNICAL INFORMATION

CITIZEN QUARTZ

Cal. No. 24※※

CITIZEN

■1. OUTLINE



This watch newly contains an alarm function in addition to the conventional merits of an analog watch, that is, the easy reading of time plus a good look. The adaption of a small-size movement realizes the unisexual use as a dress watch.

■2. FEATURES

1) A unique alarm function is incorporated.
   The alarm can be set at every minute since the conventional standard needle is not used.

2) Both the alarm time and the ordinary time can be indicated in common by hour and minute hands to keep a good look of an analog watch.

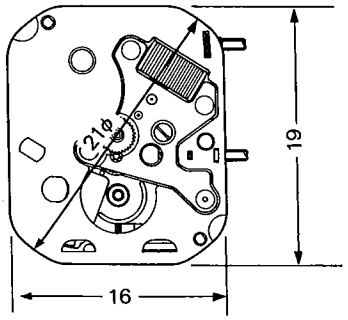
3) An electromagnetic correction system is applied with the forward/backward turns of the crown.

4) The following two features are attained for the output of alarm.
   - A soft tone is obtained with the use of an envelop circuit.*
   - The tone of alarm features an original and soft melody including the chords.

5) DFC (Digital Frequency Control) system is applied.

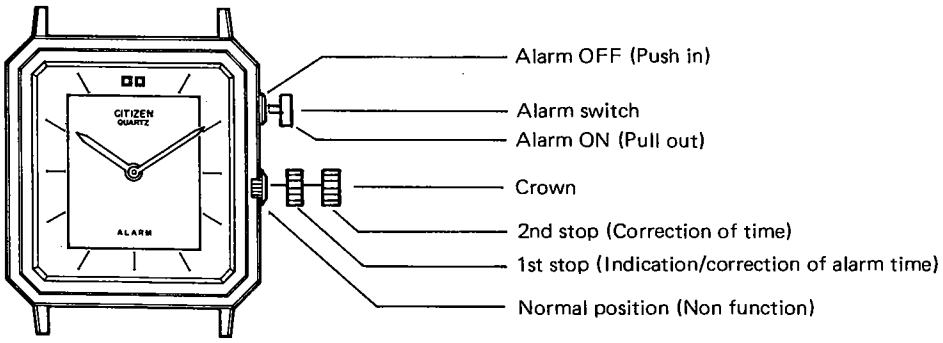
*Envelope circuit
This circuit produces echoes to the alarm tone.

■3. SPECIFICATIONS

Caliber No.	2400-02
Type	Analog quartz watch (with hour/minute hands)
Size of movement (mm)	Thickness: 2.51 (Power cell part 2.6) 
Accuracy	±20 sec./month at normal temperatures
Oscillation	32,768Hz
Converter	Bipolar step motor a. For forward/backward revolutions b. 20-second step movement of hands
Integrated circuit	C/MOS-LSI (1 unit)
Effective temperature range	−10°C ~ +60°C (14°F ~ 140°F)
Adjustment of time rate	DFC system (Unit measurement of time 10 sec. with no control terminal)
Additional functions	●Alarm (with melody) The alarm time is indicated by hour/minute hands in common with the ordinary time. ●Alarm monitor ●Auto-return system ●Hour/minute hand stopping device ●Electromagnetic correction system (Quick advance of time with forward/backward turns of crown)
Power cell (Silver oxide)	Parts No. : 280-53 (1 unit) Maker code : SR721W (Ag_2O/KOH) Size : 7.9φ x 2.1mm^t Nominal voltage : 1.55V Nominal capacity : 25mAH Lifetime : About 2 years (With alarm actuated 24 sec. per day)

■4. HANDLING INSTRUCTIONS

1) Look of watch and nomenclature

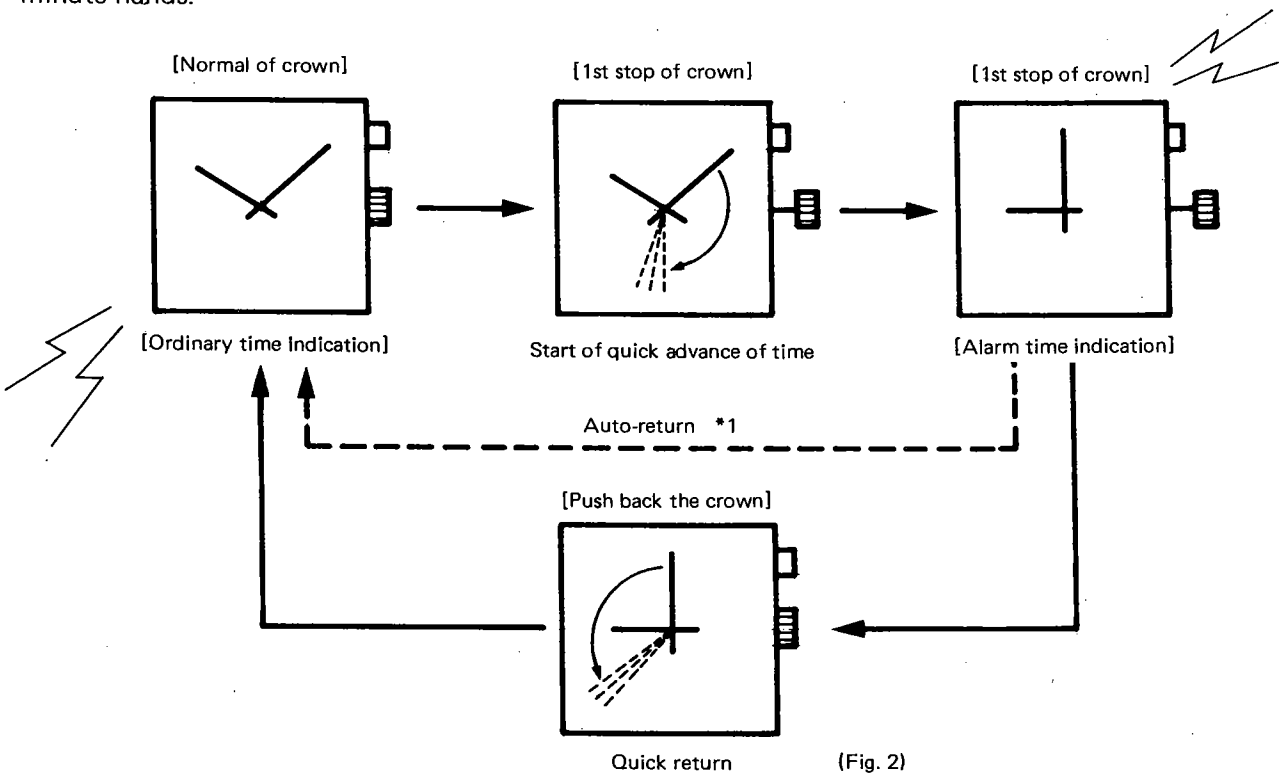


(Fig. 1)

*** All operations must be carried out in a slow and steady way owing to their electrical switching actions.**

2) Switching between ordinary/alarm time indications

Both the ordinary time and the alarm time are indicated in common by the same hour and minute hands.

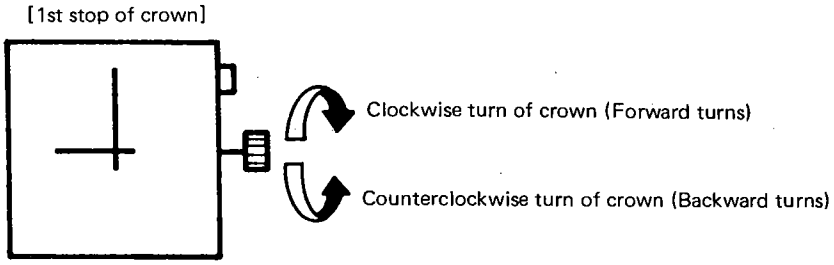


(Fig. 2)

*1 Auto-return

The ordinary time indication is automatically reset (with quick return) from the alarm time indication if no operation is carried out for two minutes. After an auto-return, the crown must be once pushed to its normal position before carrying out the subsequent operations.

3) Correction of alarm time

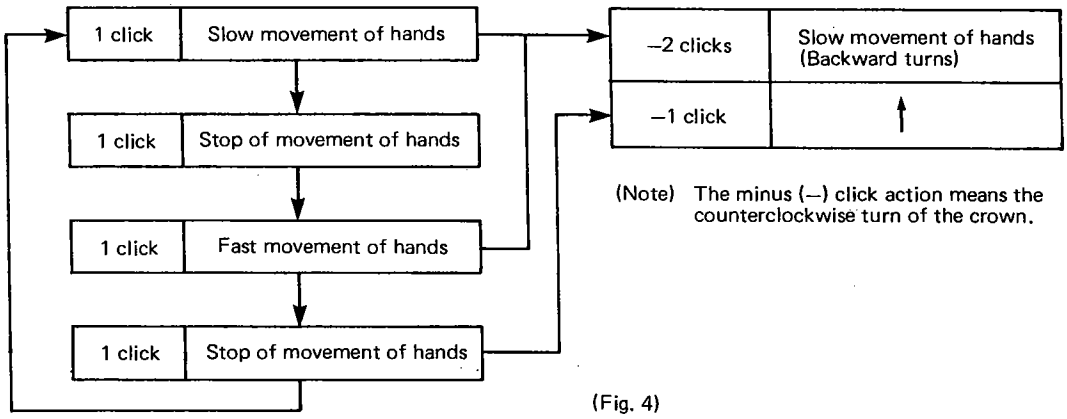


(Fig. 3)

When the crown is pulled out to its 1st stop position in the mode of ordinary time indication, the mode is quickly advanced to the alarm time indication.

The alarm time can be corrected after the movement of hands is stopped and by turning the crown as indicated in Fig. 3.

As this caliber applies an electromagnetic correction system, a consecutive correction is possible for the movement of hands with the following operation and without giving a consecutive turn to the crown.

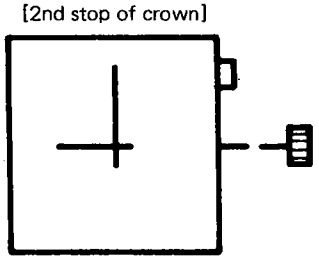


(Note) The minus (–) click action means the counterclockwise turn of the crown.

(Fig. 4)

* The ordinary time indication will be automatically reset in a consecutive movement of hands for 80 seconds in both modes of slow and fast movements of hands. In this case, the alarm is set at the last time of the 80 sec. movement of hands.
* The switching operation must be assuredly done with each click.
* The correction is possible with every 3 pulses, i.e., with every minute.

4) Correction of time



(Fig. 5)

The correction mode is obtained for the ordinary time indication mode by pulling out the crown by 2 stops, and then the watch stops.
The correcting method is exactly equal to the correction of alarm time (mentioned in the preceding section) excepting the following points.

- The correction is done with each pulse, i.e., with every 20 seconds.
- The hands automatically stop after a consecutive movement of 80 seconds in both modes of slow and fast movements.

5) Just-minute synchronization between ordinary time and alarm time

The timing starts at the moment when the crown is pushed into its normal position after a correction of time. Then the hands moves in 20 seconds after the start of timing.

The alarm time has no change although the ordinary time is changed. However, the just-minute position sometimes has an error of ±20 seconds.

(Ex.) Alarm time set at 9 : 00

a) In case the alarm time is started at ※:※※' 00" after correction of an ordinary time. ——— The alarm rings at 9:00'00".

b) In case the alarm time is started at ※:※※' 20" after correction of an ordinary time. ——— The alarm rings at 9:00'20".

c) In case the alarm time is started at ※:※※' 40" after correction of an ordinary time. ——— The alarm rings at 8:59'40".

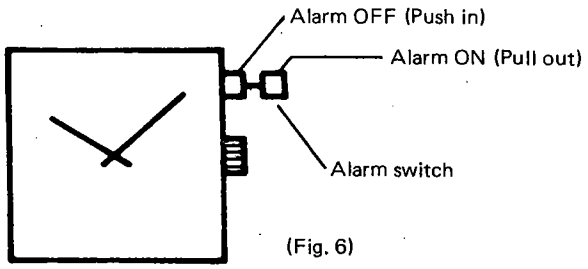
Thus the alarm time is decided as a "just second" (00") at the moment when the "second" starts in the mode of ordinary time indication.

Accordingly the time must always be started at 00" after correction of an ordinary time to secure the synchronization with the alarm time.

* It is impossible to set the alarm time at a "just second" when the ordinary time is started at a position excepting 00".

6) ON/OFF of alarm

The alarm is switched on and off by pulling out and pushing in the alarm switch respectively. As the alarm mode is set under a 12-hour indication system, it rings twice (AM and PM) a day.



(Fig. 6)

7) Alarm monitor

When the alarm switch is switched ON → OFF → ON (within a second), a melody is heard for 48 seconds as an alarm monitor. However, this alarm monitor is possible only in the ordinary time indication mode. The alarm monitor is discontinued by turning off the alarm switch.

8) Stopping of alarm

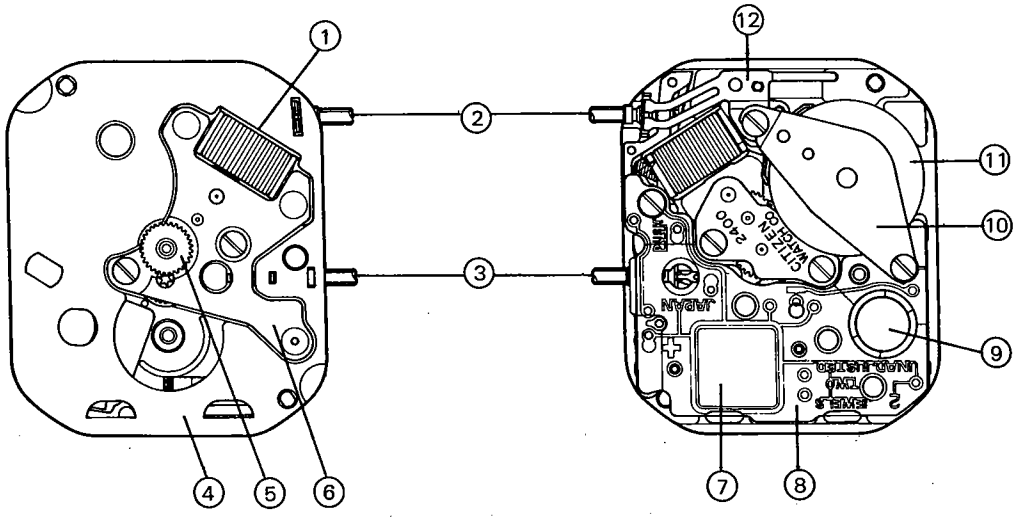
The alarm ring is stopped at the moment when the alarm switch is pushed into its normal position.

- **Alarm tone**
  Owing to the property of an envelope circuit used in this caliber, the echoes of the alarm tone are apt to be short at a high temperature. This phenomenon does not mean a fault at all and can be recovered at the normal temperatures again.

■5. CONSTITUTION OF MOVEMENT

The device supporter that houses the movement uses GM-20 (reinforced DURACON filled with ultra-short glass fiber).

When handling a movement itself, use a movement holder bearing the marking "2400" and avoid the unstable state of the switching stem.



(Fig. 7)

① Coil unit
② Switching stem
③ Setting stem
④ Device supporter
⑤ Hour wheel
⑥ Plate complete
⑦ LSI
⑧ Unit of electronic circuit
⑨ Booster coil
⑩ Power cell strap
⑪ Power cell
⑫ Switch click stop spring

■6. DISASSEMBLY/ASSEMBLY OF MOVEMENT

6-1. Disassembling/assembling procedure with lubrication

Disassembling procedure : ① → ㉗

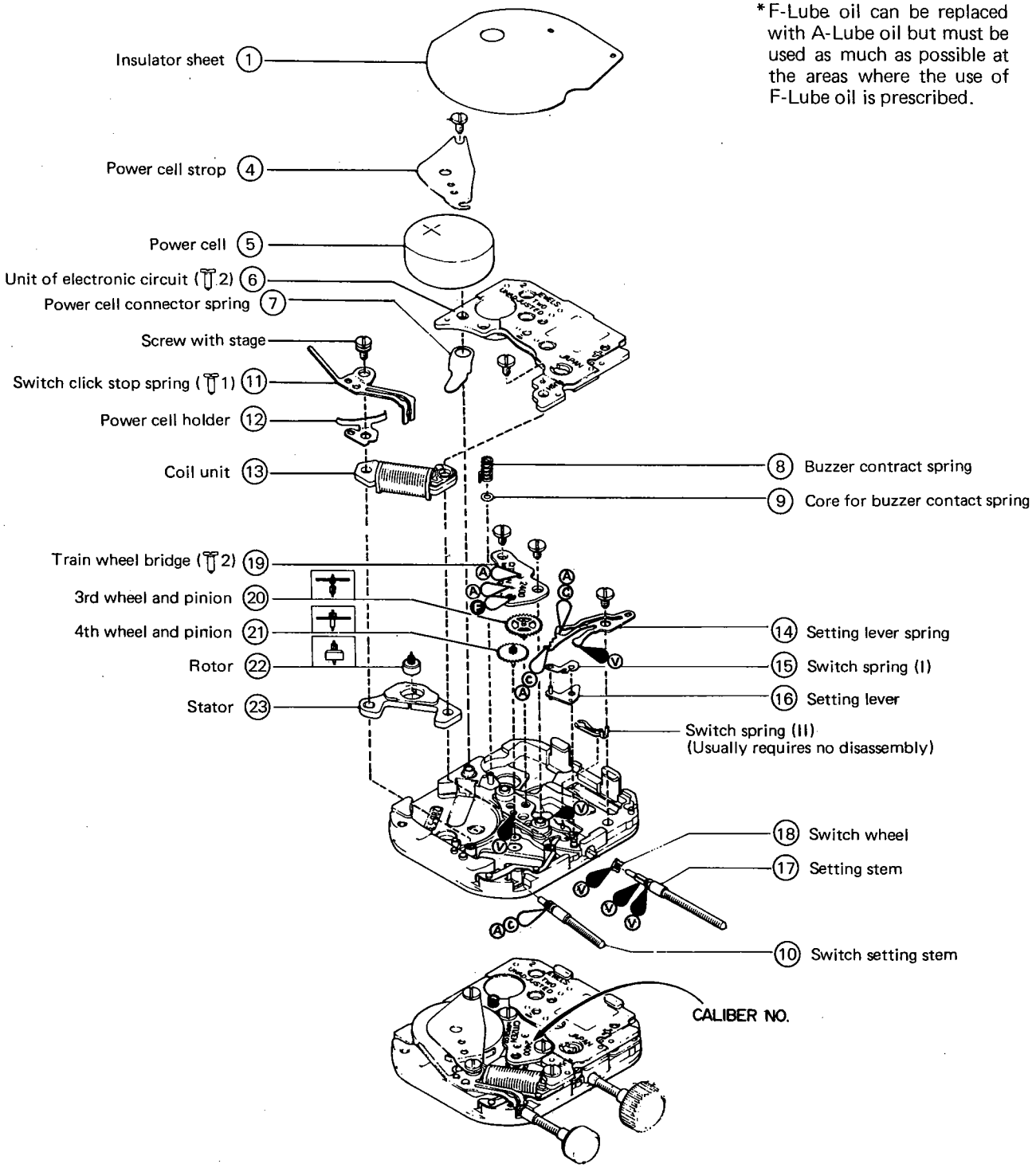
Assembling procedure : ㉗ → ①

Marks of lubrication

- Ⓐ A-Lube oil
- Ⓥ V-Lube oil
- Ⓕ F-Lube oil
- ⓒⒶ CA-1 oil

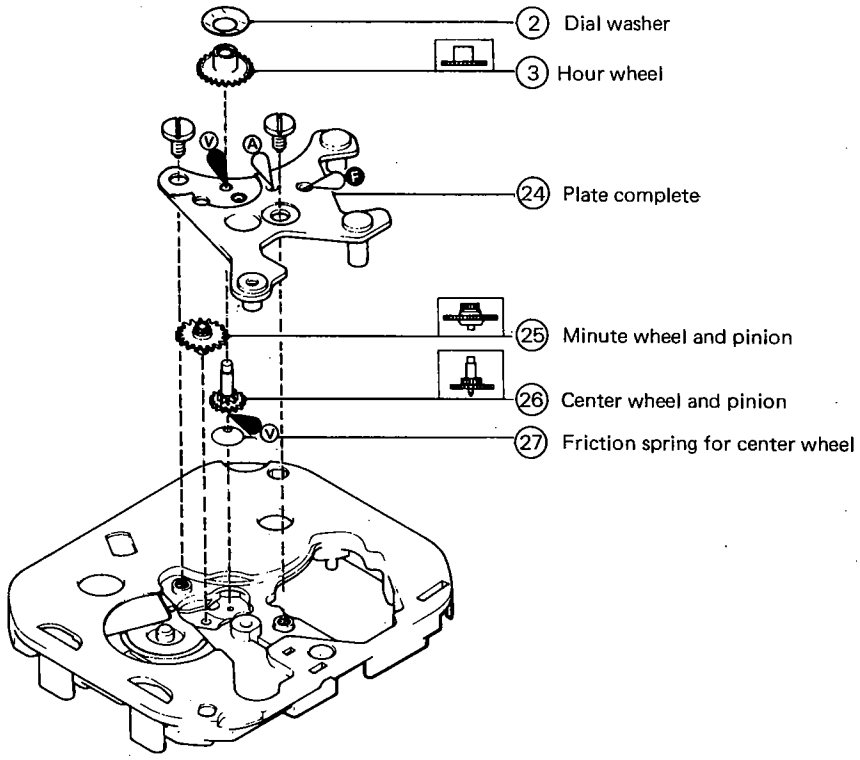
*F-Lube oil can be replaced with A-Lube oil but must be used as much as possible at the areas where the use of F-Lube oil is prescribed.

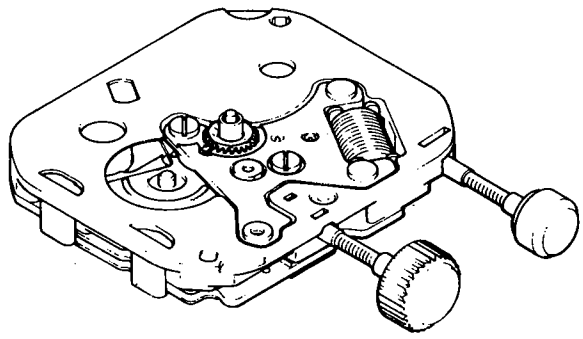
[Power cell side]



(Fig. 8)

[Dial side]

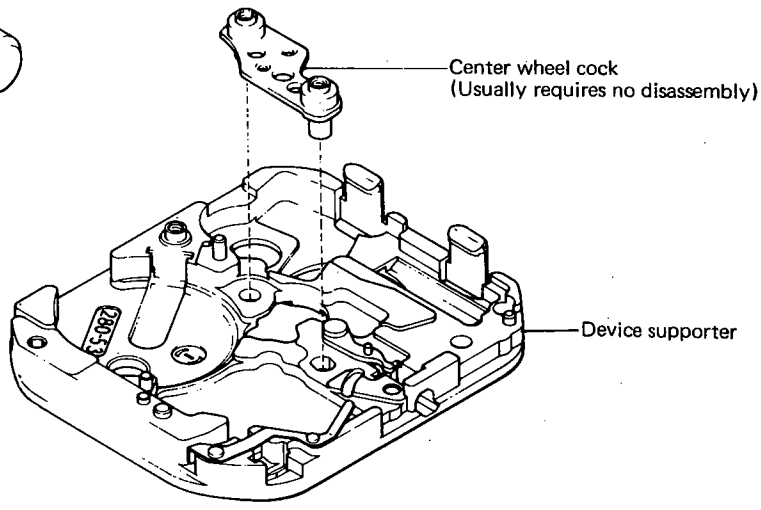




(Fig. 9)

[Exploded View of Center Wheel Cock]

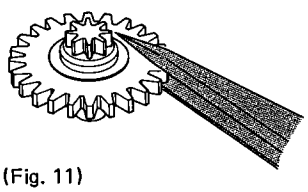
(Power cell side)



(Fig. 10)

6-2. Notes on disassembly/assembly

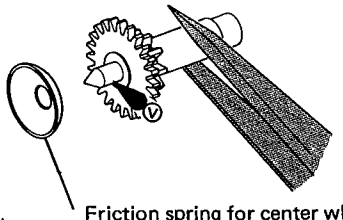
1) Handling of minute wheel and pinion



(Fig. 11)

As this wheel and pinion is made of plastic (GM-20), it must be handled with good care not to break the pinion part. Hold the wheel at the gear part as illustrated left. (Fig. 11) The breakdown of the pinion part will cause the stop of the watch operation.

2) Setting of friction spring for center wheel

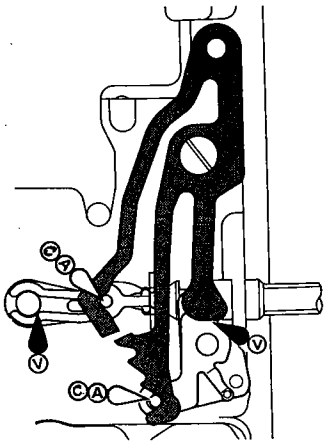


Friction spring for center wheel (Be careful of the setting direction.)

(Fig. 12)

As illustrated, the friction spring for center wheel is set after lubrication.

3) Lubrication of setting lever spring



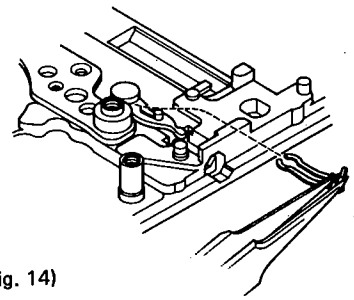
(Fig. 13)

Lubricate the areas indicated in the diagram. (Fig. 13) If the V-Lube oil is used in place of the CA-1 oil, some effect may be given to the pull-out action and the turning click stop action of the crown.

4) Lubrication of switch click stop spring

The CA-1 (Citizen watch) oil is supplied at the side of the switch setting stem. The use of other kinds of oil may affect both the durability and the electrical properties of the switch click stop spring. Thus never fail to use only the CA-1 oil.

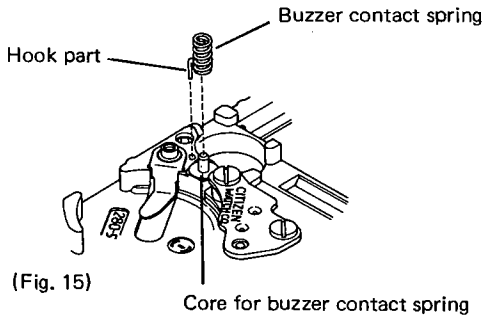
5) Replacement of switch spring (II)



(Fig. 14)

The switch spring (II) is unset by holding the contact part with a tweezers and then pulling it out lightly. Reverse the above-mentioned actions to set the spring by clinging it to a pin that fixes the switch lever.

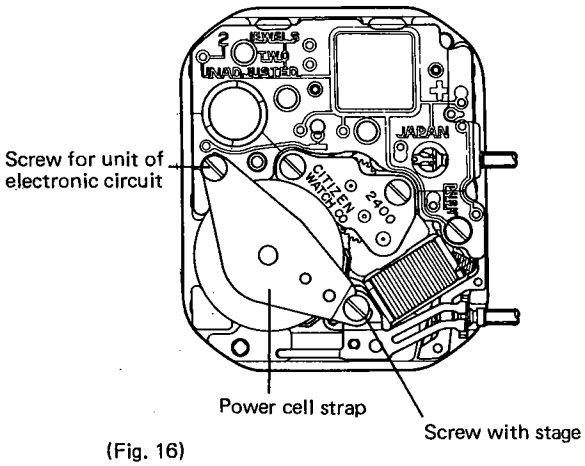
6) Setting of buzzer contact spring



(Fig. 15)

The buzzer contact spring is set after the core for buzzer contact spring and by fitting the hook part into a positioning hole.

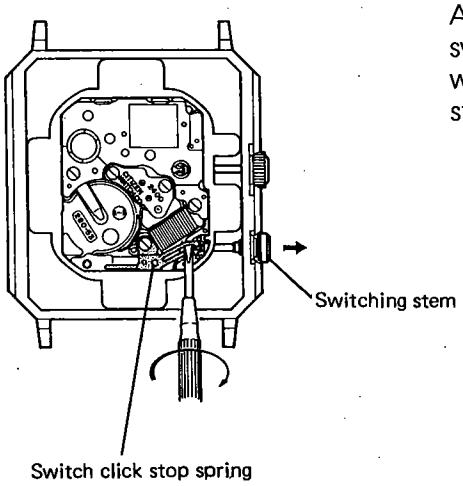
7) Setting of power cell strap



(Fig. 16)

The power cell strap is set after loosening the screws for unit of electronic circuit. The screw at the coil side has a stage, and the power cell strap is set to this screw. In case the setting is not easy, you had better loosen once the screw having stage. After the setting of the power cell strap, the screws at both sides must be driven tight.

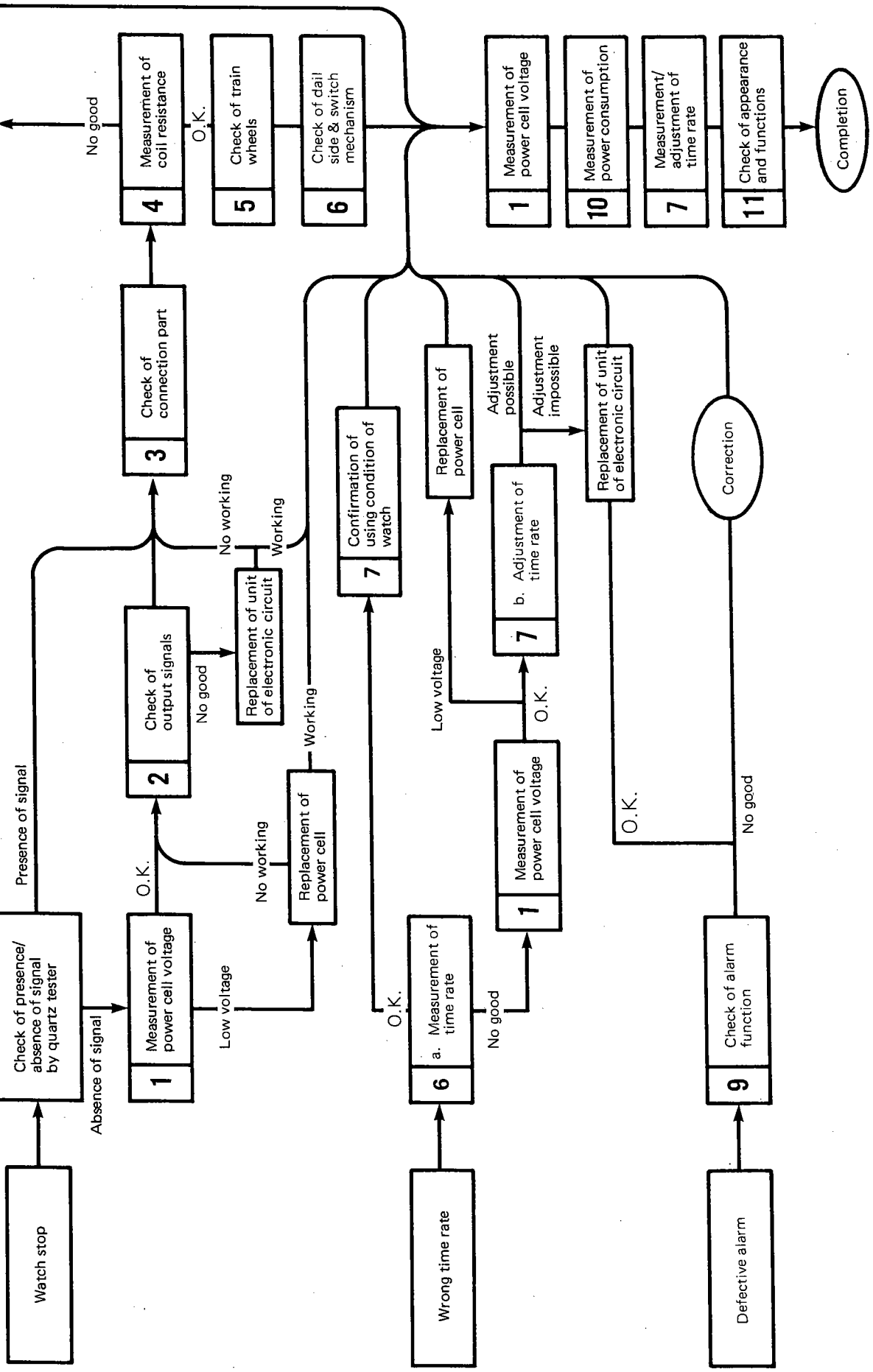
8) How to pull out switching stem

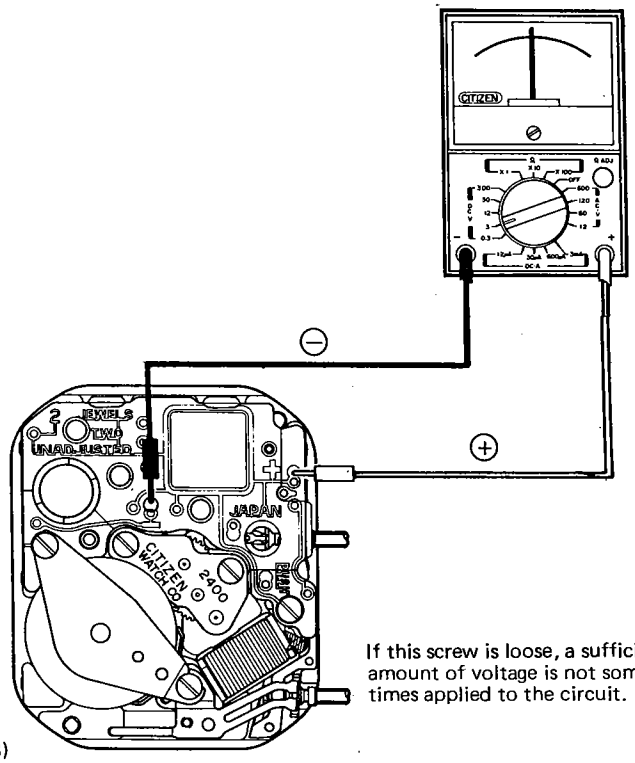
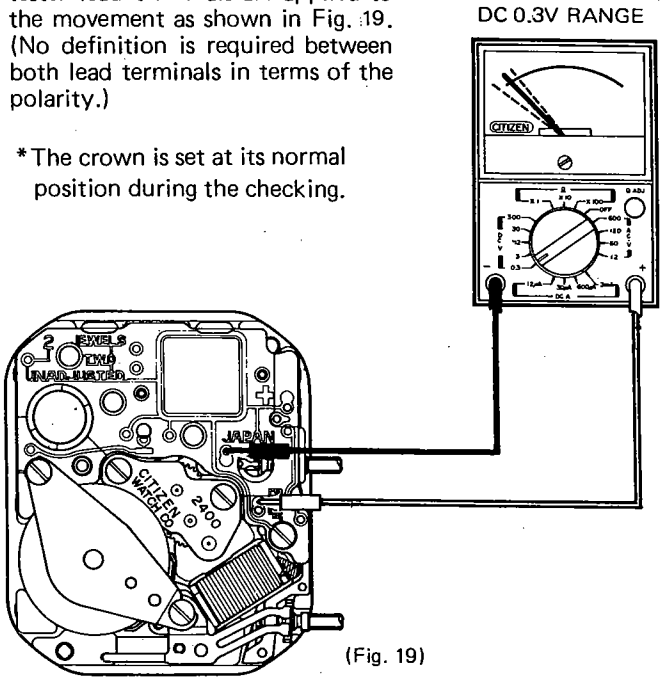


(Fig. 17)

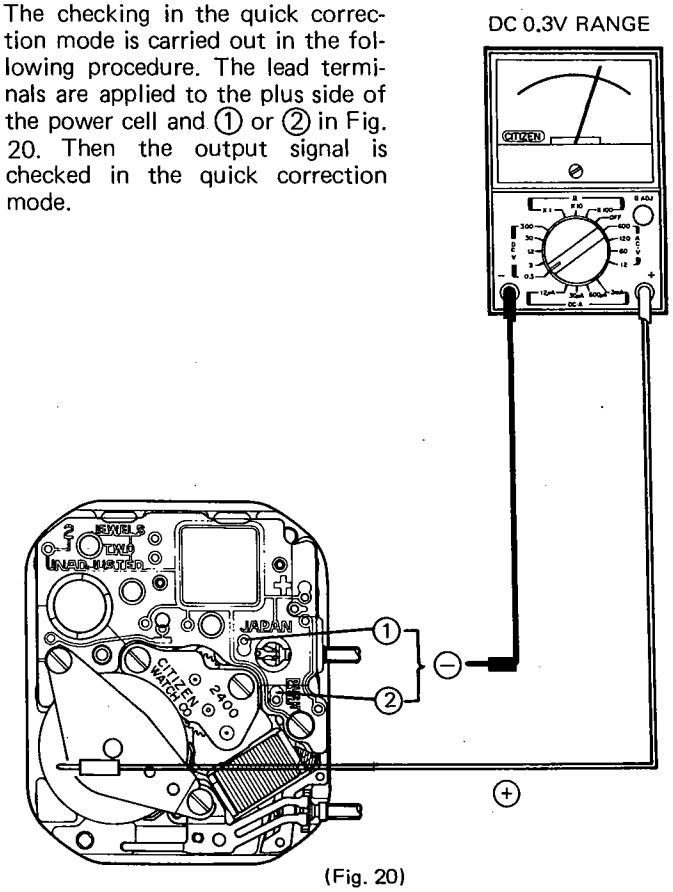
As illustrated, a driver is put into the fork part of the switch click stop spring. Then the driver is turned to widen the fork part area. After this, the switch setting stem is pulled out.

7. TROUBLESHOOTING AND ADJUSTMENT

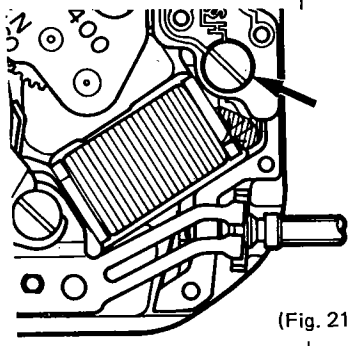


Checking items	How to check	Result and treatment
1 Measurement of power cell voltage	DC 3V RANGE  If this screw is loose, a sufficient amount of voltage is not sometimes applied to the circuit. (Fig. 18)	**Over 1.5V** → Nondefective
2 Check of output signals	a) This watch has a 20 sec. step movement of hands, and accordingly the tester pointer swings once right and left with every 20 seconds when the tester lead terminals are applied to the movement as shown in Fig. 19. (No definition is required between both lead terminals in terms of the polarity.) *The crown is set at its normal position during the checking. DC 0.3V RANGE  (Fig. 19)	Swinging of tester pointer → Nondefective
	b) A quick checking is possible by performing the above-mentioned procedure in the slow correction mode (consecutive drive) of the ordinary or alarm time.	Swinging of tester pointer → Nondefective

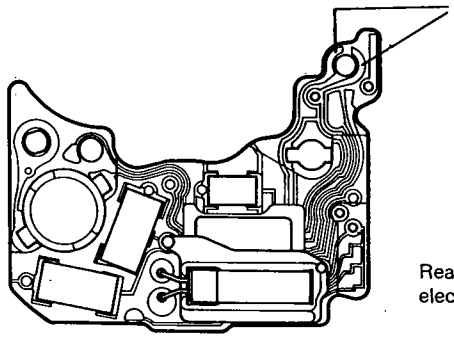
Checking items	How to check	Result and treatment
	c) The checking in the quick correction mode is carried out in the following procedure. The lead terminals are applied to the plus side of the power cell and ① or ② in Fig. 20. Then the output signal is checked in the quick correction mode.	Pointer swinging about 0.2V → Normal
3 Check of connection part	The drive signal is not sometimes transmitted if the screw for unit of electronic circuit is loose as shown in Fig. 21.	
	The conduction becomes defective if some soil attaches to a coil terminal or the output pattern of drive signal of the unit of electronic circuit.	



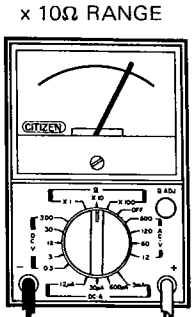
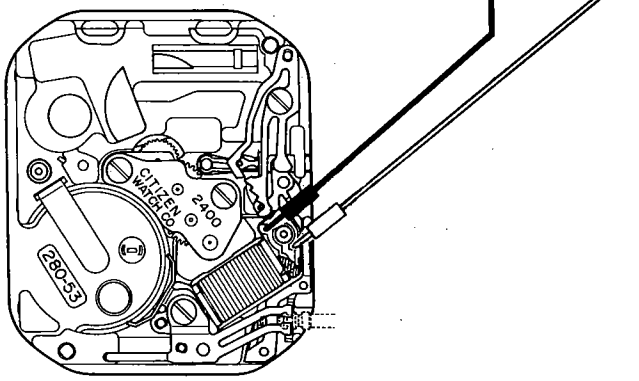
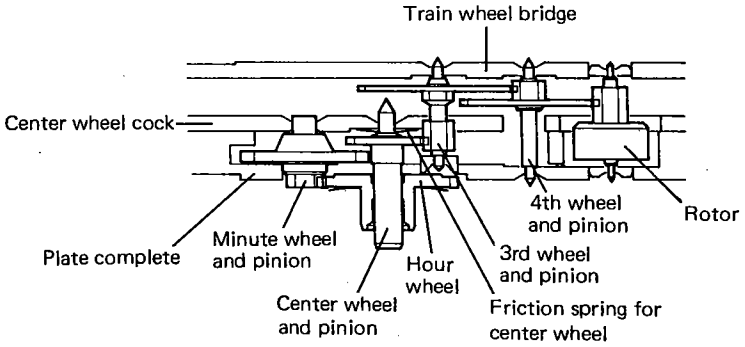
(Fig. 20)



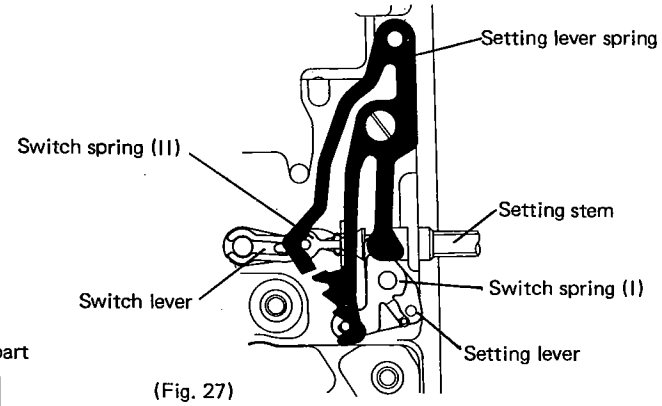
(Fig. 21)



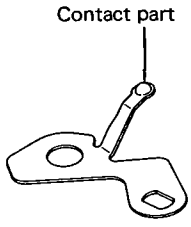
(Fig. 22)

Checking items	How to check	Result and treatment
4 Measurement of coil resistance	The lead terminals are applied to the movement as shown in the diagram. (No definition is required between both terminals in terms of the polarity.)  (Fig. 23)  	
5 Check of train wheels	a) Make sure that each gear is set in a correct way. b) The non-setting or deformation of the friction spring for center wheel will cause a faulty working.  (Fig. 24)	

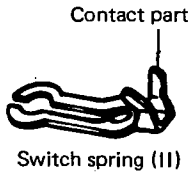
Checking items	How to check	Result and treatment
6 Check of dial side mechanism & switch mechanism	a) Check of indicating mechanism Check the engagement between the hour wheel and the minute wheel. In particular, avoid the breakdown of the pinion part of minute wheel which may be caused by the wrong setting of the hour wheel. The breakdown of this pinion part will stop the watch operation. b) Check of switch mechanism The switch spring (I) may be defective if the following inconveniences arise. ●No alarm time is indicated although the crown is pulled out by 1 stop. ●No correction mode is obtained although the crown is pulled out by 2 stops. On the other hand, the switch spring (II) may be defective if the switching action is faulty for correction of movement of hands.	**Switch spring I** Wear of malformation of contact part ⟶ Replacement of switch spring (I) Stains on patterns A and B ⟶ To be cleared away **Switch spring II** Wear of malformation of contact part ⟶ Replacement of switch spring (II) Stains on patterns C and D ⟶ To be cleared away



(Fig. 27)

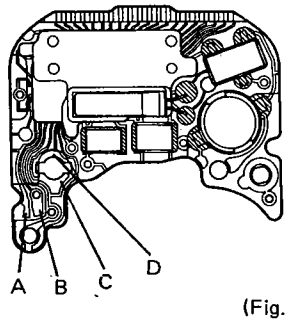


(Fig. 25)

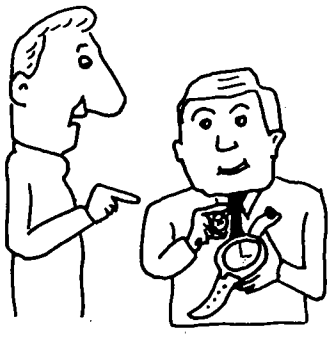


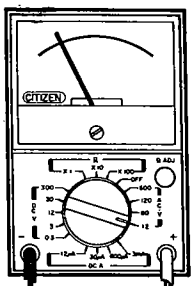
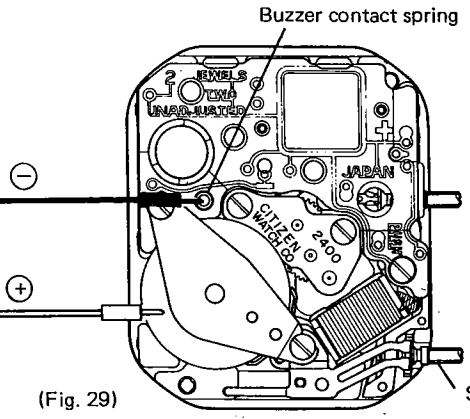
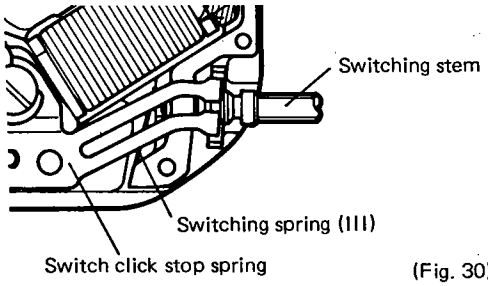
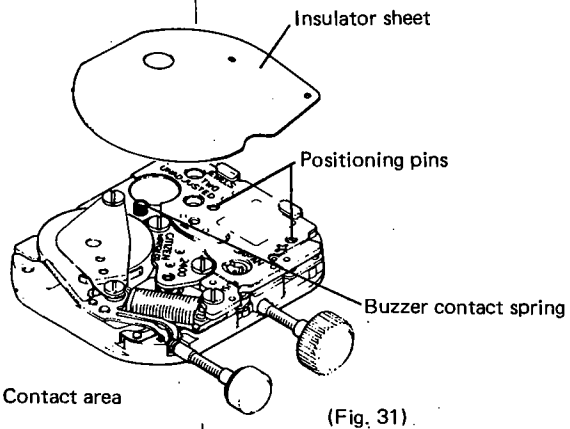
(Fig. 26)

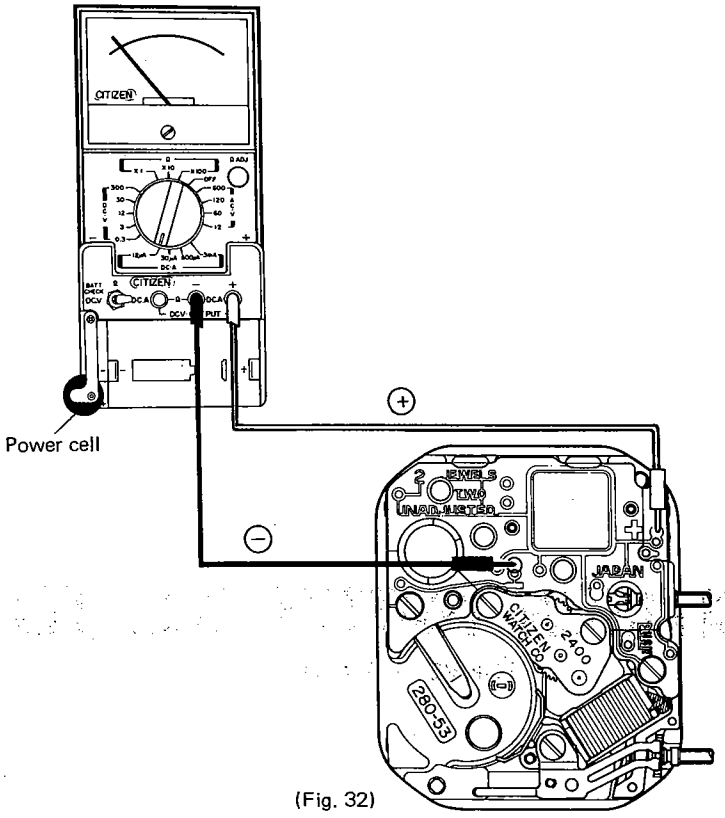
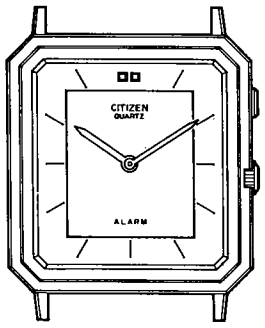
(Rear side of unit of electronic circuit)



(Fig. 28)

Checking items	How to check	Result and treatment
7 Measurement/ adjustment of time rate	a) Measurement of time rate This watch adapts the DFC system, and accordingly the unit time of measurement must be set at "10 sec." or an integer-fold value of 10 sec. b) Adjustment of time No adjustment is carried out for the time rate on the market since the adjustment is thoroughly given to this watch at the factory. If a big error should arise in the time rate, the unit of electronic circuit must be replaced with new one.	
8 Check of using condition of watch	The following points are confirmed with the user of the watch. 1) A use of the watch outside the effective temperature range 2) A use of the watch in an atmosphere of strong magnetism 3) The time when the last replacement is given to the power cell 4) A wrong handling of the rate watch 5) The time when the time is set last 	

Checking items	How to check	Result and treatment
9 Check of alarm mechanism	a) Check of alarm output As illustrated, the alarm output is measured by means of the alarm monitor. [AC 12V RANGE]  * Refer to section 4 for how to carry out the alarm monitor  (Fig. 29)	Tester pointer swinging →Normal about 2V ~ 4V
	b) Check of alarm switch mechanism When the switching action is defective for the alarm switch, the state of setting must be checked for the switching stem. *When the switching stem is pushed in, the tip of the switching stem touches the switch spring (III) to perform a switching action. If the soil of oil, etc. attaches to this contact area, the switching action becomes defective.  (Fig. 30)	
	c) Check of electrical connection  (Fig. 31)	●Make sure that the insulator sheet has a correct contact to the buzzer contact spring. The positioning pins are provided on the unit of electronic circuit. ●The alarm ring will be defective if the contact area of the switch click stop spring has no correct contact to the case back. Make sure the bend height of the contact area. In addition, the state must be checked for the vibrating plate, the piezoelectric element and others.

Checking items	How to check	Result and treatment
10 Check of appearance and functions	As illustrated, the lead terminals are applied to the movement to measure the current consumption with a range of DC 12μA. DC 12μA RANGE  (Fig. 32)	**Under 0.5μA** → Normal
11 Check of appearance and functions	a) Make sure that the external appearance of the watch is good and nondefective. b) Make sure that both the clockwise and counterclockwise turns (electromagnetic correction) is nondefective. c) Make sure that the switching action is smooth and correct. d) Make sure that the alarm monitor is nondefective.  (Fig. 33)	