PARTS LIST /TECHNICAL GUIDE

Automatic Chronograph Cal. 8R28A/8R39A

[SPECIFICATIONS]

Item \ Cal. No.	8R28A/8R39A



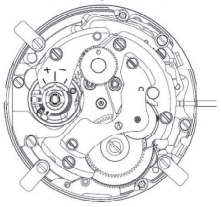
Cal. 8R39A



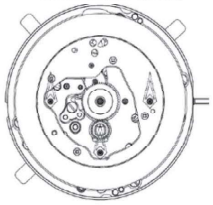
Cal. 8R28A

Movement

[Bridge side]



[Calendar side]





- 3 hands (hour and minute hands, and small second hand at 3 o'clock position)
- Calendar (Date: Date disk)

Movement size
- Diameter Outside: Ø 28.6 mm
  Casing: Ø 28.0 mm
- Height: 7.40 mm (8R28A) / 7.62 mm (8R39A)

Driving system		Automatic winding with manual winding mechanism				
Additional function		• Stopwatch function Measures up to 12 hours • Semi-instantaneous date change mechanism • Second hand stop function				
Crown operation	Normal position	Manual winding (clockwise only)				
	1st click position	Date setting (counterclockwise only)				
	2nd click position	Time setting (Hour and minute)				
Vibration per hour		28,800 (8 beats per second)				
Loss/Gain	Daily rate worn on the wrist at temperature-range between 5 °C and 35 °C)	Between + 25 and - 15 seconds				
	Standard rate for measurement	Mainspring wind up status	Fully wind up			After 24 hours from fully wind up
		Testing positions	Dial upward: T0 (CH)	6 o'clock at the top	9 o'clock at the top	Dial upward: T24 (CH)
		Measurement (daily rate in seconds:s/d)	± 10 s/d	± 15 s/d	+ 15 s/d	(Isochronism fault: T24-T0) ± 10 s/d
Regulation system		ETACHRON system				
Lift angle of the escapment		52 °				
Continuous operating time		From fully wound to stoppage: Approximately 45 hours				
Number of jewels		34 jewels				

SEIKO WATCH CORPORATION

SPECIFICATIONS

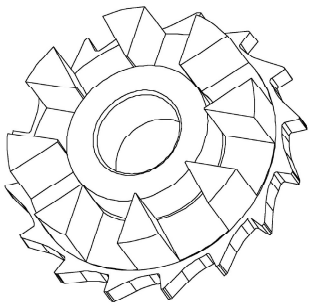
FEATURES

SEIKO Automatic Chronograph Cal. 8R28 and 8R39A are developed by a modular design combining the basic movement of the Cal. 6R series and the newly designed chronograph unit.

By employing this modular design, you can utilize your experience of servicing Cal. 6R series watches for these new calibers. Many of the parts used in the basic movement can also be shared. Both contribute in realizing easier maintenance for this multi-functional mechanical movement.

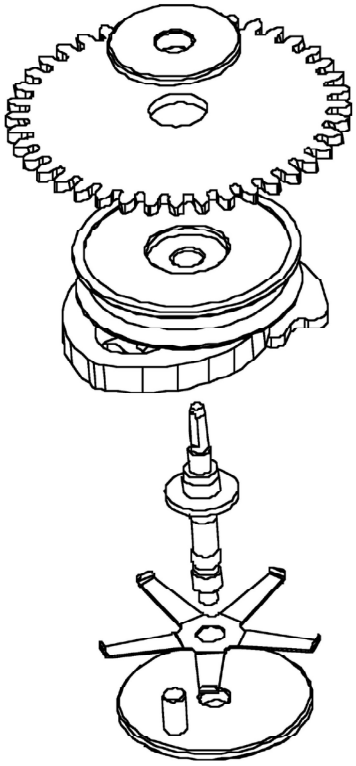
The Cal. 8R28 and 8R39A employ the Column wheel mechanism for operating start, stop and reset functions and the Vertical clutch mechanism for transmitting the power to the chronograph unit. Both are mechanisms which were chosen when SEIKO developed its world's first automatic chronograph Cal. 6139 in 1969 and the same mechanisms are used for the SEIKO SPRING DRIVE chronograph Cal. 5R86, a masterpiece in the 21st century because the original mechanisms are so technologically advanced and reliable.

[The Column wheel]



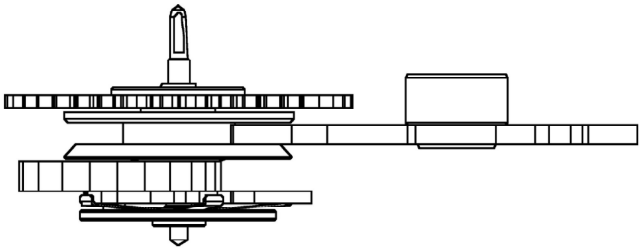
The Column wheel mechanism realizes error-free precision by its maximum stability in the stopwatch operation. This eight pillar component also creates maximum durability and reliability.

[The Vertical clutch]

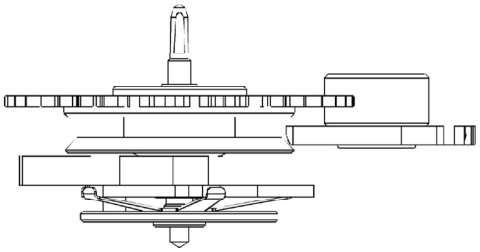


Structure of the chronograph wheel

The Vertical clutch mechanism realizes high precision for the stopwatch operation by preventing the seconds counting hand from any jumping.

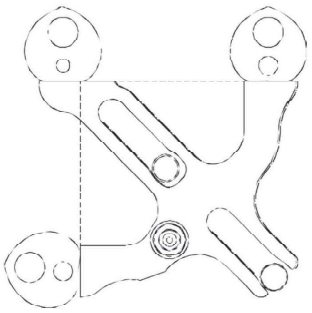


Disengaged - stopwatch function is not activated.



Engaged - stopwatch function is activated.

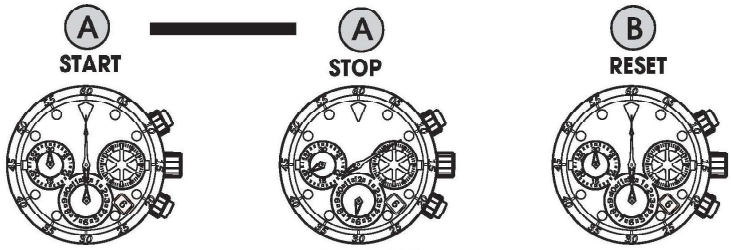
[One-piece three-pointed reset hammer]



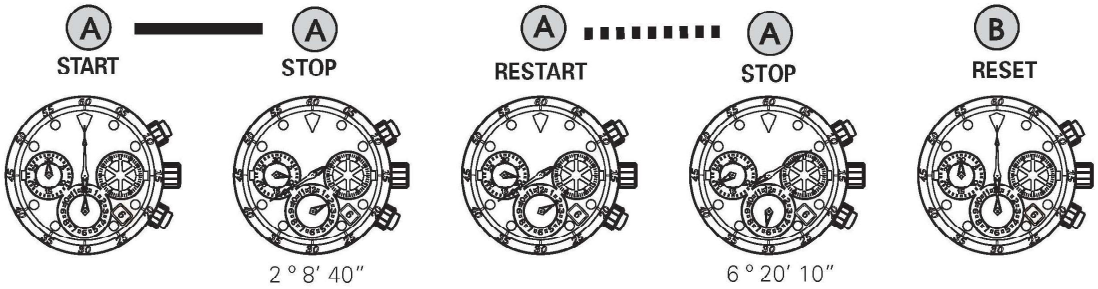
Another feature which makes the Cal. 8R28 and 8R39A outstanding from other mechanical chronograph movements from Swiss manufacturers is the one-piece three-pointed hammer for resetting all the counting hands. While others are using separate hammers which require an assembly and adjustment of the hammers, the one-piece hammer design realizes maximum durability and stability of the component and easier maintenance. It is also equipped with the self-alignment function for all counting hands to return to zero positions.

[How to use the stopwatch function]

<STANDARD MEASUREMENT>



<ACCUMULATED ELAPSED TIME MEASUREMENT>

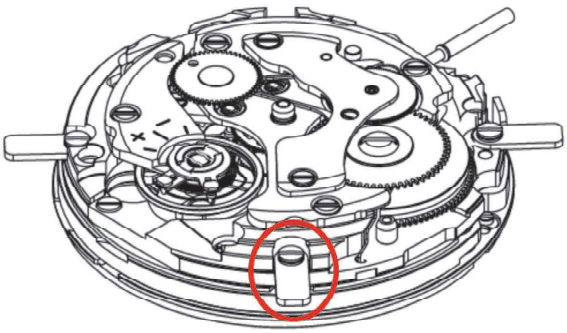


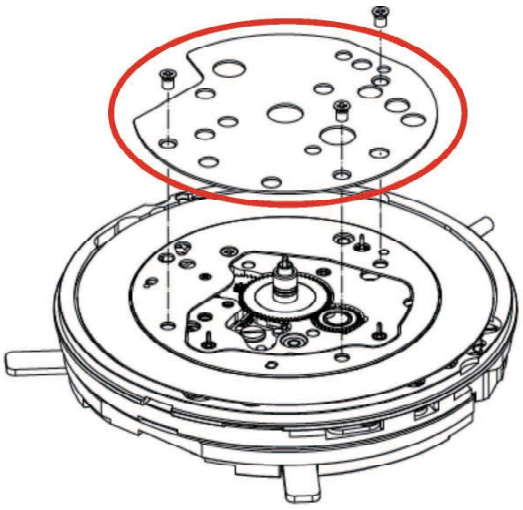
** Restart and stop can be repeated as many times as required by pressing Button A.*

CHARACTERISTICS OF 8R39A, CHRONOGRAPH DIVERS

Cal. 8R39A is a strengthened version of Cal. 8R28A, adapted to a diver's watch standard by changing the following 3 parts.

- Add the HOUR WHEEL GUARD
- Add a CASING CLAMP and hold from 3 points.
- Change BALANCE SPRING to SPRON610.





CHARACTERISTICS OF A MECHANICAL WATCH

1. This mechanical watch operates using power obtained from a mainspring.
2. While loss/gain of a quartz watch is indicated by a monthly or annual rate, accuracy of a mechanical watch is normally indicated by a daily rate (loss/gain per day).
3. Normal usage accuracy of a mechanical watch varies according to conditions of use (time period that the watch is worn on the wrist, temperature environment, hand movement, and winding state of the mainspring).
4. When the watch is affected by strong magnetism, it temporarily gains or loses time. If the watch encounters a strong magnetic field, the parts of the watch may be magnetized. In this case, repairs such as removal of magnetism are required.

PARTS LIST

Disassembling procedures Figs. : ① → ⑯
Reassembling procedures Figs. : ⑯ ← ①
Lubricating:

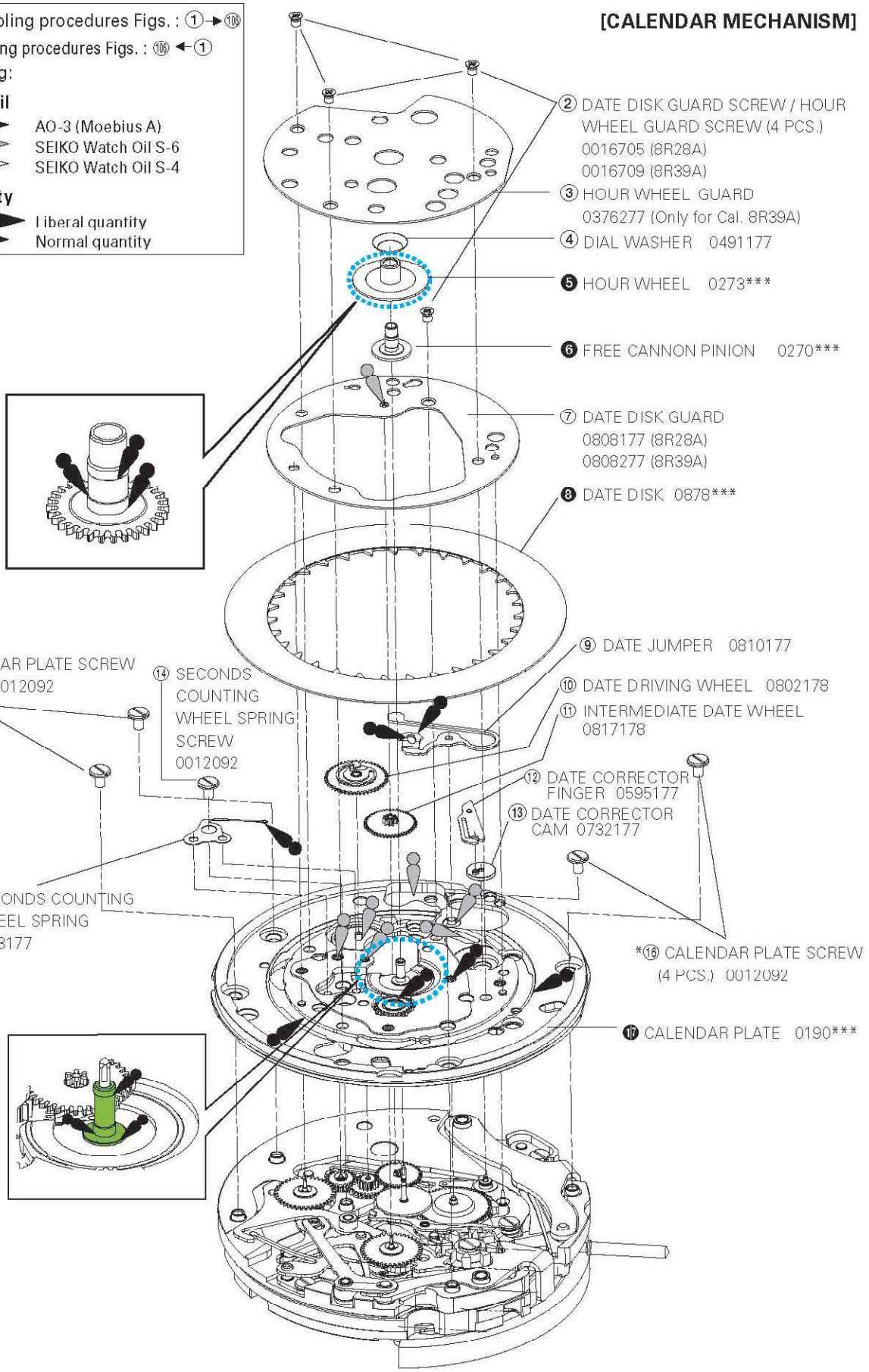
Types of oil

- AO-3 (Moebius A)
- SEIKO Watch Oil S-6
- SEIKO Watch Oil S-4

Oil quantity

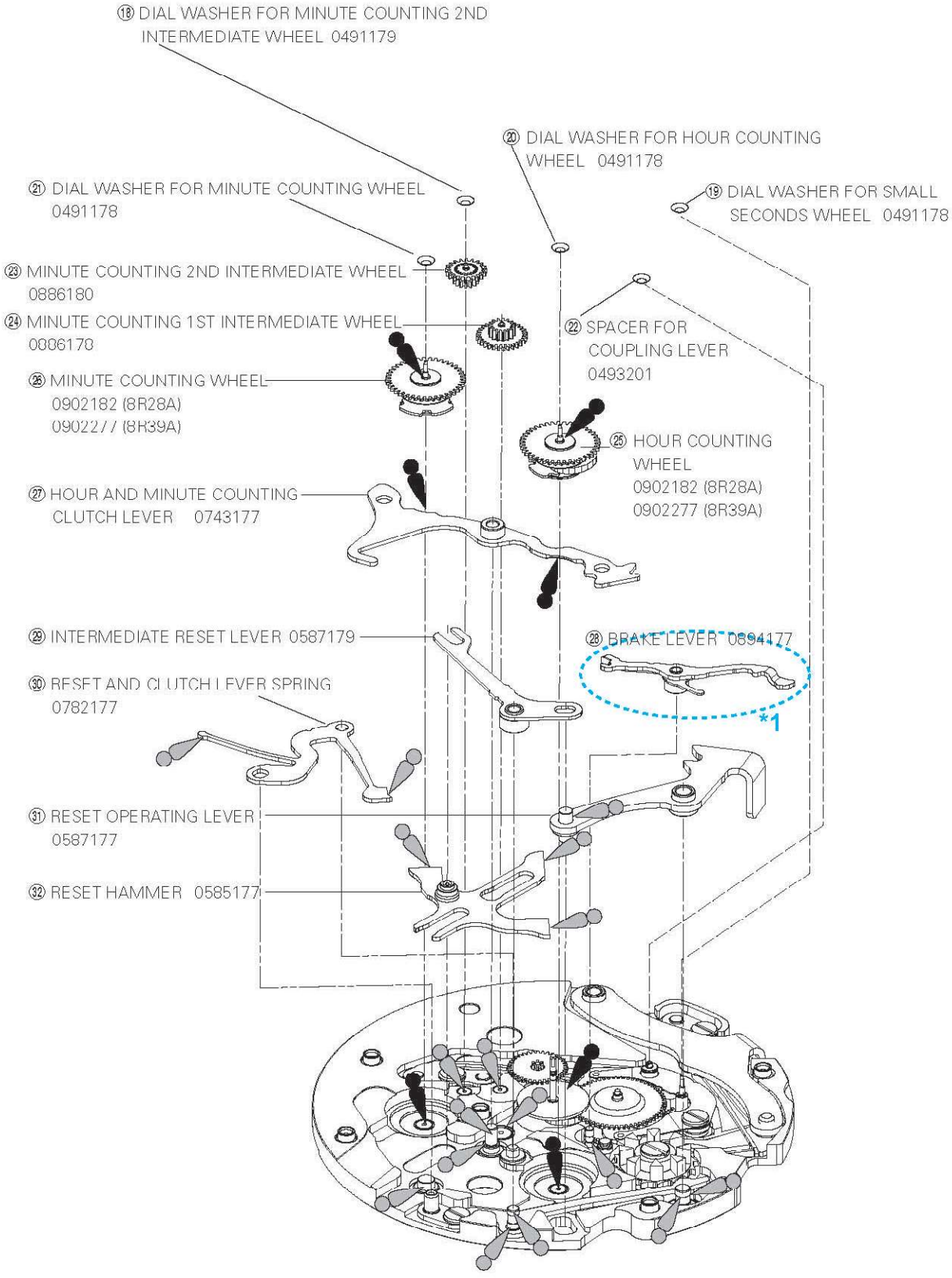
- Liberal quantity
- Normal quantity

[CALENDAR MECHANISM]



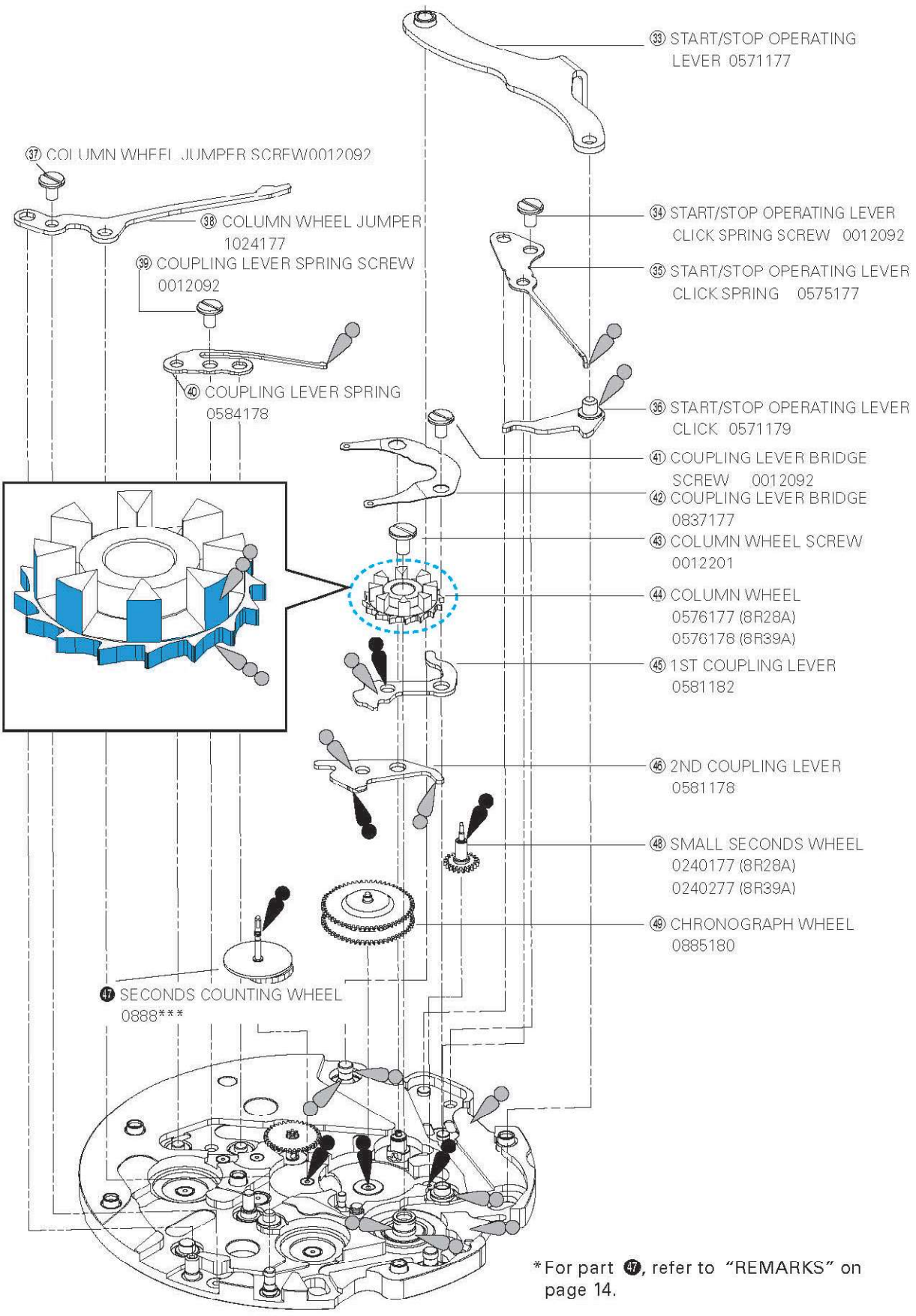
* For parts ❺, ❻, ❽ and ⓱, refer to "REMARKS" on page 14.

[CHRONOGRAPH UNIT (1)]



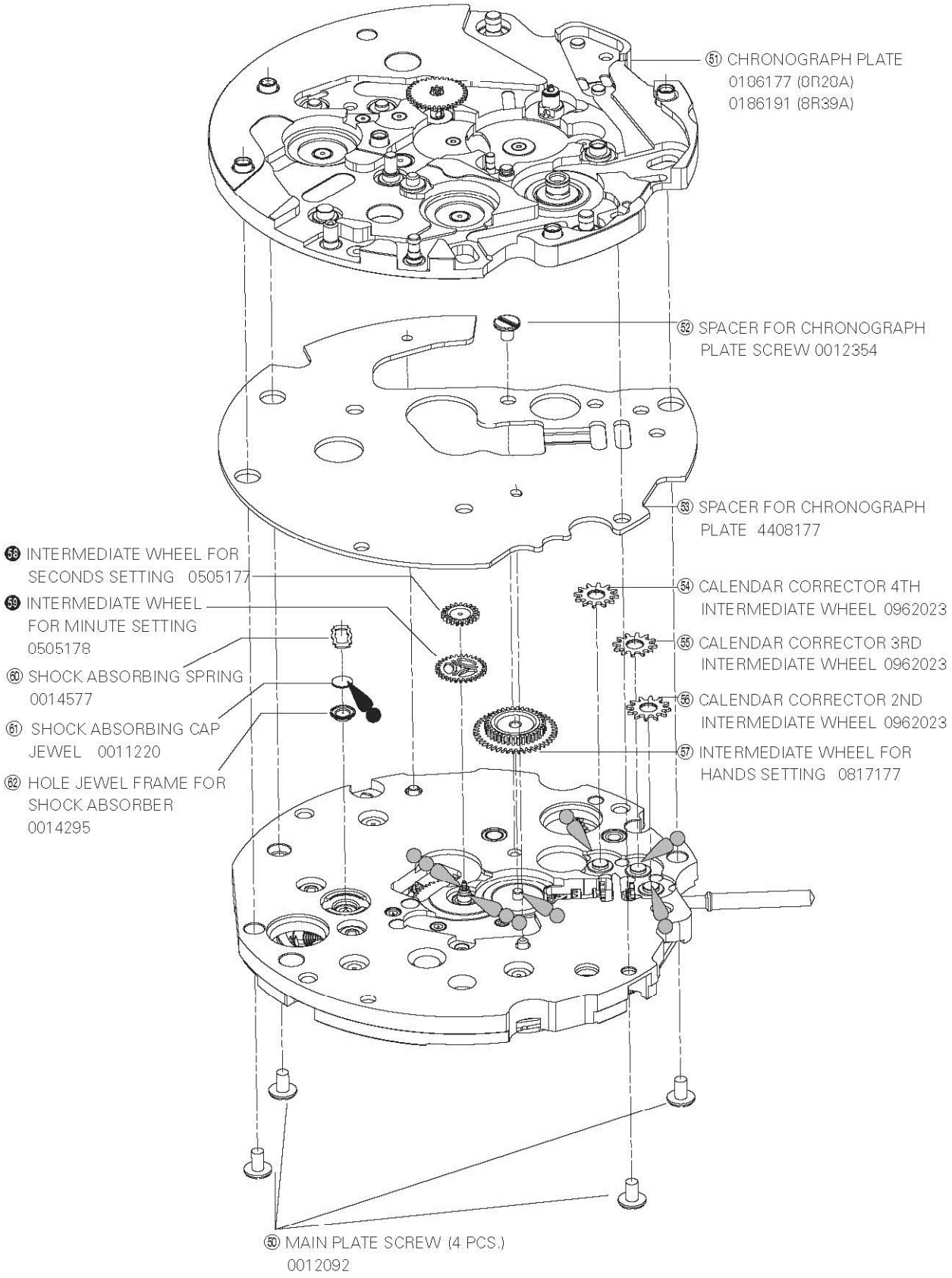
PARTS LIST

[CHRONOGRAPH UNIT (2)]



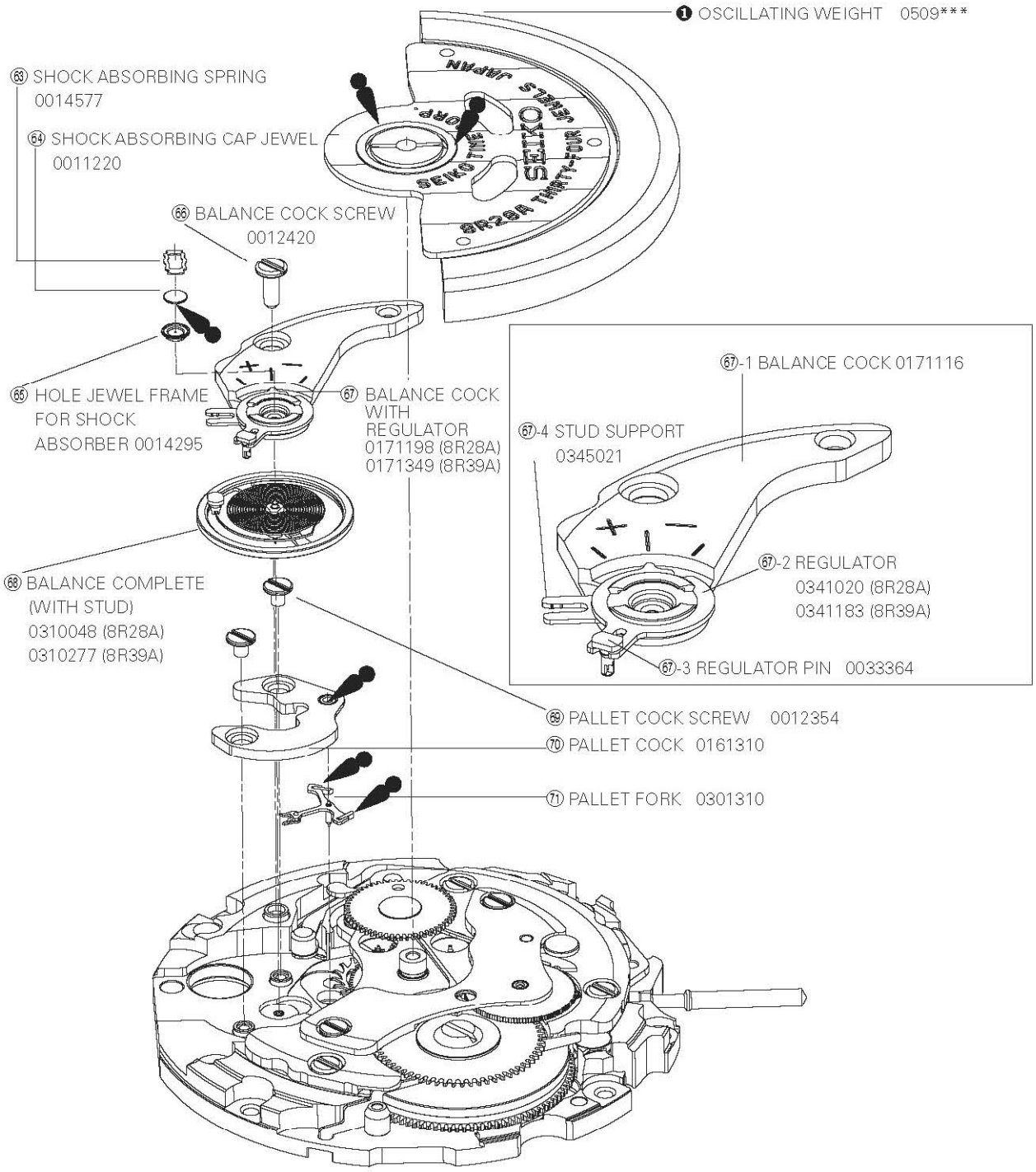
*For part ㊼, refer to "REMARKS" on page 14.

[ASSEMBLY OF CHRONOGRAPH PLATE]



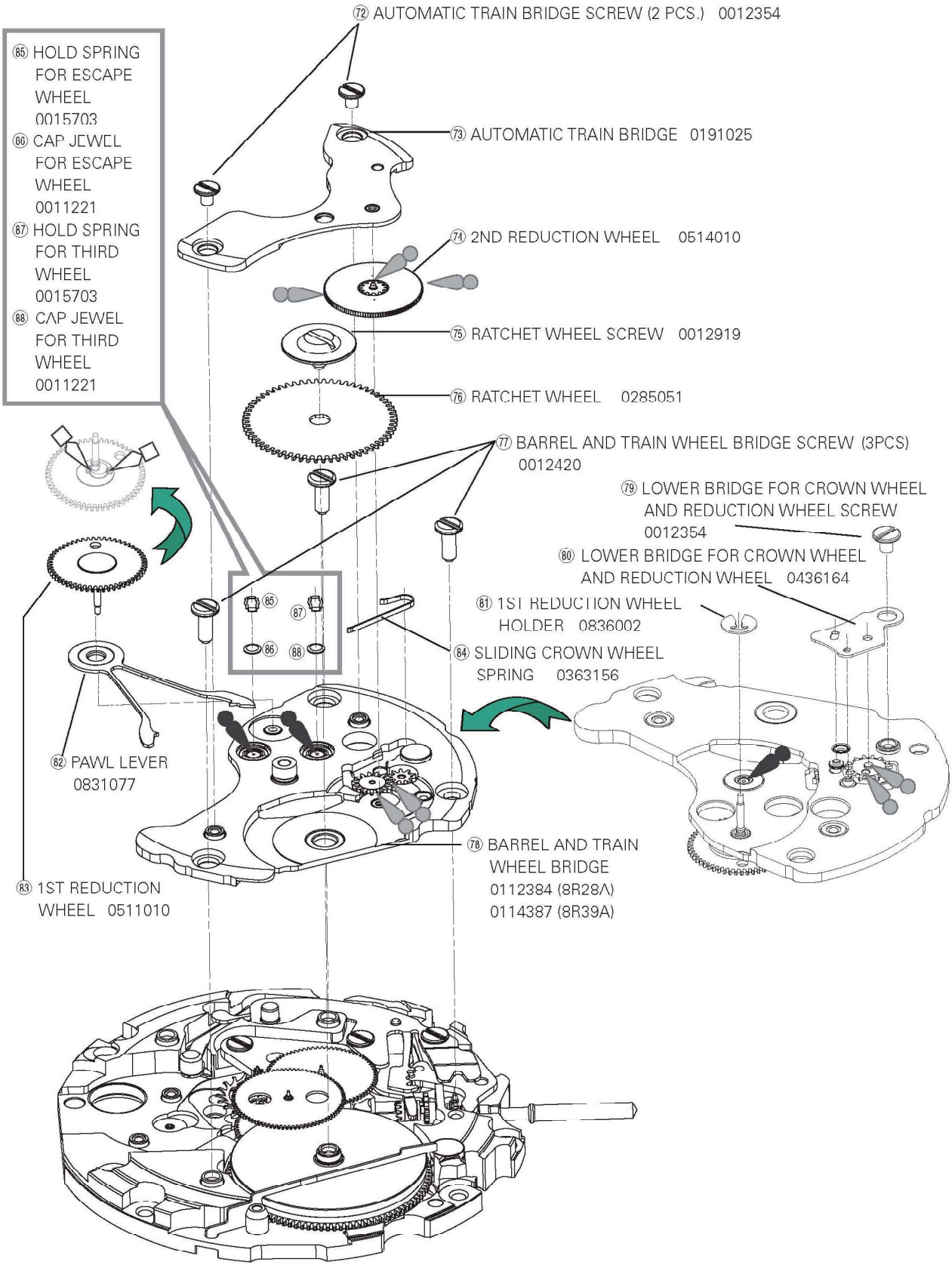
* For parts 58 and 59, refer to "REMARKS" on page 21.

[BALANCE AND ESCAPEMENT]

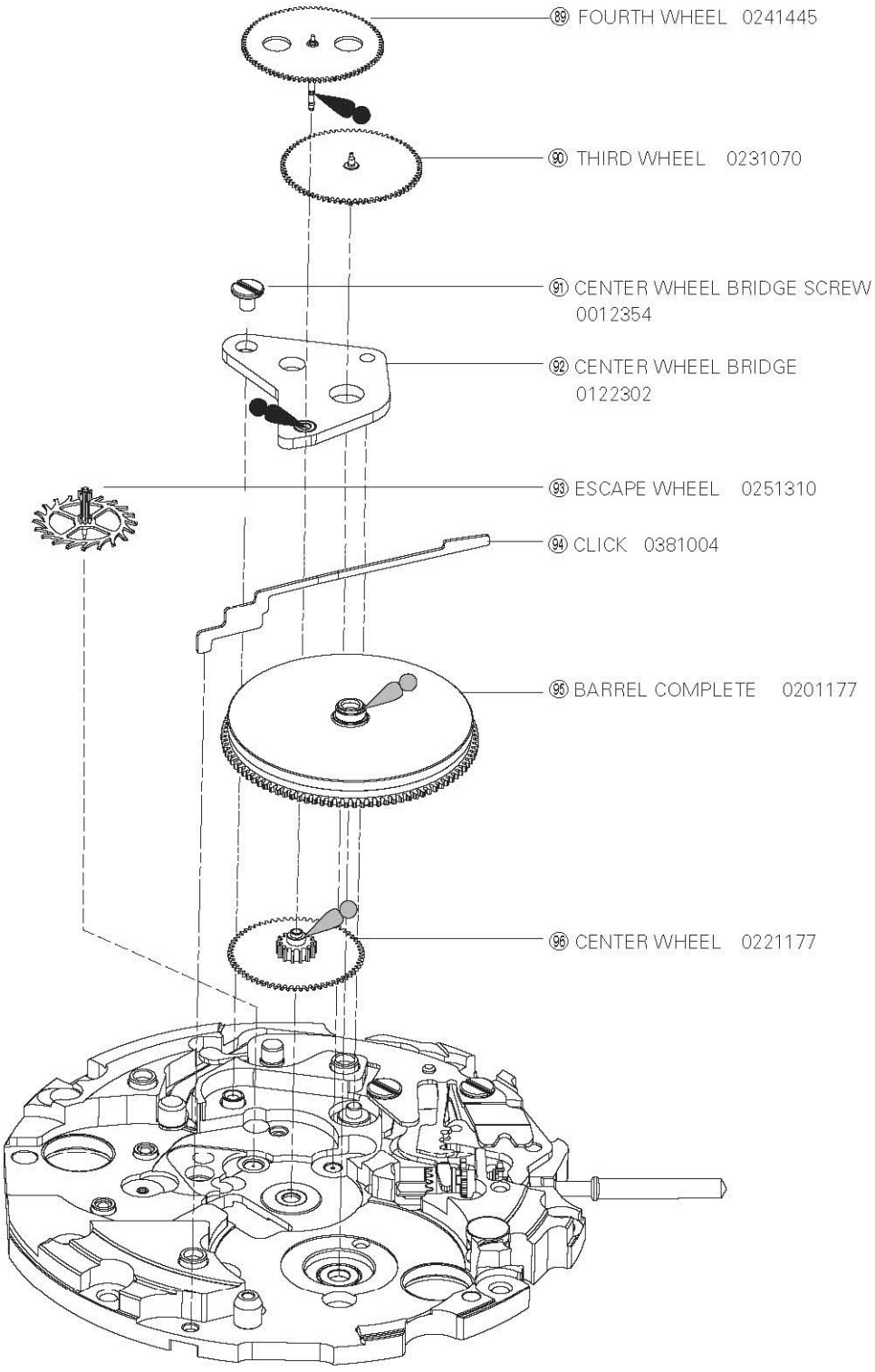


For parts ①, refer to "Remarks" on page 14.

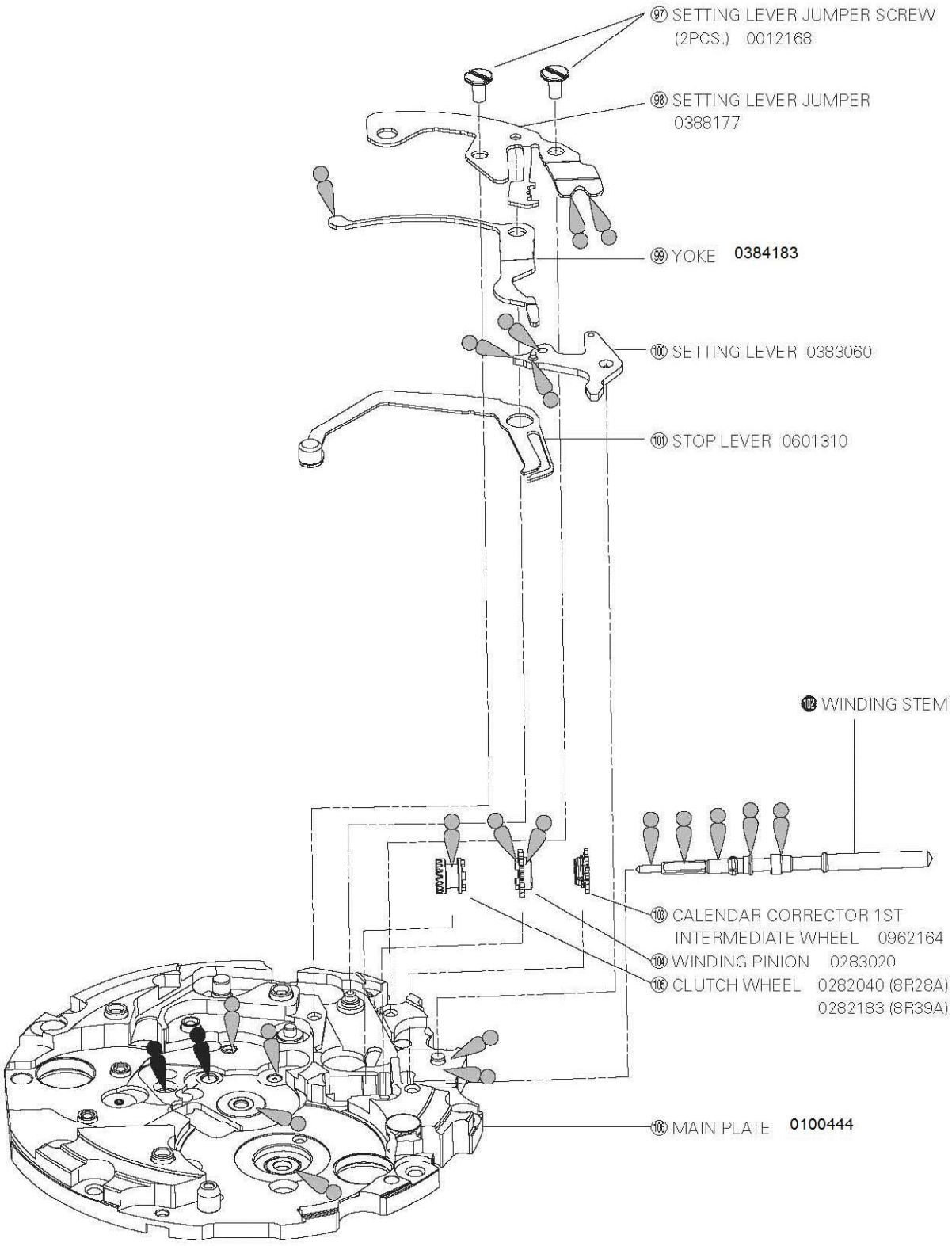
[WINDING MECHANISM]



[GEAR TRAIN MECHANISM]



[SETTING MECHANISM]



* For parts ⑩②, refer to "REMARKS" on page 14.

● How to separate the Chronograph Unit and the Basic unit

Movement of Cal. 8R series can be disassembled in the following 2 ways:

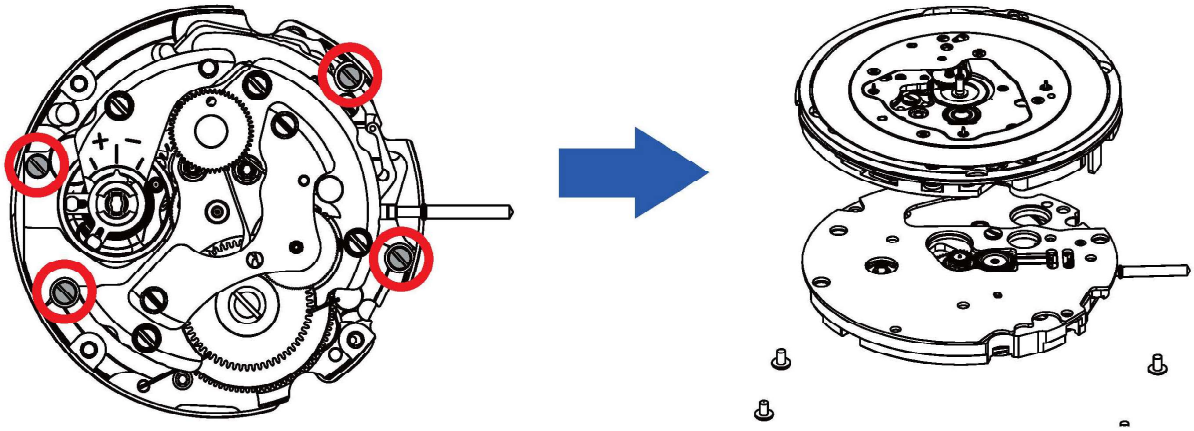
a) Separate the basic and chronograph units, and disassemble each unit.

b) Disassemble from top to bottom as mentioned in the technical guide.

An advantage of unit separation is that a watchmaker can repair only a basic unit or chronograph unit presuming the cause of problem from function checking. Also, as Cal. 8R28 is based on a normal 3-hand mechanical watch, Cal.6R2 series, the watch can be checked by dividing the chronograph unit and base 3 hand mechanical watch unit apart when you repair this caliber. This can streamline the repair process by shortening the time.

[Procedure]: Disassembling

1. Start the chronograph function
   - To disengage the HOUR AND MINUTE COUNTING CLUTCH LEVER and HOUR / MINUTE COUNTING WHEELS.
2. Disassemble the MAIN PLATE SCREW (4 pcs.).
   - The units can be separated by inserting a screw driver to the slot on the 9 o'clock.

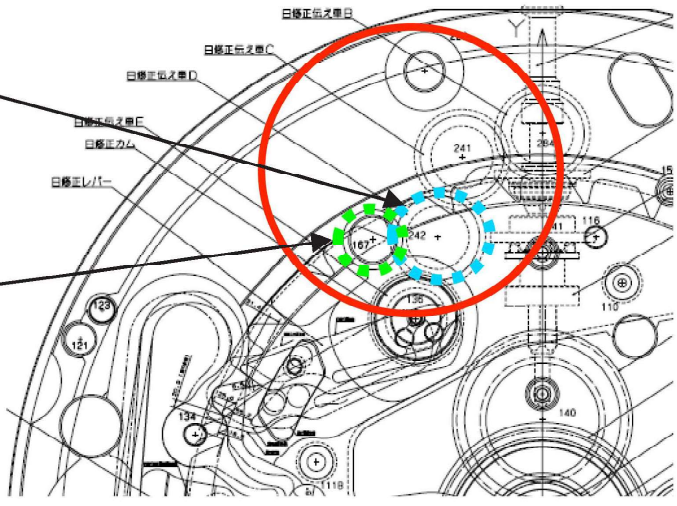


[Procedure]: Reassembling and checking

1. Pull out the CROWN to the 1st click position.
   - Set the movement by turning the stem to engage the teeth of the CALENDAR CORRECTOR 4TH SETTING WHEEL and CALENDAR CORRECTOR 5TH SETTING WHEEL. Otherwise the teeth will get broken.
2. Keep moving the chronograph function and check if the SECOND CHRONOGRAPH WHEEL is moving after you set the units.

CALENDAR CORRECTOR 4TH SETTING WHEEL

CALENDAR CORRECTOR 5TH SETTING WHEEL (assembled in the CHRONOGRAPH PLATE)



● How to find the correct parts, if not determined by 4 digit caliber number

Following parts are determined based on the design of watches, such as hands height, dial color, and design of cases. Please refer to the SEIKO WATCH PARTS CATALOGUE in order to choose corresponding parts.

① OSCILLATING WEIGHT 0509***

⑧ DATE DISK 0878***

⑩② WINDING STEM 0351200

* For screw down crown models, the stem is assembled to the crown and is not available separatelly.

⑤ HOUR WHEEL

⑥ FREE CANON PINION

⑰ CALENDAR PLATE

㊼ SECONDS COUNTING WHEEL

Please refer to the following table in order to find the correct part number of each wheel according to the hand installation height. The numeral 2 or 3 is printed on the CALENDAR PLATE. If the numeral is not mentioned on the CALENDAR PLATE, the hand installation height is same as 3.

[8R28A]

	⑤ HOUR WHEEL	⑥ FREE CANON PINION	⑰ CALENDAR PLATE	㊼ SECONDS COUNTING WHEEL
3	0273178	0270441	0190177	0888178

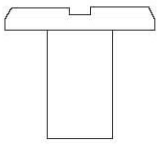
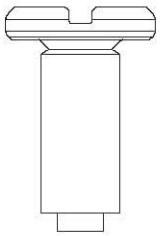
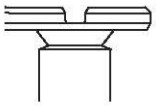
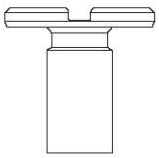
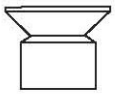
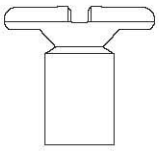
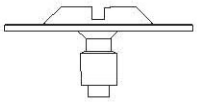
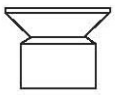
[8R39A]

	⑤ HOUR WHEEL	⑥ FREE CANON PINION	⑰ CALENDAR PLATE	㊼ SECONDS COUNTING WHEEL
3	0273277	0270443	0190191	0888277

PARTS LIST

● How to discrimianate resembled parts

Screws and washers

 0012092	⑭ SECONDS COUNTING WHEEL SPRING SCREW (1 pce.) ⑯ CALENDAR PLATE SCREW (4 pcs.) ㉞ START/STOP OPERATING LEVER CLICK SPRING SCREW (1 pce.) ㊲ COLUMN WHEEL JUMPER SCREW (1 pce.) ㊴ COUPLING LEVER SPRING SCREW (1 pce.) ㊶ COUPLING LEVER BRIDGE SCREW (1 pce.)	 0012420	㊻ BALANCE COCK SCREW (1 pce.) ㊼ BARREL & TRAIN WHEEL BRIDGE SCREW (3 pcs.)
 0012354	㊿ MAIN PLATE SCREW (4 pcs.) (52) SPACER FOR CHRONOGRAPH PLATE SCREW (1 pce.) (69) PALLET COCK SCREW (2 pcs.) (72) AUTOMATIC TRAIN BRIDGE SCREW (2 pcs.) (79) LOWER BRIDGE FOR CROWN WHEEL AND REDUCTION WHEEL SCREW (1 pce.) (91) CENTER WHEEL BRIDGE SCREW (1 pce.)	 0012168	(97) SETTING LEVER JUMPER SCREW (1 pce.)
 0016705	② DATE DISK GUARD SCREW (4 pcs.) *For Cal. 8R28A Height: 0.77 mm*	 Gilt 0491177	② DIAL WASHER
 0012201	㊸ COLUMN WHEEL SCREW (1 pce.)	 Gilt 0491178	⑲ DIAL WASHER FOR SMALL SECONDS WHEEL ⑳ DIAL WASHER FOR HOUR COUNTING WHEEL ㉑ DIAL WASHER FOR MINUTE COUNTING WHEEL
 0012919	(75) RATCHET WHEEL SCREW (1 pce.)	 Silver 0491179	⑱ DIAL WASHER FOR MINUTE COUNTING 2ND INTERMEDIATE WHEEL
 0016709	② DATE DISK GUARD SCREW / HOUR WHEEL GUARD SCREW *For Cal. 8R39A Height: 0.92 mm*		

* For the parts 0016705 and 0016709, please be careful that the shape is the same but only the length is different.

PARTS LIST

● **Location of the jewels**

		Upper		Lower	
		Cap jewel	Hole jewel	Cap jewel	Hole jewel
GEAR TRAIN MECHANISM	(89) FORTH WHEEL	–	○	–	–
	(90) THIRD WHEEL	○	○	–	○
	(93) ESCAPE WHEEL	○	○	–	○
	(96) CENTER WHEEL	–	○	–	○
WINDING MECHANISM	(74) 2ND REDUCTION WHEEL	–	○	–	○
	CROWN WHEEL (Assembled to the (78) BARREL AND TRAIN WHEEL BRIDGE	–	○	–	–
	(83) 1ST REDUCTION WHEEL	–	○	–	○
CHRONOGRAPH UNIT	(11) INTERMEDIATE DATE WHEEL	–	○	–	–
	(23) MINUTE COUNTING 2ND INTERMEDIATE WHEEL	–	○	–	○
	(24) MINUTE COUNTING 1ST INTERMEDIATE WHEEL	–	○	–	○
	(25) HOUR COUNTING WHEEL	–	–	–	○
	(26) MINUTE COUNTING WHEEL	–	–	–	○
	(47) SECONDS COUNTING WHEEL	–	○	–	–
	(48) SMALL SECONDS WHEEL	–	–	–	○
	(49) CHRONOGRAPH WHEEL	–	○	–	○
BALANCE AND ESCAPEMENT	(68) BALANCE COMPLETE (WITH STUD)	○	○	○	○
	(71) PALLET FORK	–	○	–	○
	ENTRY PALLET JEWEL		○		
	EXIT PALLET JEWEL		○		
	ROLLER JEWELS		○		
	TOTAL NUMBER OF JEWELS		34 jewels		

● Tools and consumables required for disassembling/reassembling

• Movement holder

UNIVERSAL MOVEMENT HOLDER (S-682)



• Watch oils

SEIKO watch grease S-6 and S-4, watch oil A0-3 (or Moebius A)

S-6



A0-3



S-4

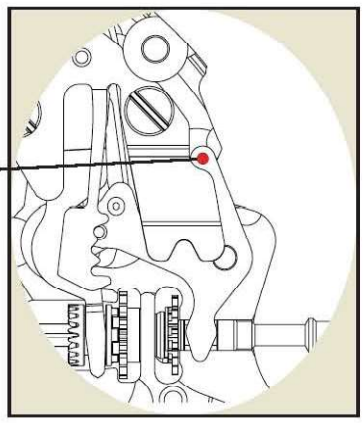


REMARKS ON DISASSEMBLING AND REASSEMBLING THE MOVEMENT

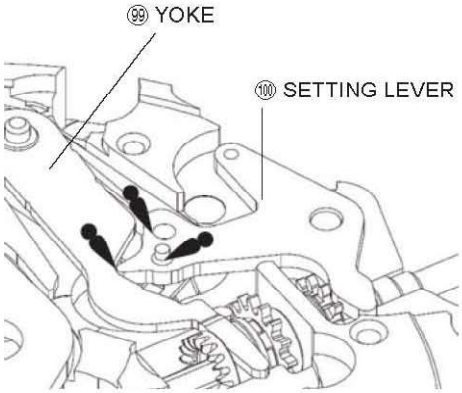
● HOW TO REMOVE THE SETTING STEM BEFORE DISMANTLING THE MOVEMENT

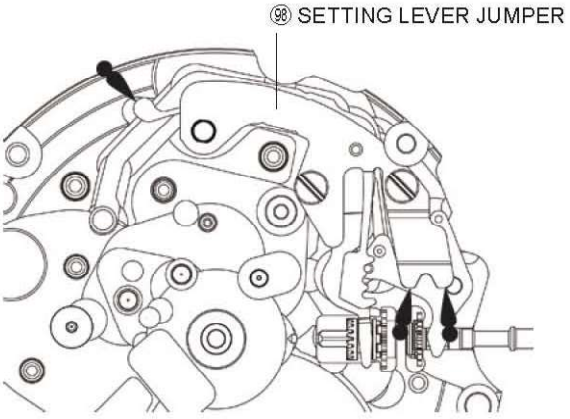
Crown position: 0 position

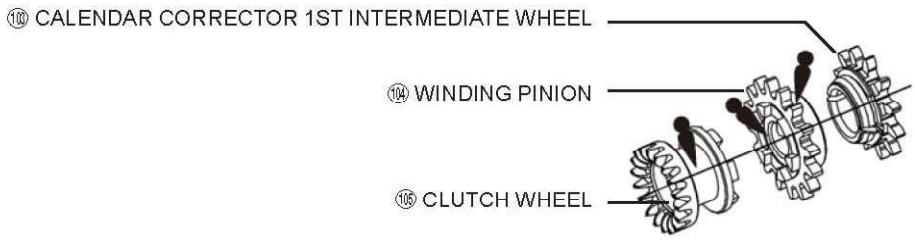
Push the SETTING LEVER gently (refer to the picture on the right) in order to disengage it from the SETTING STEM. Then pull out the crown with stem completely.



● SETTING MECHANISM





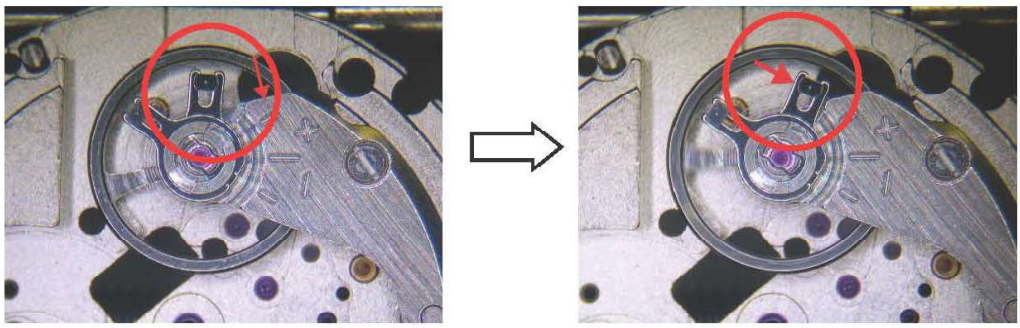


● BALANCE AND ESCAPEMENT

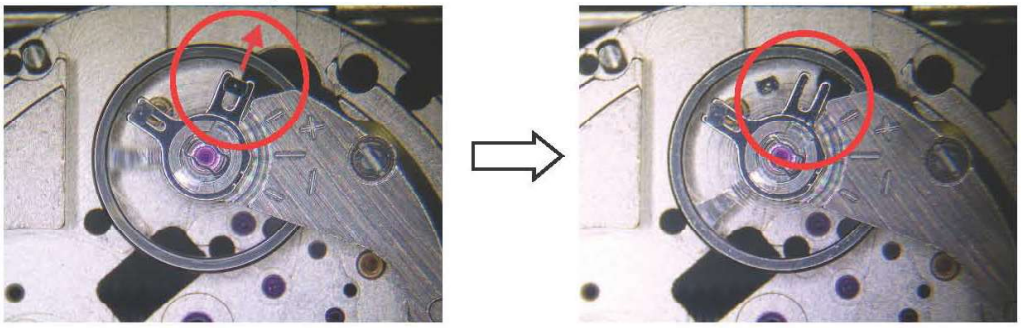
How to disassemble/reassemble the BALANCE and BALANCE COCK

• Disassembling

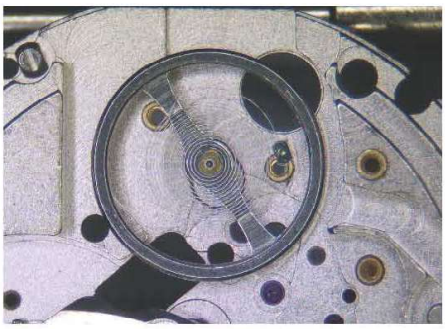
1) Rotate the STUD SUPPORT until it touches to the BALANCE COCK.
When doing so, make sure that the second bend of the balance-spring does not touch the REGULATOR PIN.



2) Push out the stud parallel to the slit of the STUD SUPPORT (the direction also shown by the red arrow in the illustration) in order to remove it from the STUD SUPPORT.



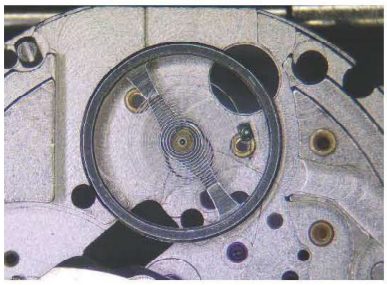
3) Unscrew the BALANCE COCK SCREW and remove the BALANCE COCK WITH REGULATOR.



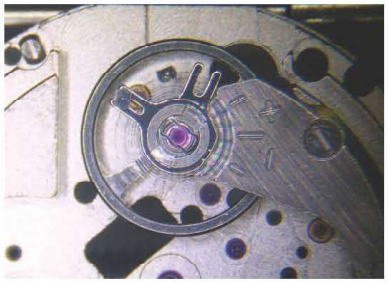
4) Remove the BALANCE COMPLETE WITH STUD.

- **Reassembling**

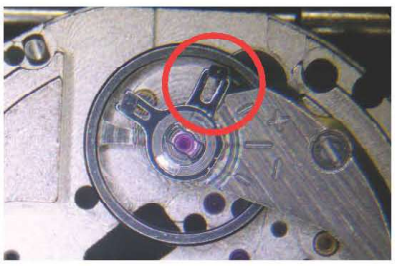
1) Install the BALANCE COMPLETE WITH STUD to the MAIN PLATE.

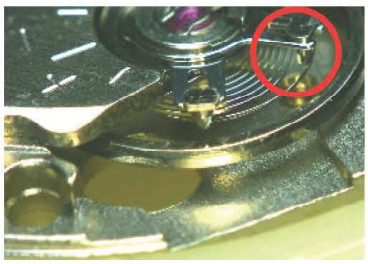


2) Set the BALANCE COCK WITH REGULATOR and tighten the BALANCE COCK SCREW.

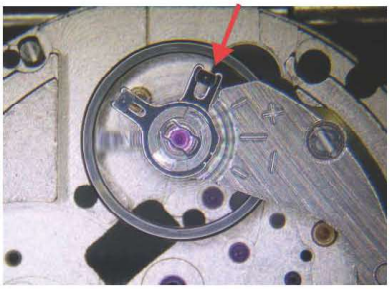


3) Temporarily set the stud to the STUD SUPPORT.
Do not engage the balance-spring to the REGULATOR PIN. The balance-spring passes outside of the REGULATOR-PIN at this stage.





4) Push back the stud parallel to the slit of the STUD SUPPORT.



5) Engage the balance-spring with the slit of the REGULATOR PIN.



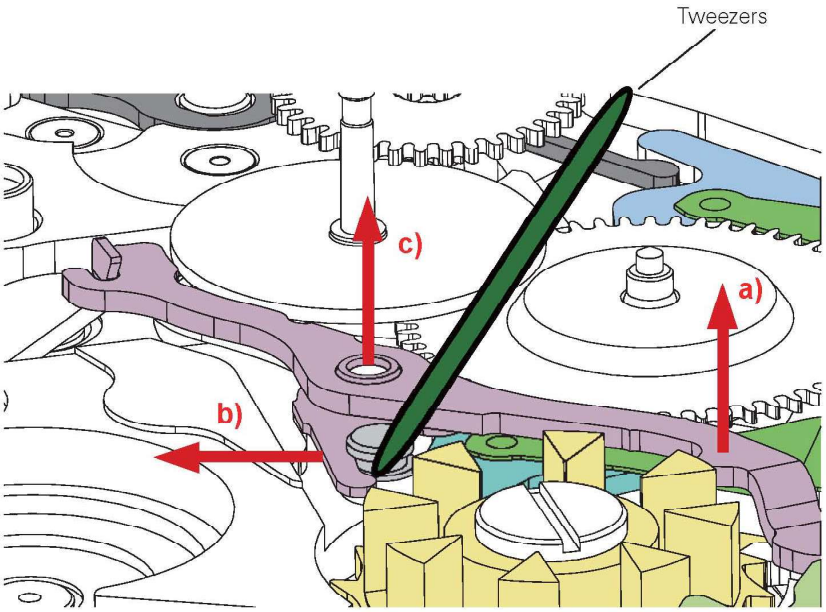
* When assembling the BALANCE COMPLETE, pay great attention not to deform the balance-spring, especially at the second bend.

● HOW TO DISASSEMBLE THE BRAKE LEVER

A) Disengage the spring and pull up on the COLUMN WHEEL.

B) Disengage the b) part with tweezers from pin.

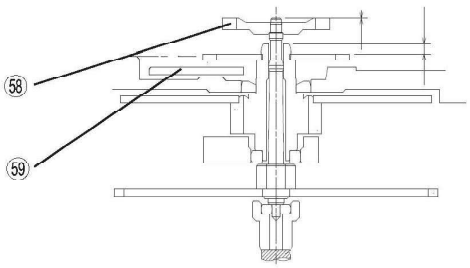
C) Disassemble the BRAKE LEVER by holding the c) part.



● CHRONOGRAPH MECHANISM

- **Reassembly of INTERMEDIATE WHEELS**

⑱	INTERMEDIATE WHEEL FOR SECONDS SETTING	0505177
⑲	INTERMEDIATE WHEEL FOR MINUTE SETTING	0505178



Please replace the above wheels with new ones when you disassemble them for overhauling.

When reassembling them, make sure that they are assembled in parallel (refer to the above illustration).

● CHRONOGRAPH UNIT

- **Operation of chronograph mechanism**

STARTING

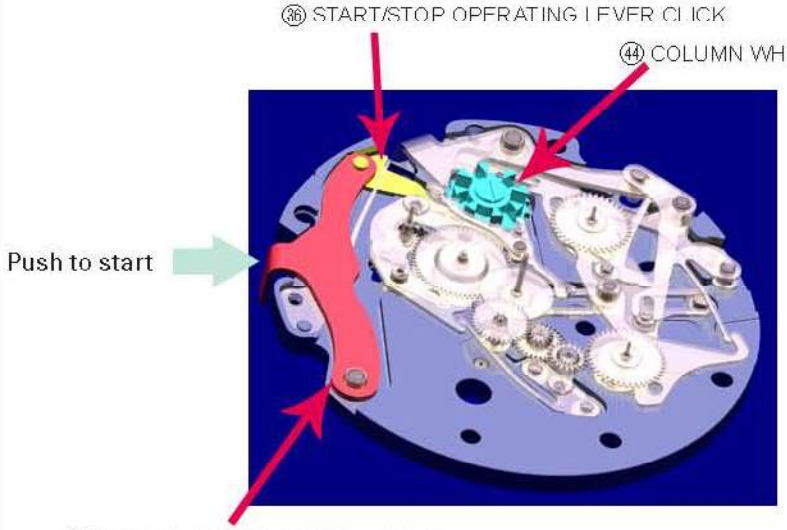


Fig.1

Process of power transmisson

START/STOP PUSH BUTTON

↓

START/STOP OPERATING LEVER

↓

START/STOP OPERATING LEVER CLICK

↓

COLUMN WHEEL

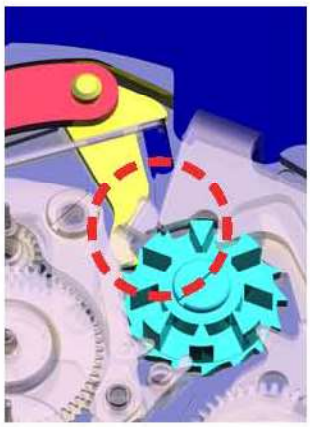


Fig.2-a

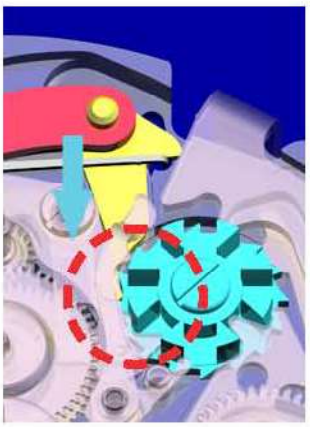


Fig.2-b

Forwarded one tooth of its ratchet (see Fig. 2-a and 2-b)

↓

The vertical clutch system starts transmitting the power of the power train to the chronograph train.

How the vertical clutch works

1) SECONDS COUNTING WHEEL

[Stopwatch function not in operation]

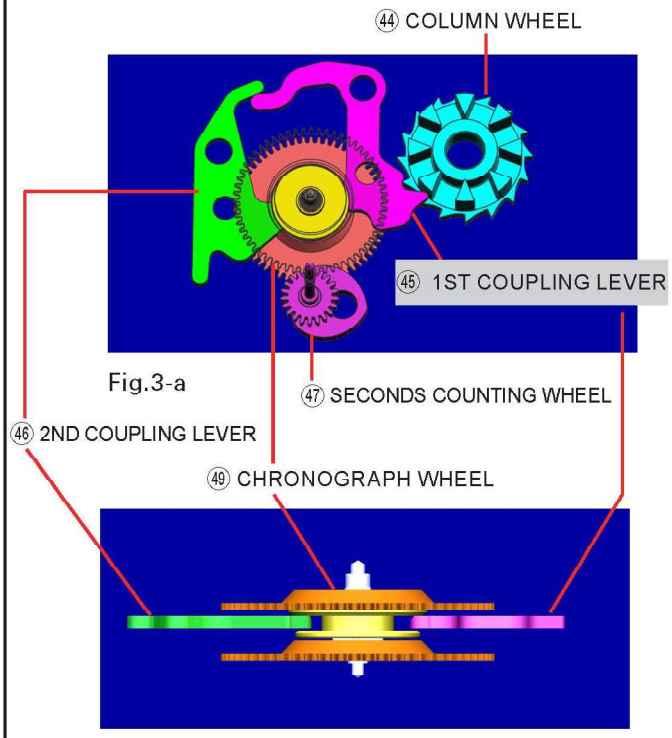


Fig.3-a

Fig.3-b

The vertical clutch is disengaged.

The CHRONOGRAPH WHEEL is lifted by coupling levers to free it from turn.

[in operation]

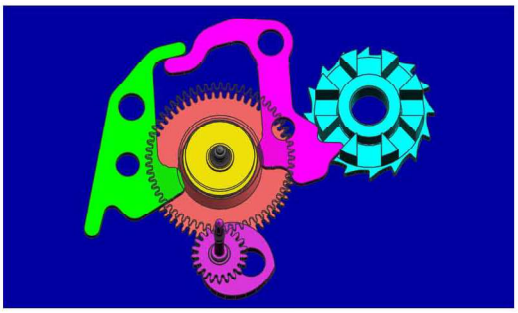


Fig.4-a

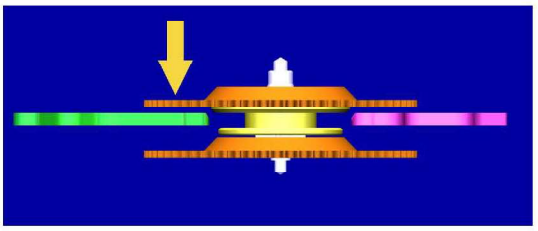


Fig.4-b

The vertical clutch is connected.

The coupling levers are released from the CHRONOGRAPH WHEEL and it is driven by the SMALL SECONDS WHEEL.

2) HOUR and MINUTE COUNTING WHEELs

[Stopwatch function not in operation]

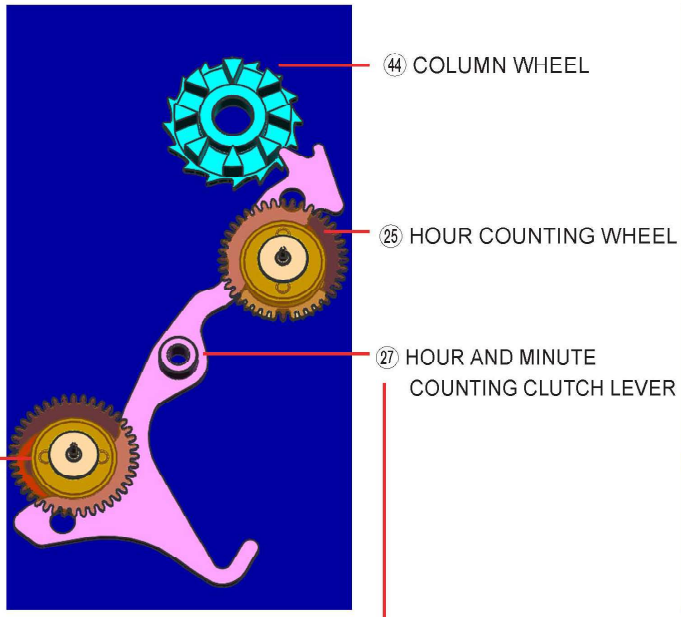


Fig.5-a

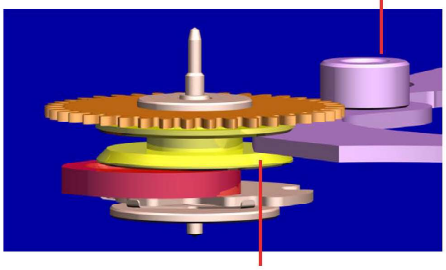


Fig.5-b Counting wheel

The vertical clutch is disengaged.

Both counting wheels are lifted by the HOUR AND MINUTE COUNTING CLUTCH LEVER to free it from turn.

[in operation]

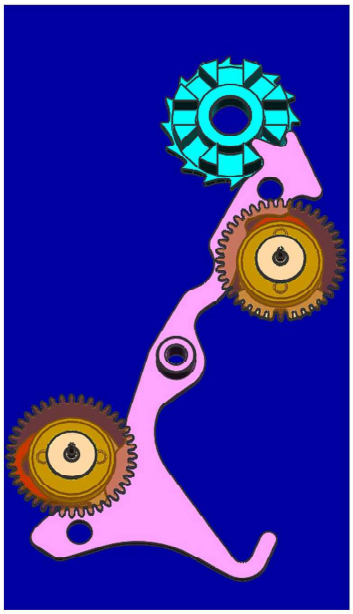


Fig.6-a

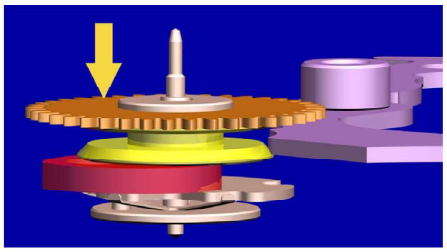


Fig.6-b

The vertical clutch is connected.

The HOUR AND MINUTE COUNTING CLUTCH LEVER is released from two counting wheels and they are driven by gear train.

STOPPING

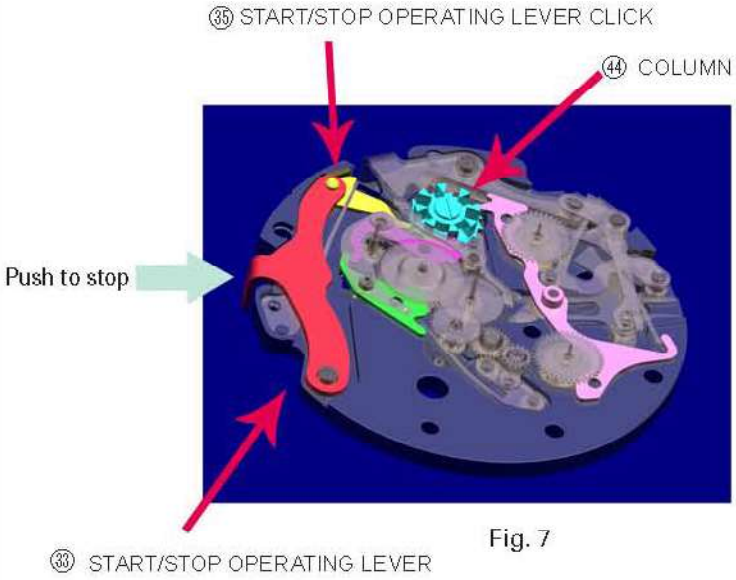


Fig. 7

When the COLUMN WHEEL is forwarded another tooth, the clutch is disengaged (Fig. 7).

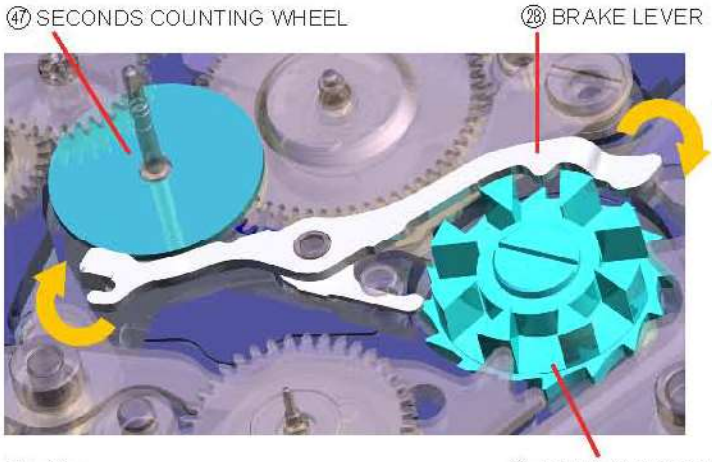


Fig.3-a

At the same time, the BRAKE LEVER turns to brake the SECONDS COUNTING WHEEL (Fig. 8).

RESETTING

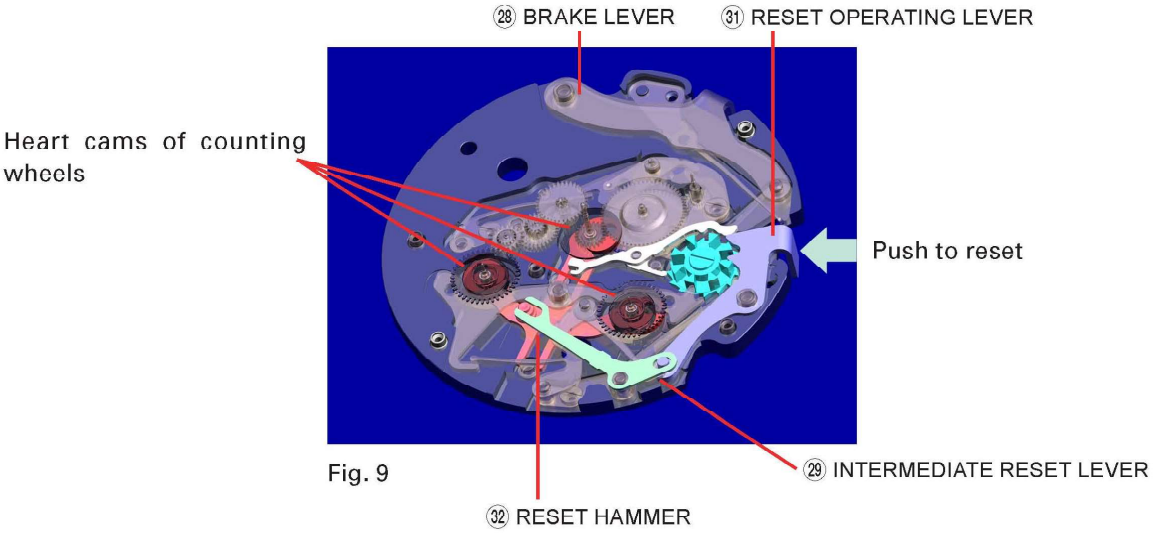
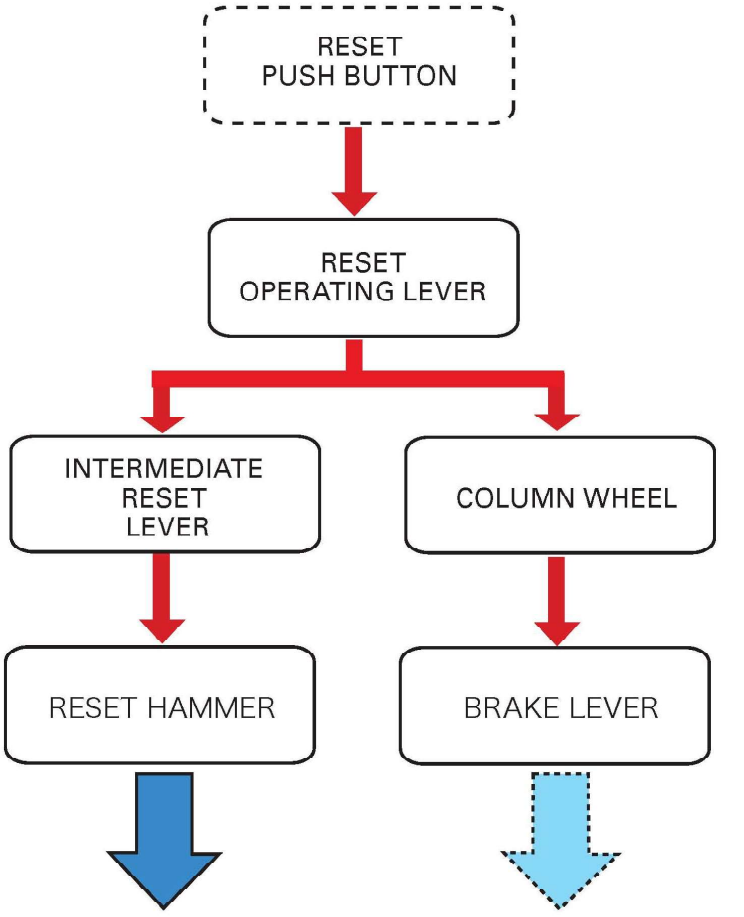


Fig. 9

Note:

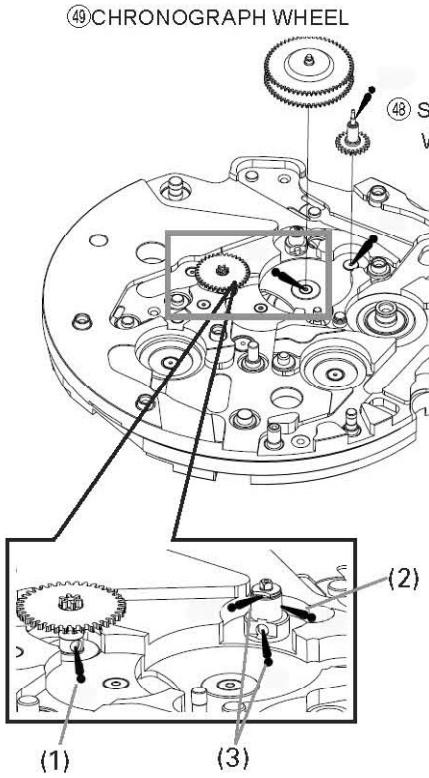
When the stopwatch function is in motion, the RESET OPERATING LEVER is blocked by a pillar of the COLUMN WHEEL and the push button cannot be pressed for resetting.

Process of power transmisson



- **Assembling of chronograph unit**

1



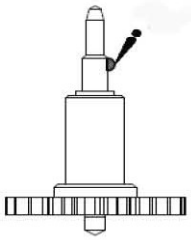
Assemble the CHRONOGRAPH WHEEL.

Assemble the SMALL SECONDS WHEEL.

[Instructions for lubrication]

- Pivot holes of the wheels
- Upper pivot of the SMALL SECONDS WHEEL

  Type of oil: AO-3



(1) Pinion of the MINUTE WHEEL (pre-assembled to the plate)

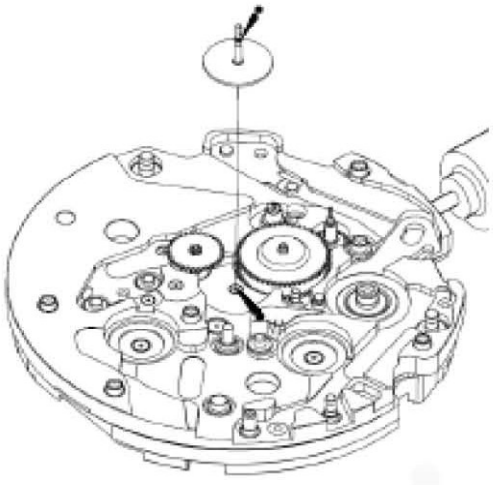
(2) Support pin for the 2ND COUPLING LEVER

  Type of oil: S-6

(3) CALENDAR CORRECTOR DRIVE SHAFT (pre-assembled to the plate)

  Type of oil: AO-3

2

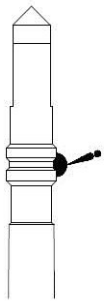


Assemble the SECONDS COUNTING WHEEL.

[Instructions for lubrication]

- Pivot hole of the SECONDS COUNTING WHEEL
- Axis of the SECONDS COUNTING WHEEL

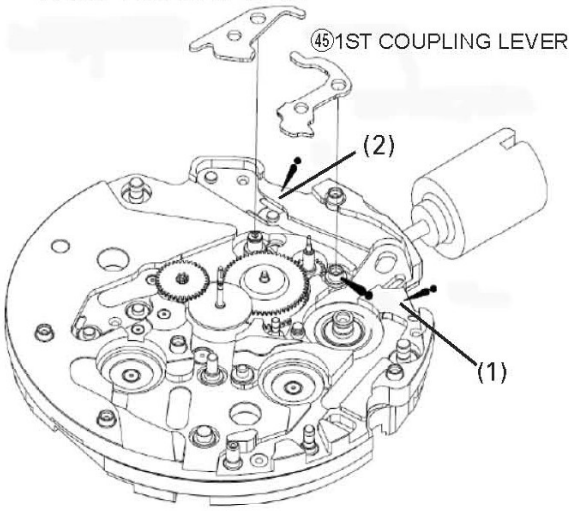
  Type of oil: AO-3



3

㊻ 2ND COUPLING LEVER

㊺1ST COUPLING LEVER



Assemble the 2ND COUPLING LEVER.

Assemble the 1ST COUPLING LEVER.

[Instructions for lubrication]

- CHRONOGRAPH PLATE

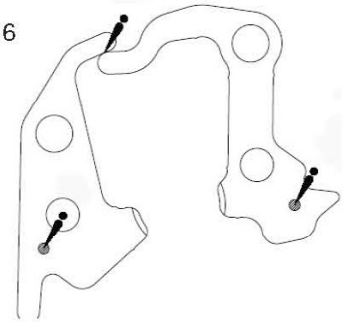
(1) Friction surface of the RESET OPERATING LEVER

(2) Friction surface of the START/STOP OPERATING LEVER

Type of oil: S-6

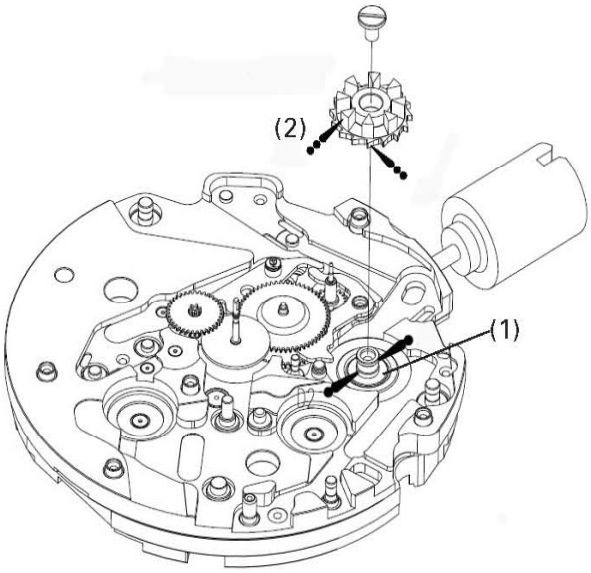
- Contact points between the coupling levers

Type of oil: S-6

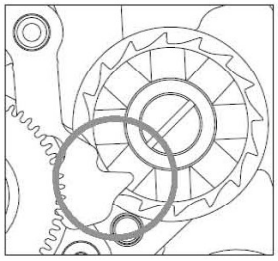


4

㊸&㊹COLUMN WHEEL AND SCREW



Assemble the COLUMN WHEEL and tighten the screw.



[Alignment with the 1ST COUPLING LEVER]

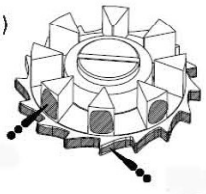
[Instructions for lubrication]

(1) Shaft for the wheel

(2) Teeth of the wheel

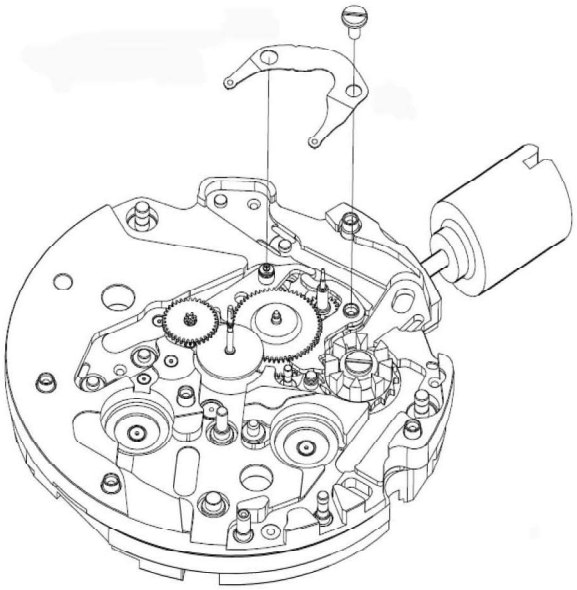
Type of oil: S-6

(2)

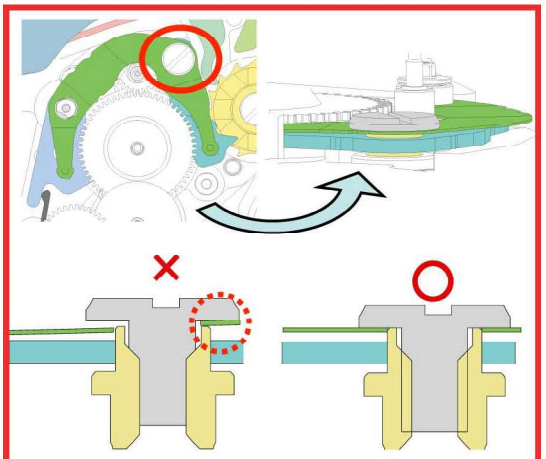


5

㊶&㊷ COUPLING LEVER BRIDGE AND SCREW



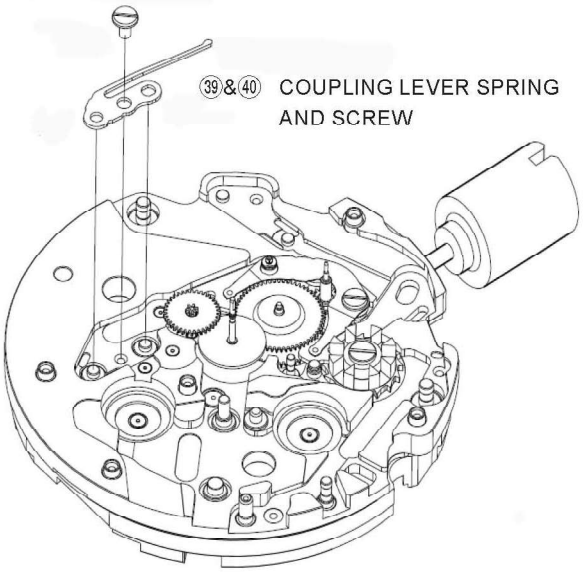
Assemble the COUPLING LEVER BRIDGE and tighten the screw.



The coupling lever bridge is easily caught by the coupling lever bridge screw.

6

㊴&㊵ COUPLING LEVER SPRING AND SCREW



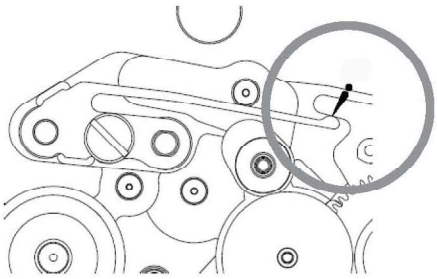
Set the COUPLING LEVER SPRING and secure it to the 2ND COUPLING LEVER.

Tighten the COUPLING LEVER SPRING SCREW.

[Instructions for lubrication]

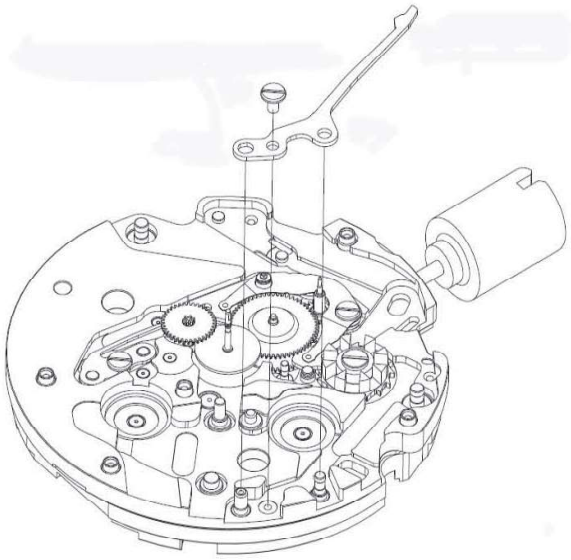
- Contact point with the 2ND COUPLING LEVER

  Type of oil: S-6



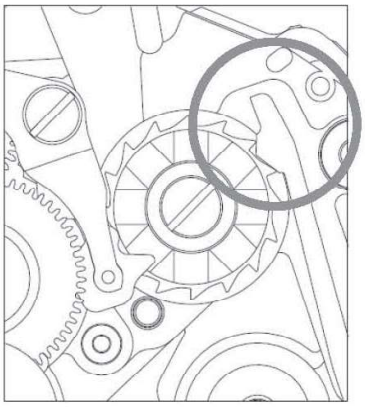
7

㊲&㊳ COLUMN WHEEL JUMPER AND SCREW



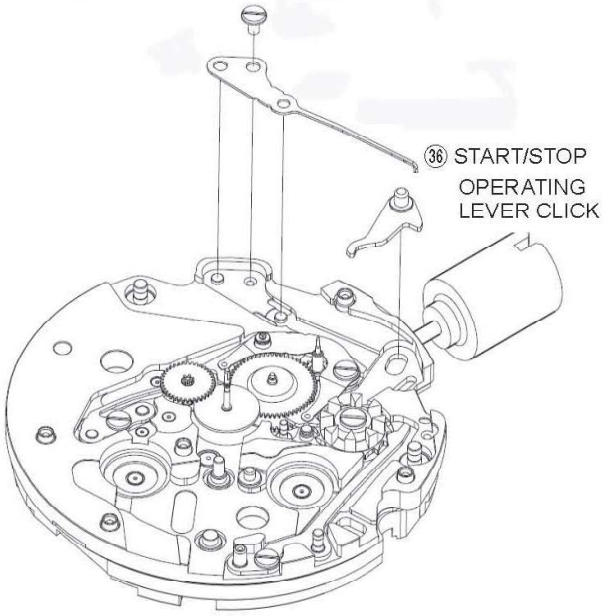
Set the COLUMN WHEEL JUMPER and tighten the screw.

Secure the jumper to the COLUMN WHEEL.



8

㉞&㉟ START/STOP OPERATING LEVER CLICK SPRING AND SCREW



Assemble the START/STOP OPERATING LEVER CLICK.

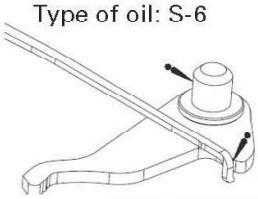
Set the START/STOP OPERATING LEVER CLICK SPRING and tighten the screw.

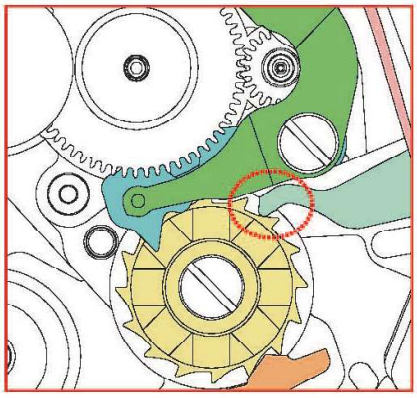
Secure the spring to the operating lever click.

[Instructions for lubrication]

- Support pin for the START/STOP OPERATING LEVER and contact point between the click and the spring.

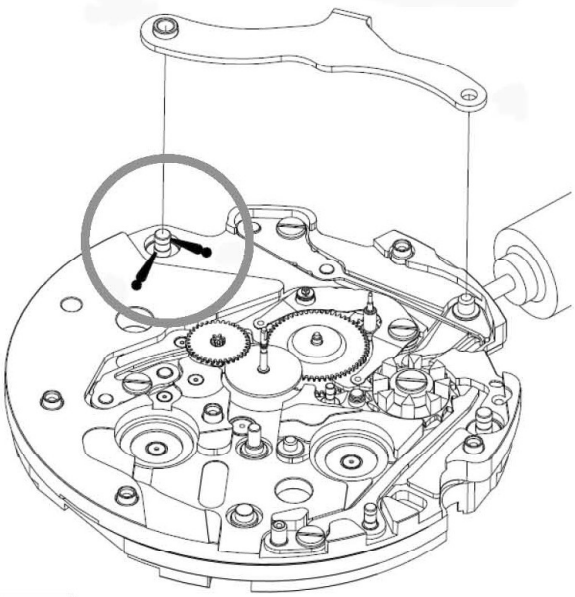
  Type of oil: S-6





9

㉝ START/STOP OPERATING LEVER



Assemble the START/STOP OPERATING LEVER.

[Instructions for lubrication]

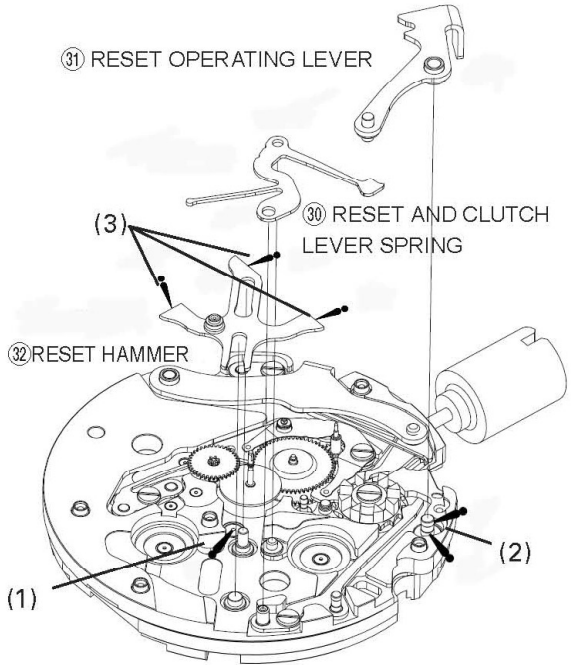
- Support pin for the START/STOP OPERATING LEVER.

  Type of oil: S-6

10

Assemble the RESET HAMMER.

Assemble the RESET OPERATING LEVER.



Set the RESET AND HOUR COUNTING STOP LEVER SPRING and secure it to the guide pin for reset operating levers.

[Instructions of lubrication]

(1) Cap jewel for the RESET HAMMER

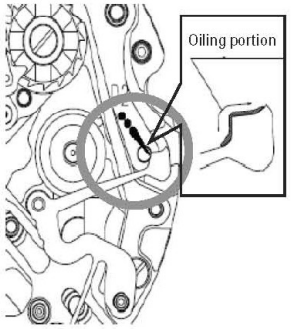
(2) Support pin for the INTERMEDIATE RESET LEVER

(3) Contact points between the hammer and the cams

Type of oil: S-6

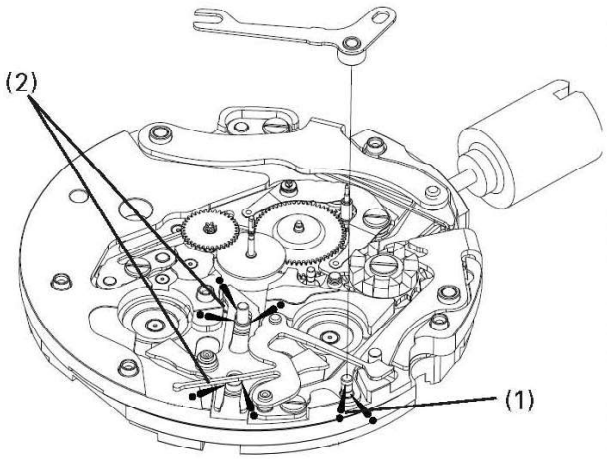
- Contact point between the RESET AND CLUTCH LEVER SPRING and the support pin of the operating levers

Type of oil: S-6



11

㉙ INTERMEDIATE RESET LEVER

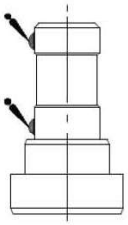


Assemble the INTERMEDIATE RESET LEVER.

[Instructions of lubrication]

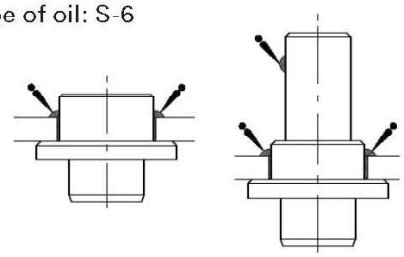
(1) Support pin for the INTERMEDIATE RESET LEVER

Type of oil: S-6



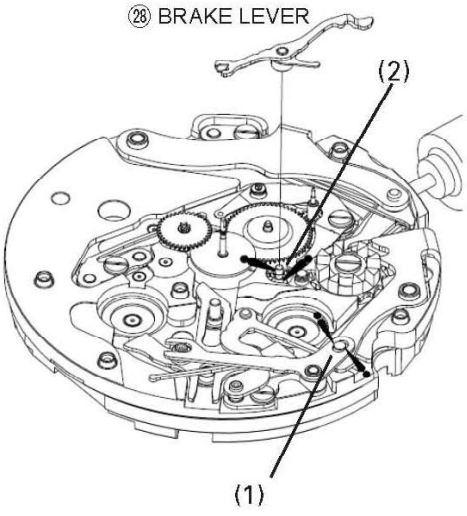
(2) Guide pins for the RESET HAMMER

Type of oil: S-6

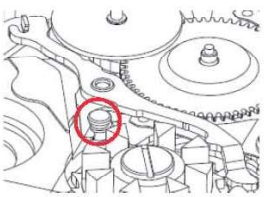


12

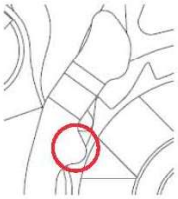
㉘ BRAKE LEVER



Assemble the BRAKE LEVER.



[ASSEMBLY POSITION]

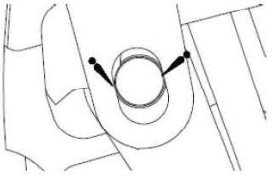


[ALIGNMENT WITH THE COLUMN WHEEL]

[Instructions of lubrication]

(1) Guide pin for the reset operating levers.

Type of oil: S-6

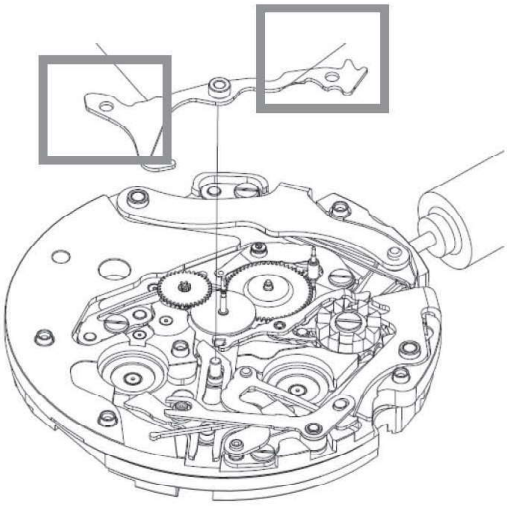


(2) Support pin for the BRAKE LEVER.

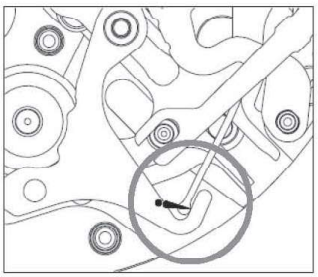
Type of oil: S-6

13

㉗ HOUR AND MINUTE COUNTING CLUTCH LEVER



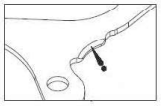
Assemble the HOUR AND MINUTE COUNTING CLUTCH LEVER and secure the spring to it.

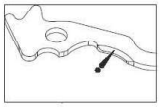


[Instructions of lubrication]

- Contact point with the spring (see above)
  Type of oil: S-6

- Friction surface with wheels
  Type of oil: AO-3





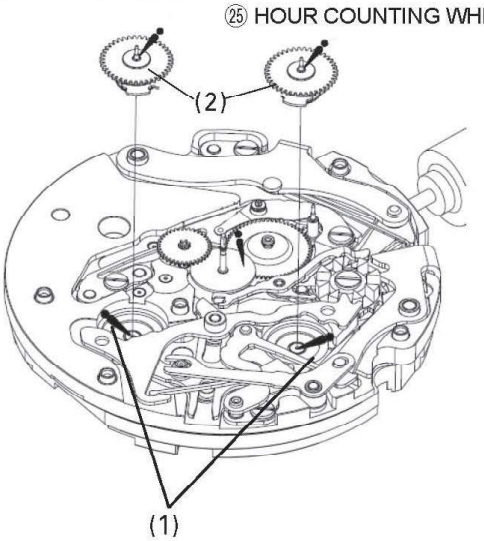
14

Assemble the MINUTE COUNTING WHEEL.

Assemble the HOUR COUNTING WHEEL.

㉖ MINUTE COUNTING WHEEL

㉕ HOUR COUNTING WHEEL

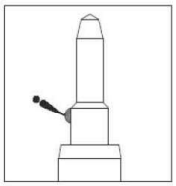


[Instructions of lubrication]

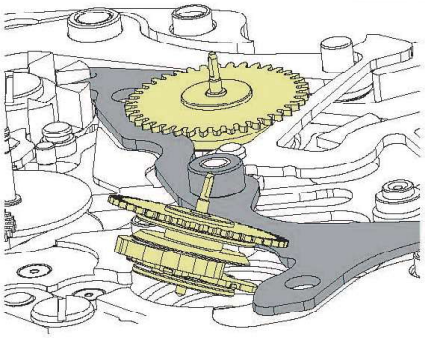
- Pivot of the counting wheels

(1) Pivot holes for counting wheels

(2) Upper pivot of counting wheels



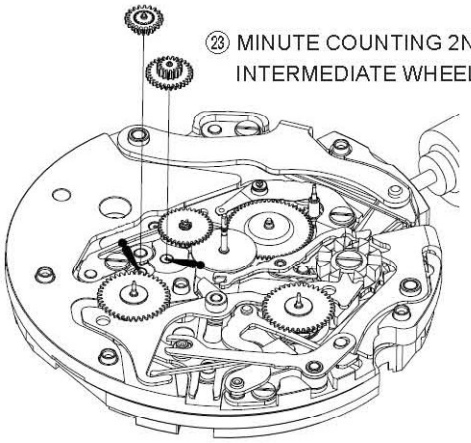
* Assemble the wheels crawling under the HOUR AND MINUTE COUNTING CLUTCH LEVER.



15

㉔ MINUTE COUNTING 1ST INTERMEDIATE WHEEL

㉓ MINUTE COUNTING 2ND INTERMEDIATE WHEEL



Assemble the MINUTE COUNTING 1ST INTERMEDIATE WHEEL.

Assemble the MINUTE COUNTING 2ND INTERMEDIATE WHEEL.

[Instructions of lubrication]

Pivot holes for the intermediate wheels

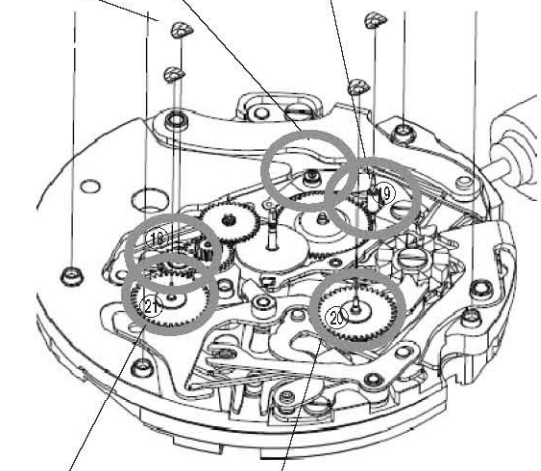
Type of oil: S-6

16

⑱ DIAL WASHER FOR MINUTE COUNTING 2ND INTERMEDIATE WHEEL

㉒ SPACER FOR COUPLING LEVER

⑲ DIAL WASHER FOR SMALL SECONDS WHEEL



⑳ DIAL WASHER FOR HOUR COUNTING WHEEL

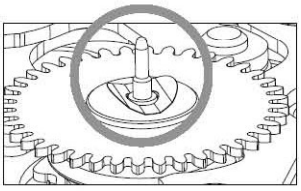
㉑ DIAL WASHER FOR MINUTE COUNTING WHEEL

Assemble the SPACER FOR COUPLING LEVER to the support of the 2ND COUPLING LEVER.

Assemble the dial washers '0491178 (gilt)

MINUTE COUNTING WHEEL
HOUR COUNTING WHEEL
SMALL SECONDS WHEEL

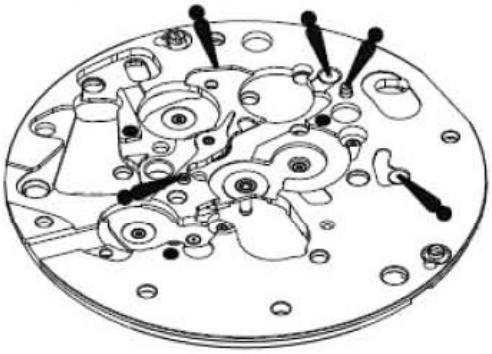
'0491179 (SILVER)
INTERMEDIATE MINUTE COUNTING WHEEL



Be careful not to assemble the dial washers upside down.

17

⑰ CALENDAR PLATE



[Instructions of lubrication]

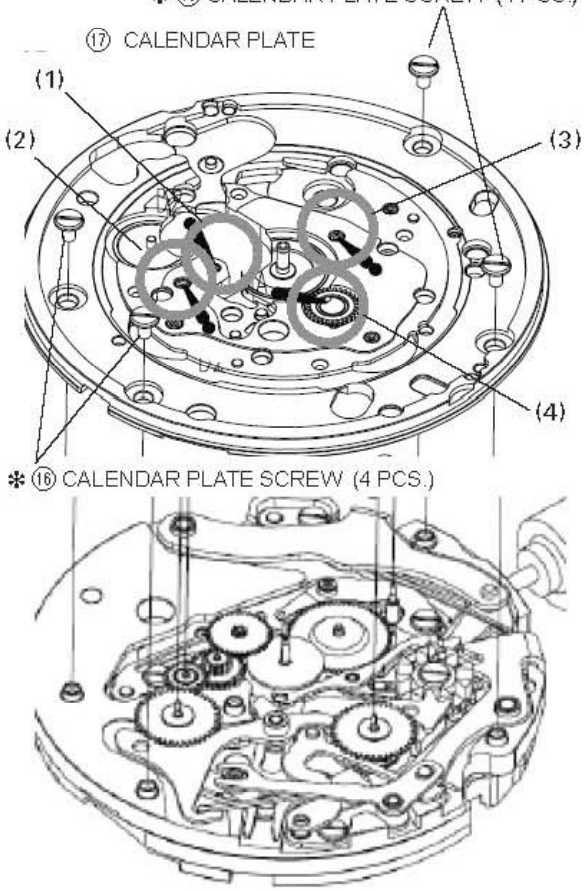
Pivot holes on the back side of the CALENDAR PLATE

Type of oil: S-6

18

✻ ⑯ CALENDAR PLATE SCREW (4 PCS.)

⑰ CALENDAR PLATE



Assemble the CALENDAR PLATE.

Tighten the CALENDAR PLATE SCREWs.

[INSTRUCTIONS OF LUBRICATION]

- Jewel holes of the chronograph train wheels through the plate

(1) MINUTE COUNTING 2ND INTERMEDIATE WHEEL

(2) MINUTE COUNTING 1ST INTERMEDIATE WHEEL

Type of oil: S-6

(3) CHRONOGRAPH WHEEL

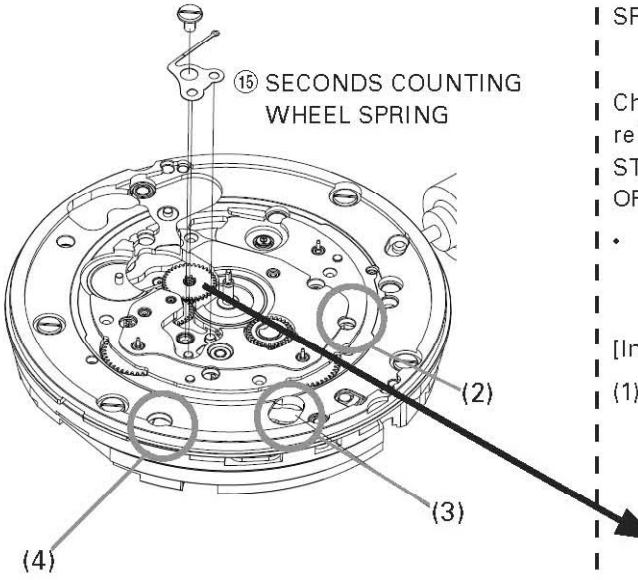
Type of oil: AO-3

(4) Hour counting intermediate wheel (pre-installed to the CALENDAR PLATE)

Type of oil: AO-3

19

⑭ SECONDS COUNTING WHEEL SPRING SCREW



Assemble the SECONDS COUNTING WHEEL SPRING.

Tighten the SECONDS COUNTING WHEEL SPRING SCREW.

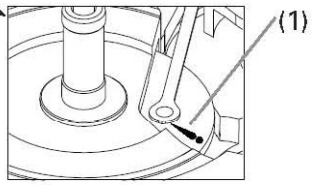
Check the engagement and positions of related parts when operating the START/ STOP OPERATING LEVER and the RESET OPERATING LEVER.

- Be sure to wind the mainspring prior to the checking.

[Instructions of lubrication]

(1) Contact point of the SECONDS COUNTING WHEEL and its spring

Type of oil: AO-3

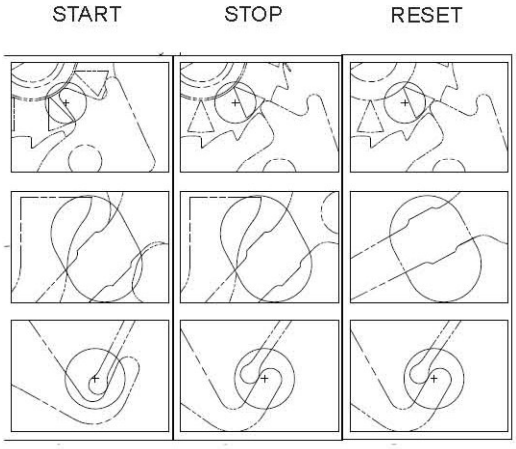


Check the followings through the holes on the CALENDAR PLATE.

(2) Mesh positions of the COLUMN WHEEL and the HOUR COUNTING STOP LEVER

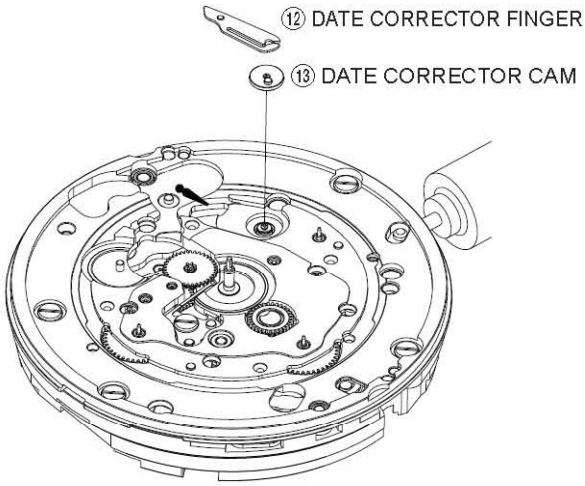
(3) Positions of the INTERMEDIATE RESET LEVER

(4) Secure positions of the RESET AND HOUR COUNTING STOP LEVER SPRING and the HOUR COUNTING STOP LEVER



● ASSEMBLING OF THE CALENDAR MECHANISM

1



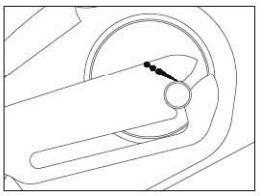
Assemble the DATE CORRECTOR CAM.

Assemble the DATE CORRECTOR FINGER to the pin of the cam.

[Instructions of lubrication]

Contact point between the DATE CORRECTOR FINGER and the pin on the DATE CORRECTOR CAM

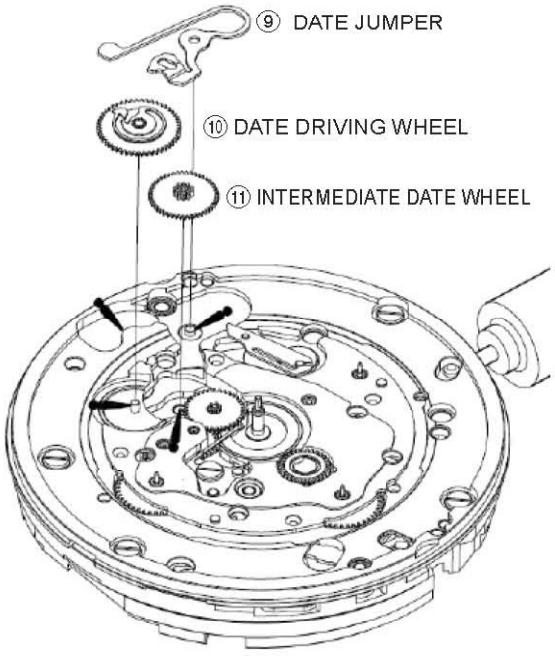
Type of oil: AO-3



Contact point between the pin of DATE CORRECTOR FINGER and the plate

Type of oil: S-6

2



Assemble the INTERMEDIATE DATE WHEEL.

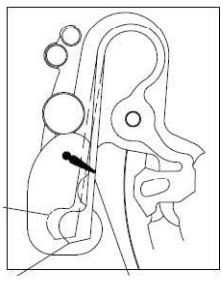
Assemble the DATE DRIVING WHEEL.

Set the DATE JUMPER and hook it to the CALENDAR PLATE.

[Instructions of lubrication]

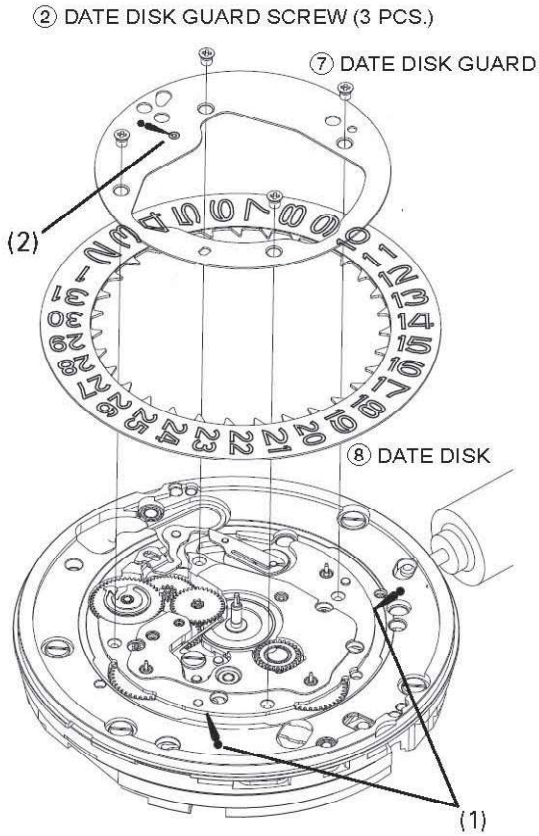
- Pivot holes for the INTERMEDIATE DATE WHEEL and DATE DRIVING WHEEL
- Support pin for the DATE JUMPER
- Friction point between the jumper and the plate

  Type of oil: S-6



Assembly and lubrication point of the DATE JUMPER

3



Assemble the DATE DISK and secure the jumper to it.

Assemble the DATE DISK GUARD and tighten the screws.

[Instructions of lubrication]

(1) Friction surface between the tooth of the DATE DISK and the plate

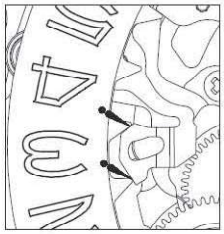
Type of oil: AO-3

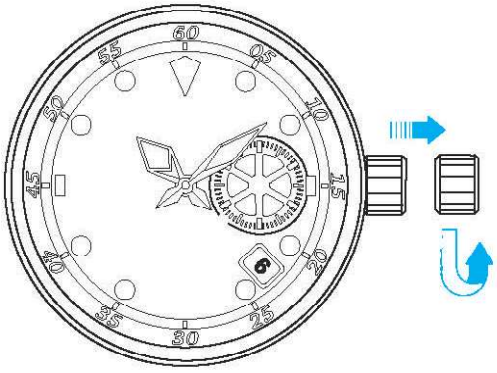
(2) Pivot of the INTERMEDIATE DATE WHEEL through the DATE DISK GUARD

Type of oil: S-6

Contact points between the teeth of the DATE DISK and the DATE JUMPER

Type of oil: AO-3



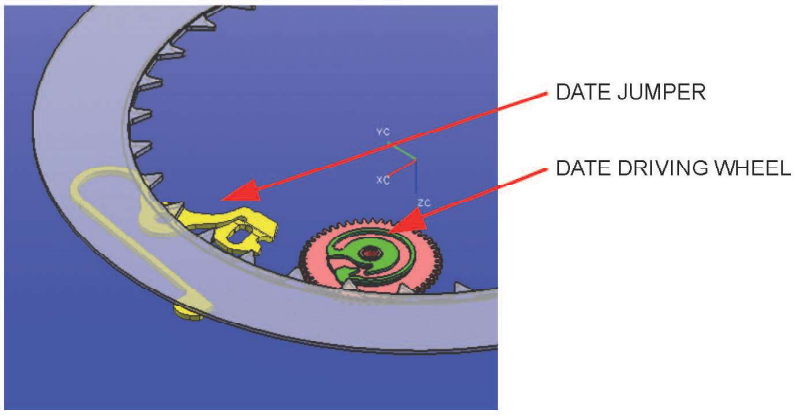


Check the date setting function.

- Pull out the crown to the 1st click, then turn it.
- Make sure that the date changes smoothly.

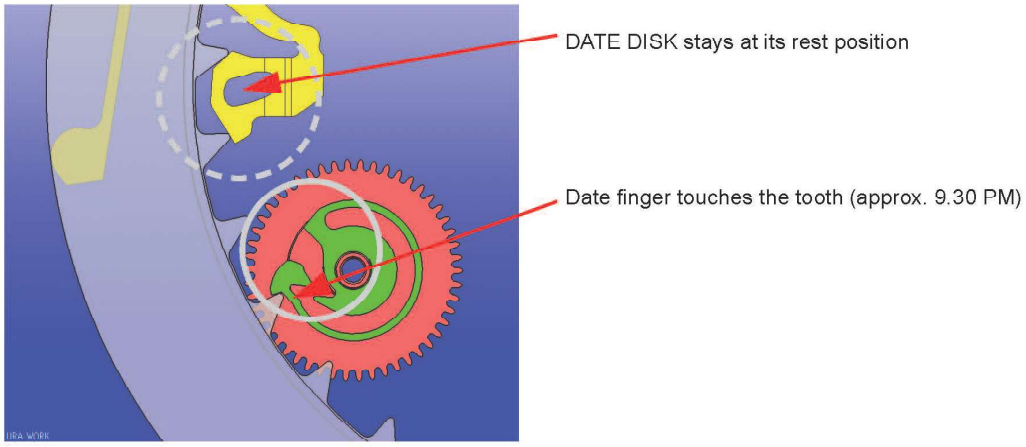
● REMARKS ON DISASSEMBLING AND REASSEMBLING THE MOVEMENT

- **How the semi-instantaneous date mechanism works**



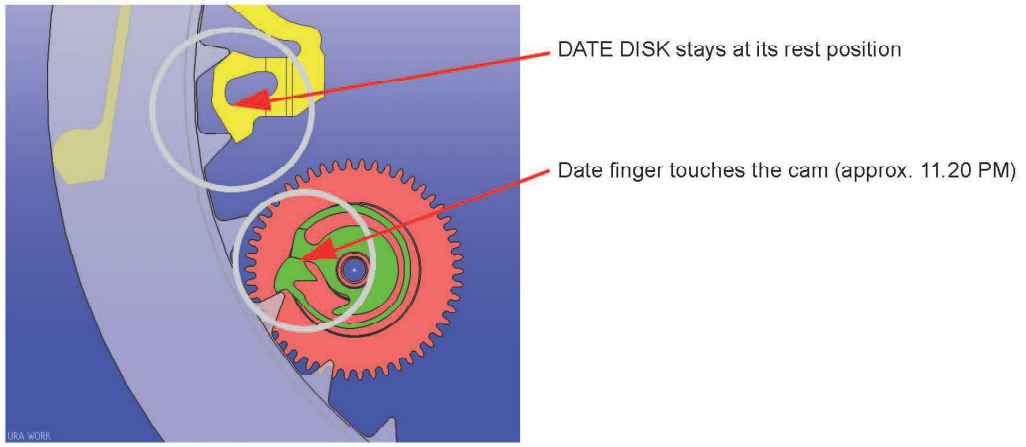
The semi-instantaneous date mechanism reduces the duration of imcomplete date display before the date changes. For the Cal. 8R series, the mechanism is controlled by the DATE JUMPER and a unique design of the DATE DRIVING WHEEL.

1)



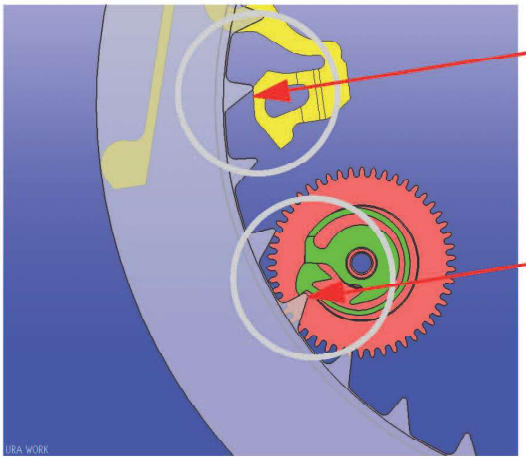
The unique date finger with spring absorbs the power which drives the DATE DISK until the finger touches the cam of the DATE DRIVING WHEEL. The DATE JUMPER sits between two teeth of the DATE DISK to force it to stay at its rest position.

2)-1



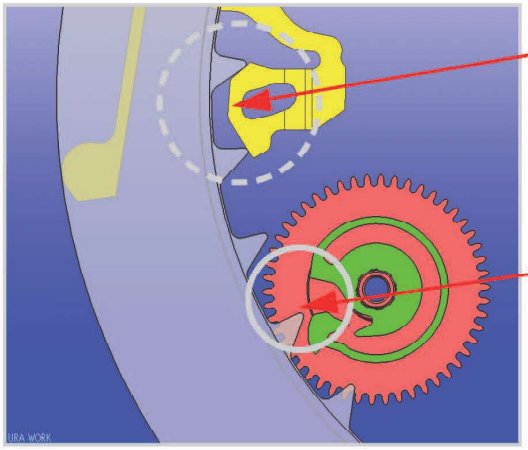
Once the finger touches the cam, the driving force of the wheel starts being transferred to the DATE DISK.

2)-2



The DATE JUMPER will be disengaged when the tip of the tooth goes beyond its edge by the driving force of the DATE DRIVING WHEEL.

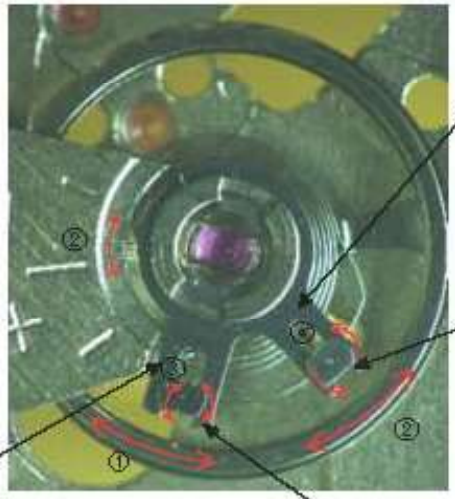
3)



When the date finger is released from the tooth, the two spring parts return to the original position and quickly force the tooth forward until its next rest position.

REGULATION

● Names of the parts for regulation and their functions



● How to regulate the isochronism fault by adjusting the position of the balance-spring

This caliber has the Etachron system for fine regulation of the isochronism fault, which is the same design used for both Cal. 7S-B series and 6R series.

When an amplitude of the balance becomes weak, the watch shows time loss, in general.

By making a clearance of the balance-spring smaller, the decline curve of the instantaneous rate gets shallower.

1) Make sure that the REGULATOR PIN is aligned in a vertical position to the REGULATOR and the balance-spring passes parallel through the slot of the REGULATOR PIN before fine-tuning the STUD and the REGULATOR PIN.

REGULATOR PIN

top side view



back side view



angled view



2) Rotate the STUD in order to align the position of the balance-spring passes through the center of the slot of the REGULATOR PIN.

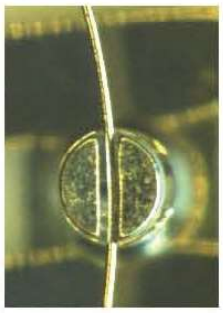
STUD

top side view



REGULATOR PIN

back side view



3) Rotate the REGULATOR PIN counterclockwise in order to fine-tune the clearance of the balance-spring passing through the slot of it.

REGULATOR PIN

top side view

Before rotating

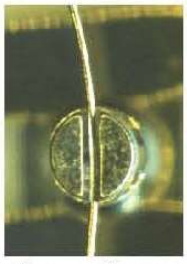


After rotating



back side view

Before rotating



(Maximum clearance)

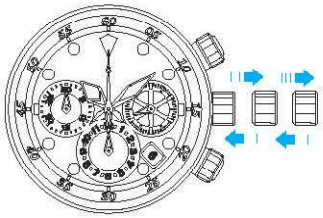
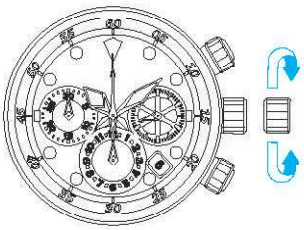
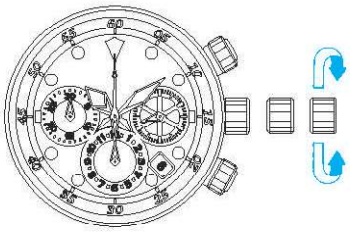
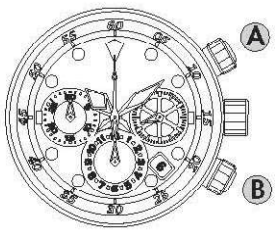
After rotating



(Minimum clearance)

REMARKS ON INSPECTION AND MEASUREMENT

● Function check

<table>
<tr><th colspan="2">Operation</th><th>Function</th><th>Checkpoint</th></tr>
<tr><td>  </td><td>Pull out the crown to the 2nd click and push it back in to the normal position. Repeat the same several times.</td><td>Setting mechanism - switching the function of the time setting</td><td>Make sure that it has a click at each position and the stem is not pulled off.</td></tr>
<tr><td>  </td><td>Pull out the crown to the 1st click, then turn it.</td><td>Calendar mechanism - correcting the date</td><td>Make sure that the date changes smoothly.</td></tr>
<tr><td rowspan="3">  </td><td rowspan="3">Pull out the crown to the 2nd click*, then turn it.</td><td>Second hand stop function</td><td>Make sure that the second hand stops when the crown is pulled out to the 2nd click.</td></tr>
<tr><td>Setting mechanism - hour and minute hand setting</td><td rowspan="2">Make sure that the hour and minute hands move smoothly (without touching each other or touching the surface of the dial or inside of the glass).</td></tr>
<tr><td>Hands installation</td></tr>
<tr><td></td><td></td><td>Calendar mechanism - date change</td><td>Make sure that the date changes when the hour and minute hands pass around midnight.</td></tr>
<tr><td>  </td><td>Press button A to start the stopwatch.
Press button A again to stop the stopwatch.
Press button B to reset the stopwatch.
A ➡ A ➡ B
Start Stop Reset</td><td>Stopwatch mechanism</td><td>Make sure that the stopwatch hands start/stop smoothly.
Make sure that the stopwatch hands are reset to the “0” position.</td></tr>
</table>

● Water resistance test

Check the water resistance according to the designated specification of the watch.

Marking on the case back	Test method	Applied pressure
WATER RESISTANT (WATER RESIST)	Air leak test	3 BAR
WATER RESIST 5BAR	Water pressure test → Condensation test	5 BAR
WATER RESIST 10BAR		10 BAR
WATER RESIST 15BAR		15 BAR
WATER RESIST 20BAR		20 BAR
SCUBA DIVER'S (AIR DIVER'S) 150 m	Condensation test → Water pressure test → Condensation test	18.75 BAR = 150 (m) times 0.125
SCUBA DIVER'S (AIR DIVER'S) 200 m		25 BAR = 200 (m) times 0.125
He-GAS DIVER'S 300 m		37.5 BAR = 300 (m) times 0.125
He-GAS DIVER'S 600 m		75 BAR = 600 (m) times 0.125
He-GAS DIVER'S 1000 m		125 BAR = 1000 (m) times 0.125

● Accuracy test

Measure the rate in three different positions within 30 minutes after the watch is fully wound up (wait approximately for 5 minutes after winding up in order to get a stable oscillation of the balance) and make sure the value shows within the range in the table below.

Measure the rate in dial-up position after 24 hours from fully wound up (T24) and check the rate difference with the rate in dial-up position when it is fully wound up (T0). Make sure that the value of T24-T0 shows within the range of the isochronism in the table below.

Standard rate for measurement	Mainspring wind up status	Fully wind up (T0)			After 24 hours from fully wind up (T24)
	Testing positions	Dial upwards: T0 (CH)	6 o'clock at the top	9 o'clock at the top	Dial upwards: T24 (CH)
	Measurement (daily rate in seconds: s/d)	±10 s/d	±15 s/d	±15 s/d	(Isochronism fault: T24-T0) ±10 s/d

ACCURACY OF MECHANICAL WATCHES

- The accuracy of mechanical watches is indicated by the daily rates of one week or so.
- The accuracy of mechanical watches may not fall within the specified range of time accuracy because of loss/gain changes due to the conditions of use, such as the length of time during which the watch is worn on the wrist, arm movement, whether the mainspring is wound up fully or not, etc.
- The key components in mechanical watches are made of metals which expand or contract depending on temperatures due to metal properties. This exerts an effect on the accuracy of the watches. Mechanical watches tend to lose time at high temperatures while they tend to gain time at low temperatures.
- In order to improve accuracy, it is important to regularly supply energy to the balance that controls the speed of the gears. The driving force of the mainspring that powers mechanical watches varies between when it is fully wound and immediately before it is unwound. As the mainspring unwinds, the force weakens.
- Relatively steady accuracy can be obtained by wearing the watch on the wrist frequently for the self-winding type and winding up the mainspring fully everyday at a fixed time to move it regularly for the wind-up mechanical type.
- When affected by external strong magnetism, a mechanical watch may loss/gain time temporarily. The parts of the watch may become magnetized depending on the extent of the effect. In such a case, consult the retailer from whom the watch was purchased since the watch requires repair, including demagnetizing.

● Duration time test

Check the continuous ooperating time of the watch after the mainspring is fully wound up and leave it oon natural condition with the dial-up position. Make sure that the watch runs **more than 45 hours** until it stops.