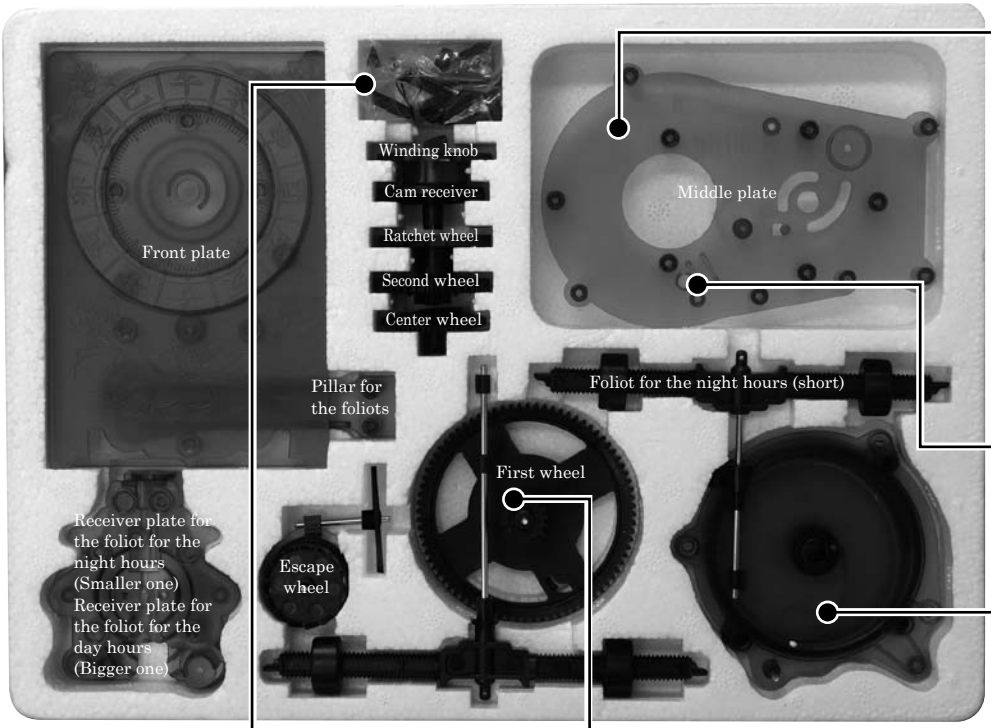
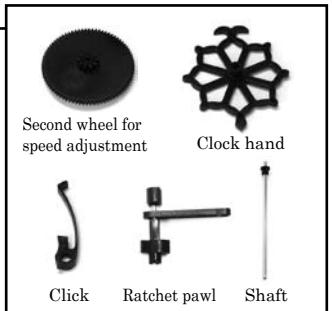
How to Assemble and Use the Supplement

Double-foliot Japanese Clock

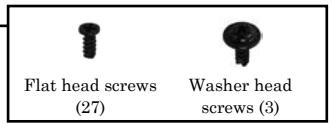
Assembly time: Approx. 1 hour and 30 minutes

Parts in the Kit

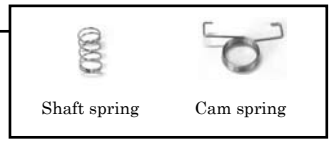


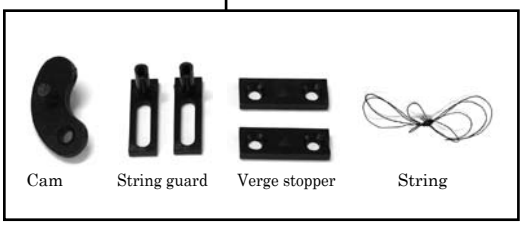


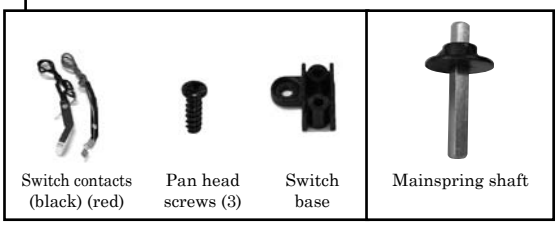
* There may be cases in which the shaft is already slipped onto the ratchet pawl assembly. If so, please remove it before proceeding.



* Any leftover screws are to be used as spares.







* Lubricant oil has been applied to the mainspring. There may be some lubricating oil dripping out of the shaft openings or other places. If so, be sure to wipe it away before proceeding with the assembly of this kit.

Things you will need

Screwdriver, scissors, and lubricating oil

⚠ CAUTION

Take necessary caution when handling parts with pointed edges. There is a risk of injury.
This kit includes screws and other small parts. Be careful not to swallow them. There is a risk of suffocation.
Do not apply too much force when assembling the inner parts of the clock.
There is a risk of damage as they are precision devices.
Keep this kit out of the reach of small children when not in use.

* Please read the instructions and cautions thoroughly before use.
* For your safety, be sure to follow the instructions in this manual. In addition, do not use any parts that have become damaged or deformed during use.

Notes for tightening screws

When tightening screws, firmly press the screwdriver straight against the screw and turn. It is said that 70 percent of the force applied is used for pushing against the screw and 30 percent for turning it. The types of screws used for the supplement are those that carve grooves into the plastic as they are inserted (self-threading). For this reason, the screw hole may be damaged if you exert too much force when tightening the screw. Precision screwdrivers are hard to turn, so use a small screwdriver with a grip diameter of about 2 cm.

Full scale image of screwdriver

Materials used in this kit

Front plate, middle plate, back plate, pillar for foliots, winding knob, mainspring case, receiver plate for foliots (transparent brown), foliots, clock hand, mainspring shaft stopper, cam, string guard, verge stopper, switch base, and weight frame (black): ABS

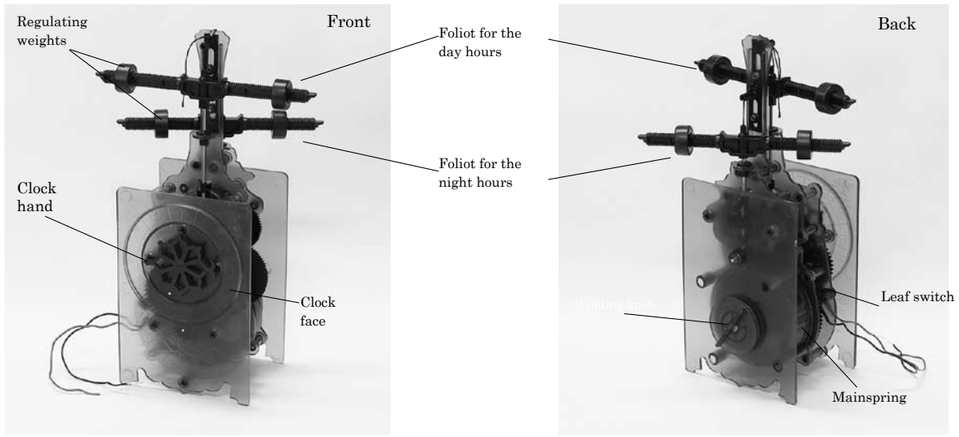
Each of the wheels, click, ratchet pawl, ends of the foliots, verge bearings, and mainspring bearings (black): POM

Escape wheel (black): PC; String: Polyester; Screws: Iron (colored black); Wires: Copper

Each type of shaft, springs, mainspring, and switch contacts: Iron (nickel-plated)

* Please dispose of this product in accordance with local regulations.

Assembled Product and Part Names

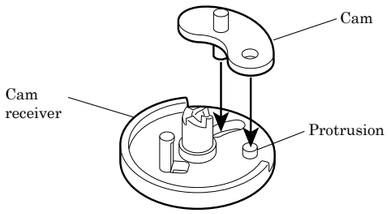


Assembling the Body

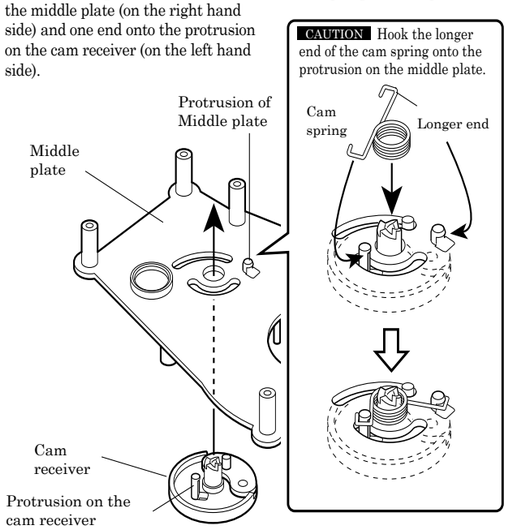
[1] Assemble the mainspring unit

1. Assemble the cam, and attach it to the middle plate

Align the protrusion and hole on the cam receiver up with the hole and protrusion on the cam, and fit them together.

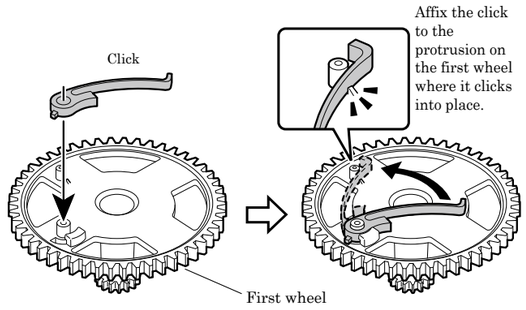


Place the middle plate up with the protrusion side up, and align the protrusion on the cam receiver with the hole on the middle plate and then attach them together. Hook one end of the cam spring onto the protrusion on the middle plate (on the right hand side) and one end onto the protrusion on the cam receiver (on the left hand side).

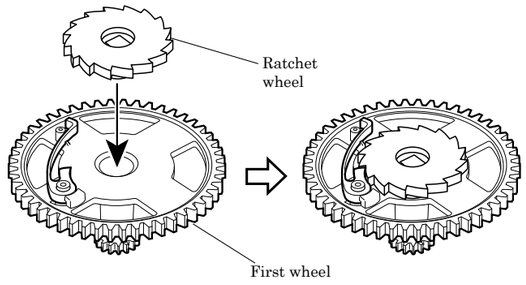


2. Assemble the first wheel

Attach the click to the first wheel. Turn the click to fix it into place.



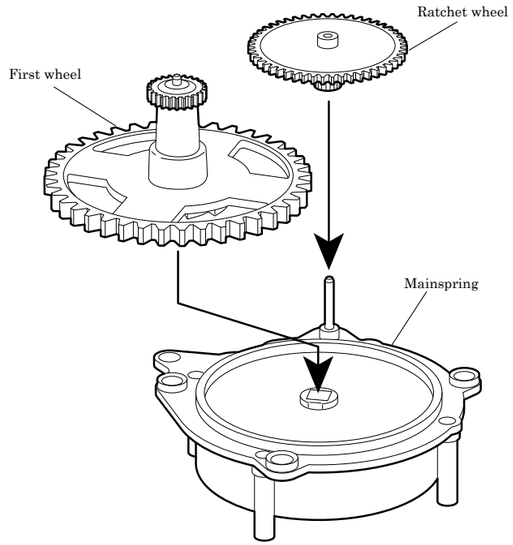
Attach the ratchet wheel so that it catches the click.



3. Fit the mainspring and wheels together

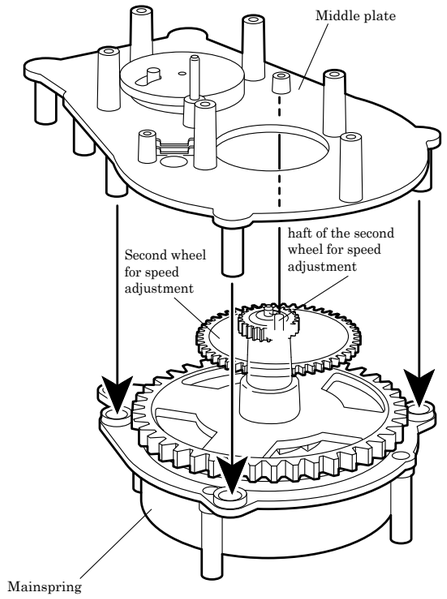
Set the first wheel onto the mainspring with the side on which the click was attached in Step 2 facing down.

Attach the second wheel for speed adjustment to the metal shaft on the side of the mainspring. Turn the second wheel to ensure that it is engaged with the first wheel.



4. Attach the middle plate

Line the middle plate up with the screw holes on the mainspring as shown in the figure below. Set the middle plate onto the mainspring, but do not screw it into place.



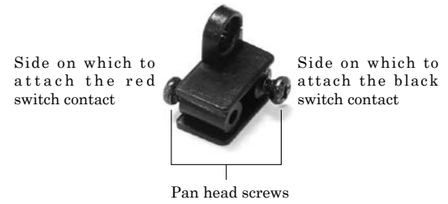
How to attach a leaf spring for linking to the Japanino 8-bit microcomputer of Supplement No. 27

* If you are not planning to use the Japanino, proceed to [2].

Assembling the switch

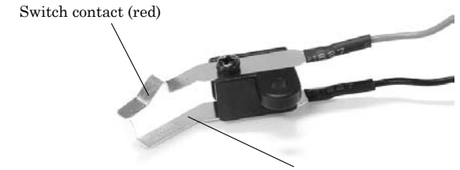
1. Insert screw threads into the switch base using two pan head screws

After screwing the pan head screws in as shown in the picture, unscrew them.



2. Attach the switch contacts

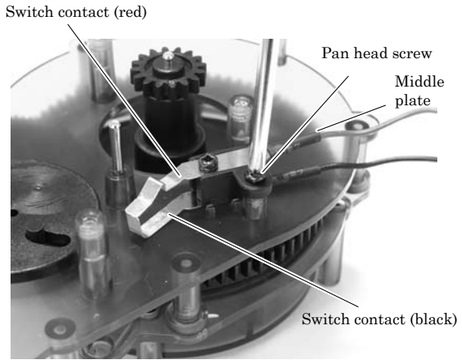
Being careful about the positions of the protrusions of the screw holes on the switch base, arrange the black switch contact and red switch contact as shown in the picture, and affix each one with a pan head screw.



CAUTION If it looks like the ends of the switch contacts may touch each other, adjust the distance between them with your fingers so that they are apart.

3. Attach the switch to the middle plate

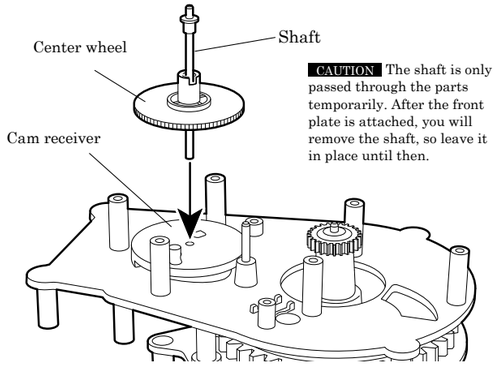
Attach the assembled switch to the switch backing on the middle plate with the red switch contact facing up. Line the hole on the protrusion on the switch base up with the screw hole on the switch backing, and affix the switch with one pan head screw.



[2] Attach the wheels

1. Attach the center wheel

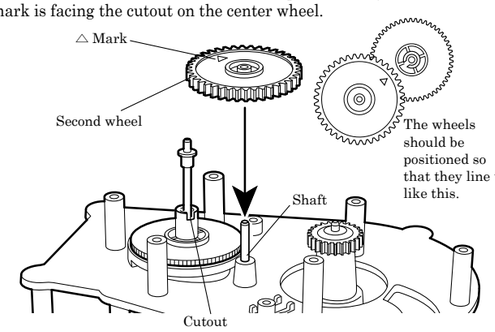
Slide the shaft through the hole in the center of the protrusion on the center wheel, with the protrusion facing up, and set the center wheel onto the cam receiver by passing the shaft through the hole on the cam receiver.



CAUTION The shaft is only passed through the parts temporarily. After the front plate is attached, you will remove the shaft, so leave it in place until then.

2. Attach the second wheel

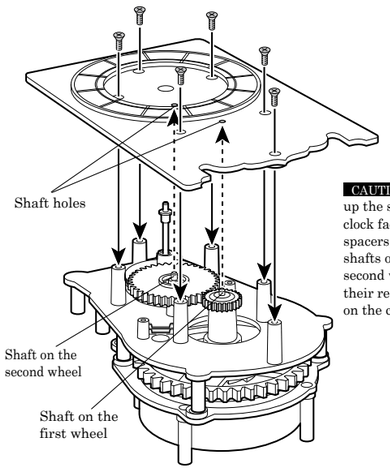
With the mark on the second wheel facing up, slide the second wheel onto the shaft in the center of the center plate and adjust it so that the mark is facing the cutout on the center wheel.



The wheels should be positioned so that they line up like this.

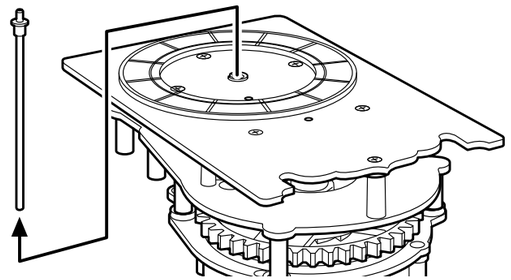
[3] Attach the front plate

With the clock face on the front plate facing up, line up the holes on the center of the clock face up with the screw spacers on the mainspring unit, and affix the front plate with six flat head screws.



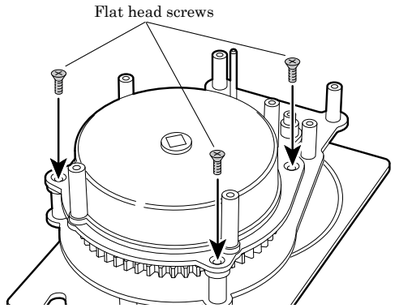
CAUTION When lining up the screw holes on the clock face with the screw spacers, ensure that the shafts on the first and second wheels line up with their respective shaft holes on the clock face.

Remove the shaft onto which you temporarily placed parts.



[4] Affix the mainspring

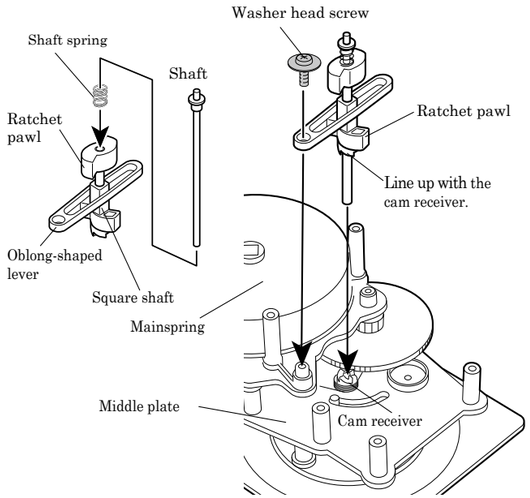
Being careful not to pull the mainspring loose, set the front plate with the clock face facing down, and affix the mainspring with three flat head screws.



[5] Attach the ratchet pawl

Assemble the ratchet pawl and shaft together, and attach them to the middle plate

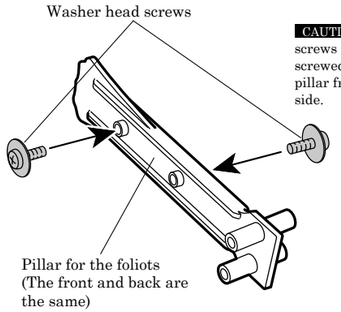
Place the oblong-shaped lever of the ratchet pawl onto the square shaft of the ratchet pawl in advance as shown in the diagram, and slip the shaft spring onto the shaft before sliding the shaft onto the ratchet pawl as shown in the drawing. With the clock face facing down, insert the shaft into the hole on the cam receiver on the main unit. Line up the round hole on the oblong-shaped lever up with the screw hole on the mainspring, and secure it with a washer head screw.



[6] Assemble the foliot unit

1. Cut screw threads into the pillar for the foliots

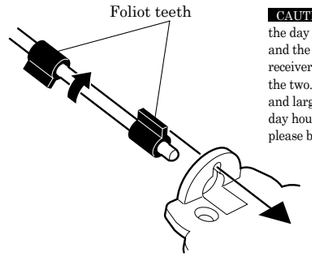
Using two washer head screws, cut screw threads into the pillar for the foliots in advance. After screwing in the screws, unscrew them.



CAUTION The screws can be screwed into the pillar from either side.

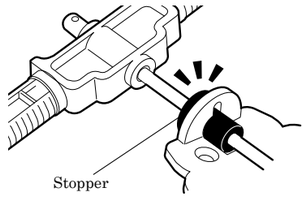
2. Assemble the foliot for the night hours

Line the teeth for the foliot for the night hours up with the keyhole on the receiver plate for the foliot for the night hours (smaller one), and insert the verge into the hole. The top and bottom teeth are placed on the verge at differing angles, so turn the verge where necessary to slide the teeth through the keyhole.

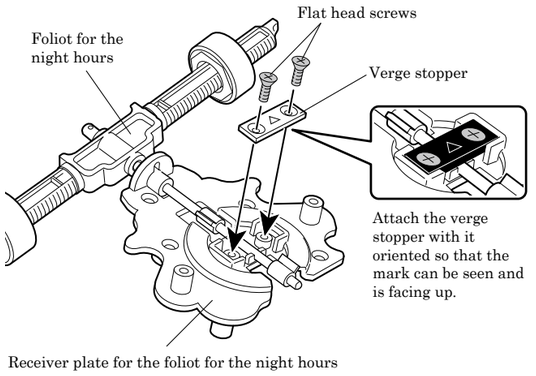


CAUTION There are two foliots, one for the day hours and one for the night hours, and the lengths of the foliots and sizes of the receiver plates for the foliots differ between the two. The foliot with the longer length and larger receiver plate is the one for the day hours. When assembling the clock, please be careful not to mix them up.

Insert the bottom of the stopper on the verge into the hole on the foliot receiver plate.

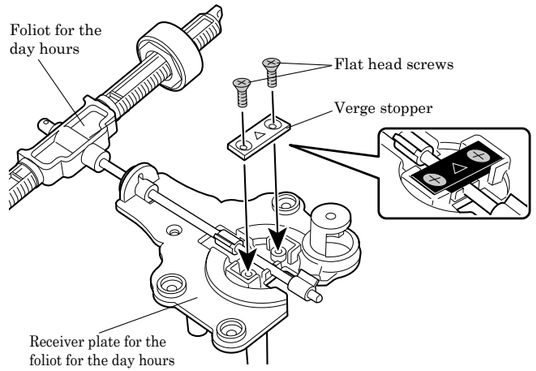


Set the verge stopper with the mark facing up as shown in the diagram, and affix it with two flat head screws.



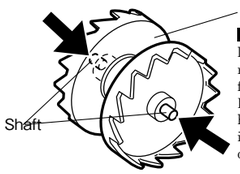
3. Assemble the foliot for the day hours

As in step 2 above, assemble the foliots and the receiver plates, and affix the verge stopper for each with two flat head screws.



4. Apply lubricant to the escape wheel

Apply a small amount of lubricant to the shafts on the escape wheel (on both sides).

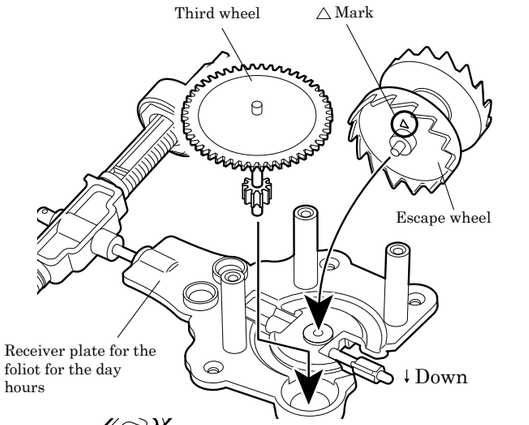


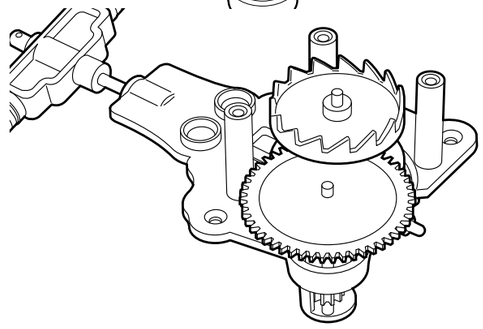
CAUTION It is best to use a lubricant with a low viscosity. We recommend the use of lubricant oil for valves of brass instruments. However, using too much oil will have an effect opposite that intended. Lightly wipe away excess oil on the shafts with a tissue.

5. Place the wheels on the foliot unit for the day hours

Set the escape wheel and third wheel on the foliot unit with the verge stopper on the foliot for the day hours facing down.

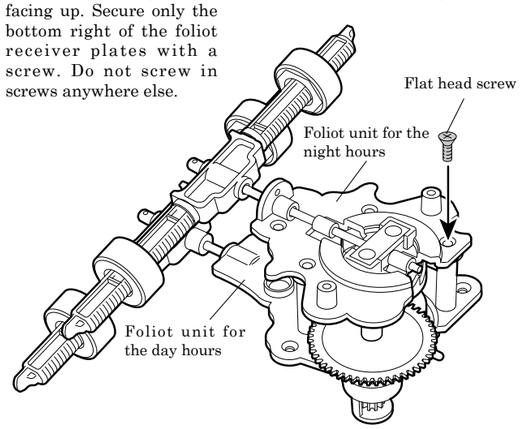
Arrange the escape wheel so that the side with the mark is facing down.





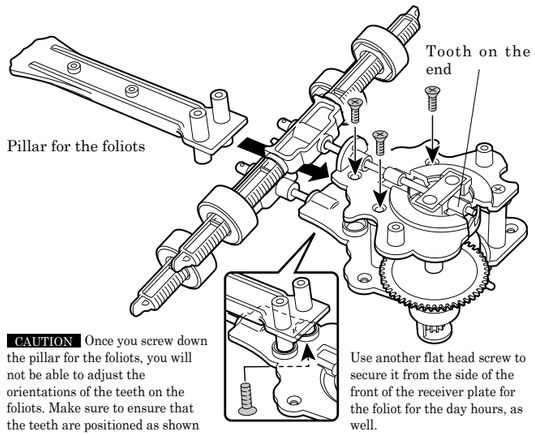
6. Put the foliot unit for the day hours and the foliot unit for the night hours together

Place the foliot unit for the night hours on the foliot unit for the day hours on which the escape wheel and third wheel have been set so that the verge stopper of the foliot unit for the night hours is facing up. Secure only the bottom right of the foliot receiver plates with a screw. Do not screw in screws anywhere else.



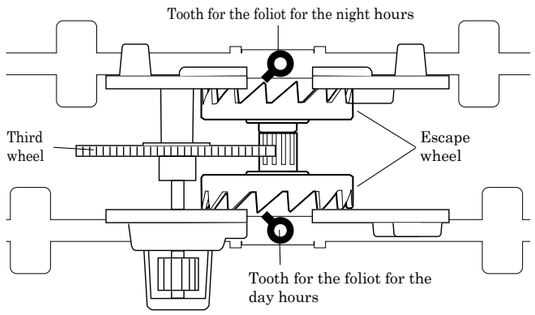
7. Attach the pillar for the foliots

For both the foliot for the day hours and the foliot for the night hours, adjust the teeth on the ends so that they are resting against the escape wheel. Being careful to not move either foliot, insert the pillar for the foliots so that it is sandwiched between the two foliot units, and screw it down in the places shown in the diagram.



CAUTION Once you screw down the pillar for the foliots, you will not be able to adjust the orientations of the teeth on the foliots. Make sure to ensure that the teeth are positioned as shown in the diagram before screwing down the pillar.

Use another flat head screw to secure it from the side of the front of the receiver plate for the foliot for the day hours, as well.



CAUTION The foliot teeth, escape wheel, and third wheel are to be positioned in the way shown in the diagram with respect to each other, as seen from the bottom of the foliot unit. Please make sure to check.

8. Attach the string to the foliots

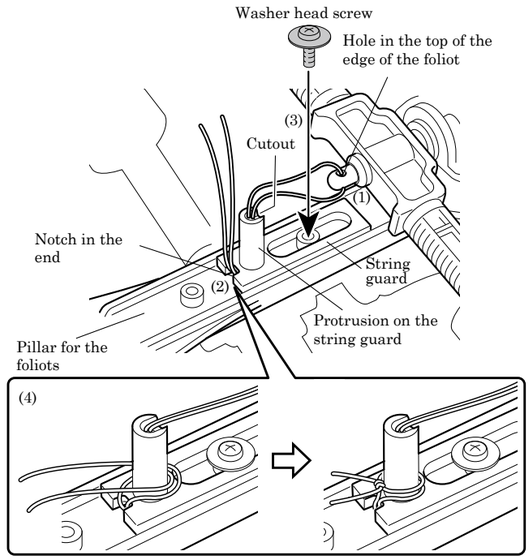
Cut the string provided in half to get two pieces.

(1) Pass the strings through the holes on the ends of the tops of the foliots, one for the foliot for the day hours and one for the foliot for the night hours.

(2) Gather the two ends of each string together, pass them through from the side with the cutout on the protrusion on the string guard, and then pull them through the back and along the notch in the end of the string guard.

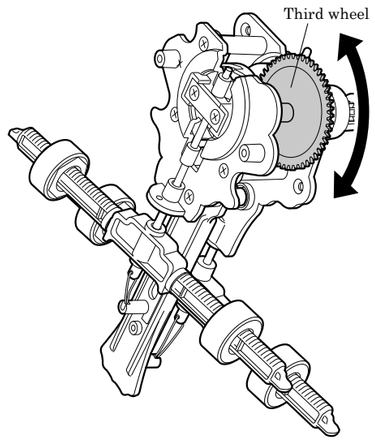
(3) Line the wide hole on the screw guard up with the screw hole on the pillar for the foliots for both the foliot for the day hours and the foliot for the night hours.
Orient the screw hole so that it is in the center of the wide hole, and fix the wide hole into place with a washer head screw.

(4) Tie a knot in each string so as to lightly push the foliots downward. Pass the ends of the string around the bottom of the protrusion, and then firmly knot the string on the top side.



CAUTION Make sure to pass the string around the protrusion on the string guard in such a way that the string is set in the groove on the end of the string guard before tying the knot.
Tie a few different knots in order to ensure that the knot is tied well enough.
You may need the extra length on the string later on for when making adjustments, so be sure to leave it and not cut any of the extra length off.

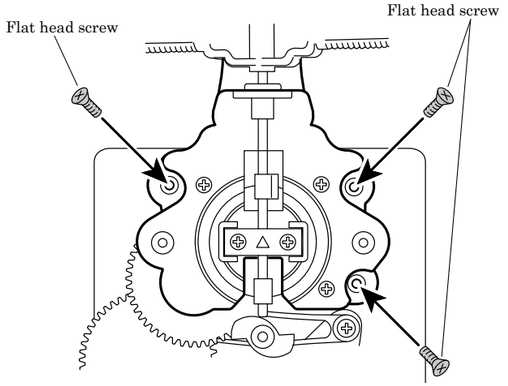
Make sure that you can lightly turn the third wheel with the foliots facing downward. If the third wheel fails to turn properly, check to ensure that the shafts on the wheels are set properly and that the screws are tightened down correctly.



[7] Attach the foliot unit to the main unit

Attach the foliot unit to the middle plate

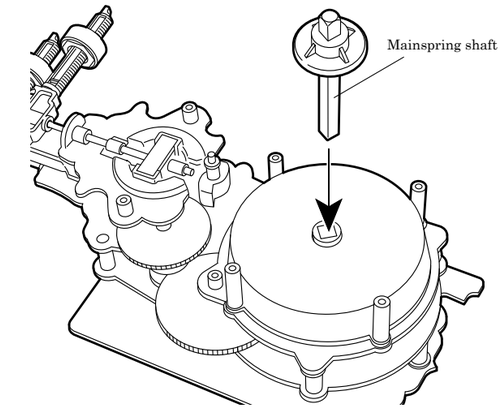
With the foliot for the night hours facing up, affix the foliot unit in place with three flat head screws.

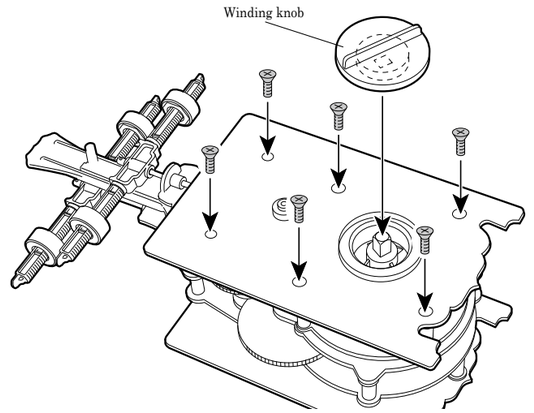


[8] Affix the back plate

1. Attach the mainspring shaft

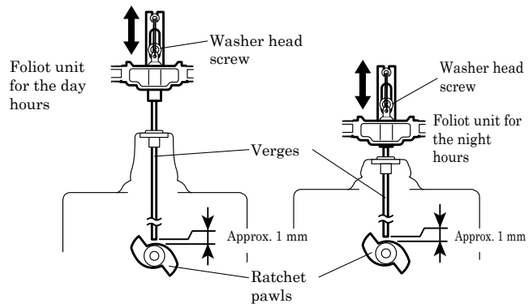
Firmly insert the mainspring shaft into shaft hole on the mainspring, and push it all the way to the back.





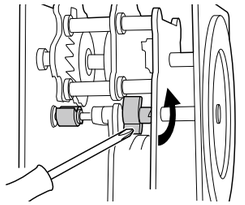
[9] Adjust the height of the foliots

Loosen the washer head screw and adjust the string guard up or down so that the bottom end of the verges (for day/night) are suspended about 1 mm above the ratchet pawl when lying sideways.



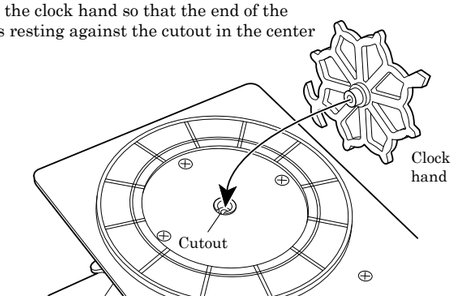
CAUTION If the bottom ends of the verges (for night/day) rest against the ratchet pawl, it will cause the parts to wear down, so be sure to adjust the positions of the parts.

As shown in the picture, using a screwdriver, rotate the ratchet pawl to switch to the foliot (day or night one) to be adjusted. Adjust the position of the foliot that is horizontal from the ratchet pawl.

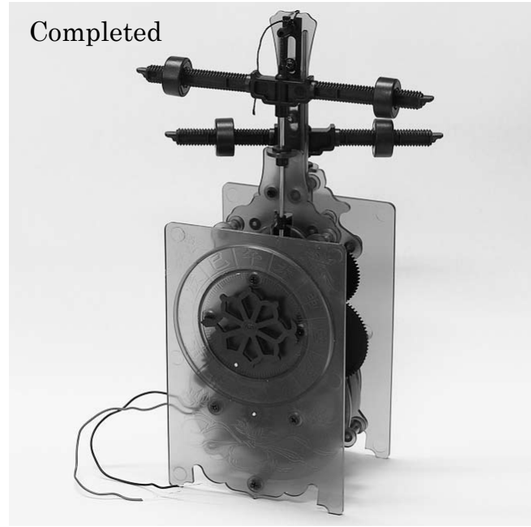


[10] Attach the clock hand

Attach the clock hand so that the end of the hand is resting against the cutout in the center wheel.



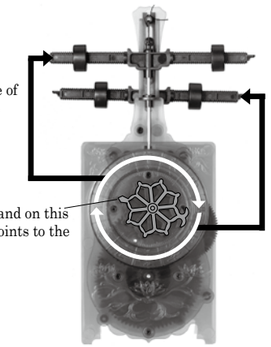
Completed



Adjusting the Japanese Clock

[1] Adjust the mechanism for switching between foliots

Before making adjustments, let's learn about the relationship between the positions of the foliots and the clock hand. For a double-foliot Japanese clock that's adjusted correctly, the foliot for the day hours will move when the clock hand is traveling across the top half of the clock face, and the foliot for the night hours will move when the clock hand is traveling across the bottom half of the clock face. When the clock hand is pointing straight up at the 6, the foliots to move will change automatically through movement of the ratchet pawl at this time. Having learned about these principals, let's now proceed with trying to adjust the clock.



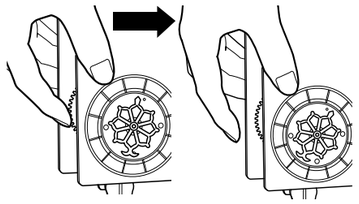
CAUTION Lubricant oil has been applied to the mainspring. While the mainspring is being repeatedly wound and unwound, some of the lubricant oil may slide out sometimes. About two weeks after you've assembled the clock, set the Japanese clock unit on top of some tissues or an old piece of cloth, and let it run in a state in which excess oil can drip down onto the tissues or cloth.

Lining up the switching of the clock hand and the foliots

Using the winding knob, completely wind up the mainspring on the finished Japanese clock all the way. When you've finished winding the mainspring, hold down the third wheel with a finger, and gently turn the clock upside down as shown in the picture. After making sure that the ends of the foliot for the day hours and foliot for the night hours are not hitting against the escape wheel, release your finger from the third wheel. The winding on the mainspring will come completely undone, so keep watch on the ratchet pawl. When the ratchet pawl switches over, making a snapping sound, stop the third wheel with a finger, and return the clock to its former upright position.

How to unwind the mainspring

Stop the third wheel with a finger, and turn the clock over while being careful not to let the mainspring come unwound. The mainspring will unwind once you release your finger. Once it has stopped unwinding, hold down the third wheel with a finger, and return the clock to its former upright position.



Check which foliot is moving after the orientation of the clock unit has been returned to its upright position, and then remove the clock hand and reattach it as shown in the diagrams.

If the foliot for the day hours is the one moving, set the clock hand to the hour of the rabbit (Brighter 6 o'clock).

If the foliot for the night hours is the one moving, set the clock hand to the hour of the bird (Darker 6 o'clock).

[2] Set the time

Check information on the present calendar

Japanese clocks are based on a system of unequal hours that change from day to day and from season to season. The standards for time used to set the clock are the times for daybreak and nightfall. The time for daybreak is called Brighter 6 o'clock (6 a.m.), and the time for nightfall is called Darker 6 o'clock (6 p.m.). You can find the times for sunrise (for daybreak) and sunset (for nightfall) for the day for a certain region on the Internet or with other resources.

Brighter 6 o'clock
35 minutes before sunrise

Darker 6 o'clock
35 minutes after sunset

The information you can use from the present calendar system to set the time on the clock is the times for daybreak (Time of sunrise - 35 min.) and nightfall (Time of sunset + 35 min.). There are 120 thin marks on the inner circle on the clock face of the Japanese clock. Accordingly, by completing the calculations given below, you can find the times for day and night as well as the time for each mark.

[Finding the times for day and night]
Day hours: Time lasting from daybreak to nightfall
Night times: Time remaining from 24 hours less the length of the day time
Ex.) August 7, the beginning of fall in Tokyo, daybreak: 4:18, nightfall: 19:15
19 hrs. 15 min. -4 hrs. 18 min. = 14 hrs. 57 min. (length of day time)
24 hrs. -14 hrs. 57 min. = 9 hrs. 3 min. (length of night time)

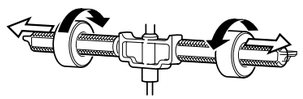
Next, divide each time found by 60, which will give you how much time each thin mark on the inner ring of the clock face represents. In the above example, the each mark for the day hours is worth approx. 15 min., and each mark for the night hours is worth approx. 9 min. To set the clock to the current time, subtract the current time from the time for daybreak or nightfall, and then move the clock hand forward the number of marks found by dividing by 15 min. for the day hours and 9 min. for the night hours.
When moving the clock hand forward, follow the steps provided in "How to unwind the mainspring" on the left.

[3] Adjust the weights on the foliots

Check the position of the clock hand after a certain amount of time has passed

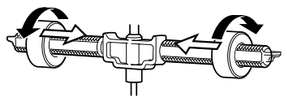
Once you've set the time, let the clock run for several hours. Using the same calculation method as given above, find the time that should be shown on the Japanese clock at this time, and compare this to the actual position of the clock hand. After checking to see if the clock is running too fast or too slow, change the positions of the weights to adjust how fast or slow the hand moves, depending on how the clock is running.

If the clock runs faster than the actual time



Turn the weights as shown in the picture, and move the weights to the outer position. The movement of the foliot will slow down.

If the clock runs slower than the actual time



Turn the weights as shown in the picture, and move the weights to the inner position. The movement of the foliot will speed down.

Repeat [2] and [3] to adjust the clock

Continue making adjustments by moving the weights until the time found by calculations and the position of the clock hand are about the same. Adjust the day hours with the weights on the foliot for the day hours and the night hours with the weights on the foliot for the night hours.

Ishikawa-style Adjustment Method for the Supplement's Japanese Clock

Mr. Eisuke Ishikawa, whom we interviewed for a feature article in this magazine, provided us with a method for adjusting the supplement's clock that is based on experiences he had living the lifestyle of the Edo period using a traditional Japanese clock he made himself. Below, we introduce a part of the "Ishikawa-style" method of adjusting traditional Japanese clocks.
Calculating the "Time it takes for the clock hand to move one hour on the clock face" when the weights on the foliot are placed at the innermost positions and when they are placed at the outermost positions, in order to balance the weights…
When the weights on the foliot for the day hours are placed at the outermost positions 185 min.
In half a day, 185 min. 6 = 18 hrs. 30 min.
When the weights on the foliot for the day hours are placed at the innermost positions 85 min.
In half a day, 85 min. 6 = 8 hrs. 20 min.

This gives us a difference of about 10 hours. The length of the distance that you can move the weights is about 40 mm, which yields 4 mm per hour. Use the same process to make measurements and calculations for the foliot for the night hours, as well. Compare the time for the day hours and the time for when the weights are placed at the outermost position on the foliot for the day hours, and adjust the position of the weights by the amount of the difference. In the example at left, the length of the day is 14 hrs. 57 min., so 18 hrs. 30 min. □ 14 hrs. 57 min. = 3 hrs. 33 min. There are 4 mm for every hour, so you would need to move the weights about 14 mm inward in this case.

* Due to differences in individual clocks because of slight part variations and variations in how the parts are assembled, the results you get for your measurements will not be the same as the values given in the example. Please be sure to actually take measurements for your own clock.

Q: The foliot does not move.
A: Check the looseness of the screws holding down the verge stopper, the orientation of the foliot, and the orientation of the escape wheel.
By slowly turning the third wheel in the downward direction with your hand, you will be able to check the movement of the escape wheel and foliot.

Q: The clock does not change between night and day.
A: Check the assembly of the cam and cam receiver.This will occur if the cam spring has come loose, or if the oblong-shaped lever on the ratchet pawl unit has come loose.

Q: The mainspring does not wind properly.
A: Check the assembly of the ratchet wheel and click. The two are assembled together correctly when the tab on the click is clicked onto the ratchet wheel.

Q: The sound of the clock parts rotating is too loud.
A: Apply a small amount of lubricant oil to the shaft of the escape wheel. Wipe away any excess oil in surrounding areas with a tissue, etc.

Q: The clock stops partway through its operation.
A: It may take several days for the wheels in the clock to "develop a rhythm" (get used to running with each other). Frequently wind up the clock, and wait for a few days to see how things go.
If you still have problems, check the looseness of the string and up/down position of the foliots. The foliots may be hanging too low. It is best to have the foliots hang about 1 mm from the top surface of the ratchet pawl.
Refer to page 83 for how to adjust the heights.

Q: No signal can be detected from the leaf switch.
A: One of the switch contacts (either the red or black one) may be curved too far inward. Increase the distance between the switch terminals.
Under normal conditions, the switch contacts are positioned correctly when there is a gap between switch terminals.

Q: The mainspring winding comes undone all at once.
A: The tooth of the relevant foliot may have been shifted upward away from the escape wheel.
Check the up/down position of the end of the foliot.
It is best to position the end of the foliot so that it hangs about 1 mm from the top surface of the ratchet pawl.

Q: The clock runs too fast.
A: There is a tendency for the clock to run fast right after assembly is completed. Wait for about three days.
If you still think that the clock runs too fast after this time, add another weight (a nut) to adjust the time.