

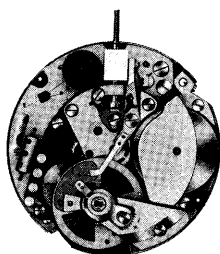


PIÈCES DE RECHANGE ET SERVICE TECHNIQUE

CALIBRE 430

Mouvement électronique à balancier - spiral, seconde au centre,
quantième à guichet, noyé dans la platine, mécanisme d'arrêt du balancier

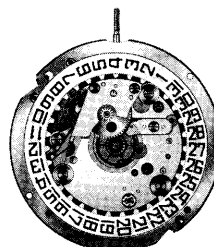
13 pierres



Diamètre: 28.00 mm

Hauteur: 5.50 mm

Nombre d'alternances: 21 600



TEXTE ANGLAIS

1. Introduction

The object of this technical communication is to make watch-repairers and jewelers familiar with the characteristics of this electronic caliber, so that they may understand its working and be in a position to repair and service it.

It is a movement of original conception, without contacts, in which the balance is at the same time the motor organ. The balance count is 21,600 vibrations per hour.

2. Current supply

The electric current is supplied by a Mallory W 12 NM anti-magnetic mercury-oxide cell with a constant voltage of 1.35 V.

This cell is guaranteed watertight and inoxidable.

3. Instruments recommended for repairing

Checking the cell voltage: any D.C. voltmeter (internal resistance $> 20,000 \Omega V$) or universal meter: Taylor 127 A.

Checking the instantaneous rate: all the watch-timing machines to be found on the market are perfectly suitable (21,600 vibrations per hour).

4. Uncasing

4.1. 2-piece case

- 4.1.1. Open the back of the case.
- 4.1.2. Loosen and remove the 2 setting-lever screws No. 5443.
- 4.1.3. Remove: setting lever No. 443, hand-setting stem No. 405, hand-setting pinion No. 412.
- 4.1.4. Unscrew and remove the casing clamps No. 166.
- 4.1.5. If necessary, remove plate-enlargement ring No. 158.
- 4.1.6. Take the movement out of the case.
- 4.1.7. Remove the hands and dial.
- 4.1.8. Remove hour wheel No. 255.
- 4.1.9. Unscrew cell bridge No. 4400.
- 4.1.10. Remove the cell.

4.2. 1-piece case

- 4.2.1. Unscrew the lid of the cell compartment and take out the cell.
- 4.2.2. Pull the winding crown hard so as to uncouple the 2 parts of the hand-setting stem, and remove the crown stem together with the crown.
- 4.2.3. Remove the crystal with a special wrench.
- 4.2.4. Turn the case over and take out the movement.
- 4.2.5. Loosen and remove the 2 setting-lever screws No. 5443.
- 4.2.6. Remove: setting lever No. 443, hand-setting stem No. 405, hand-setting pinion No. 412.
- 4.2.7. Remove the hands and dial.
- 4.2.8. Remove hour wheel No. 255.

5. Disassembling

5.1. Disassembling the movement

- 5.1.1. Unscrew and remove power-connection No. 4035.
- 5.1.2. Unscrew and remove balance-stop lever No. 9439.
- 5.1.3. Loosen circuit screw No. 54010 and the 2 coil-rest screws (on plate) No. 54065.
- 5.1.4. Turn the balance as shown in fig. 3 point 1. Keep the balance in this position. Turn circuit No. 4010 round the guide tube, point 3. of illustration. Using great care, disengage the portion of the circuit that is opposite the guide point, point 2. of illustration. When the circuit is in the position shown in fig. 3, remove it from the guide tube.
- 5.1.5. Remove circuit-insulator No. 4015.
- 5.1.6. Unscrew and remove balance cock No. 121/6 and balance No. 721; separate the balance from the cock.
- 5.1.7. Unscrew and remove pallet cock No. 125 and click lever No. 4330.
- 5.1.8. Unscrew and disengage train bridge No. 110; turn the movement over on the workbench and allow the bridge, click wheel No. 4360, fourth wheel No. 227 and third wheel No. 210 to drop out.
- 5.1.9. The double friction spring No. 472 should remain screwed to the bridge during the cleaning process.
- 5.1.10. Disassemble the shock-absorbers on the balance cock and the plate.

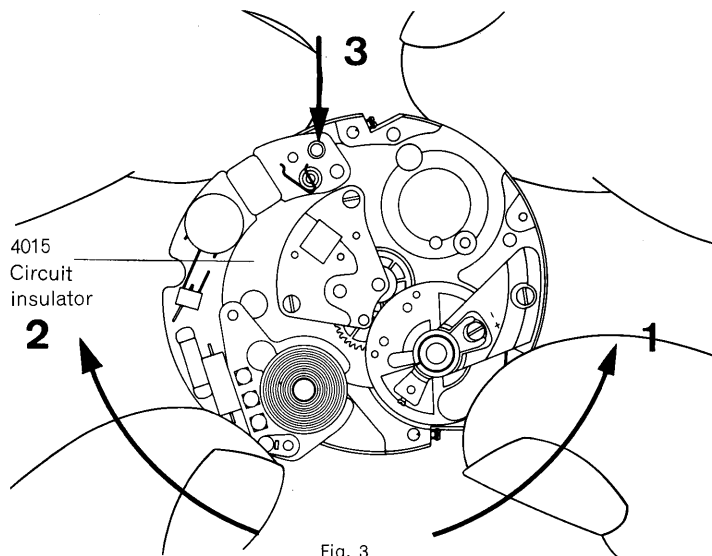


Fig. 3

5.2. Disassembling the date mechanism and the dial train

- 5.2.1. Unscrew and remove the 3 date-indicator guards No. 2535.
- 5.2.2. Remove date-indicator No. 2557.
- 5.2.3. Unscrew and remove minute-work cock No. 462.
- 5.2.4. Remove: minute wheel No. 260, setting wheel No. 450.

- 5.2.5. Remove date-jumper spring No. 2575.
- 5.2.6. Unscrew and remove date-jumper No. 2576.
- 5.2.7. Unscrew and remove date-indicator driving wheel No. 2556/1.
- 5.2.8. Unscrew and remove third-wheel bridge No. 114.
- 5.2.9. Remove cannon pinion with driving wheel No. 242.

6. Cleaning and demagnetizing

6.1. Demagnetizing

Important: With the strict exception of the balance, all parts can be demagnetized without the least risk.

6.2. Cleaning

Only the electronic circuit and the support with the coils should not be cleaned. The date-indicator should be cleaned with benzine. The rest of the parts should be washed in the usual way.

If the ultrasonic cleaning method is adopted, it is advisable afterwards to coat the click wheel and the click lever with epilame.

6.3. Replacing defective parts

Before re-assembling the movement, check the condition of all its components and, if necessary, replace any defective part.

Balance: It is impossible for the watch-repairer to replace the balance staff.
If this organ has a defect of any kind, it must be replaced.

Coils: The coil-rest and coil assembly can be separated from the circuit by loosening the 4 screws holding

the rest. If there is any defect, this organ can be replaced without replacing the complete circuit.

Circuit: A standard replacement is possible if any part of the circuit is defective.

7. Re-assembling

7.1. Re-assembling the date mechanism and the dial train

- 7.1.1. Fit the date-indicator driving wheel in position and screw it tight. The wheel should run freely, with about .03 mm endshake. Use a blower to make sure that it turns easily.
- 7.1.2. Fit the date indicator.
- 7.1.3. Fit the 3 date-indicator guards in position and screw them tight. Make sure the date-indicator turns freely and has slight axial and radial shake. Lightly grease the inside wall of the date-indicator near the three indicator guards.
- 7.1.4. Place the date jumper in position and screw it tight. It should have about .03 mm endshake and should move freely on its screw.
- 7.1.5. Grease the 3 friction points of the cannon pinion and the driving wheel mounted on it.
- 7.1.6. Oil the center pipe.
- 7.1.7. Fit the cannon pinion and driving wheel on to the center pipe.
- 7.1.8. Fit the third-wheel bridge in position and screw it tight. Make sure the cannon pinion with its driving wheel turns freely.
- 7.1.9. Lubricate the inside of the hole of the minute wheel and the rim of the plate that is solid with it (see fig. 4).
- 7.1.10. Fit the minute wheel on to its post and turn it to check the drive of the date-indicator driving wheel.

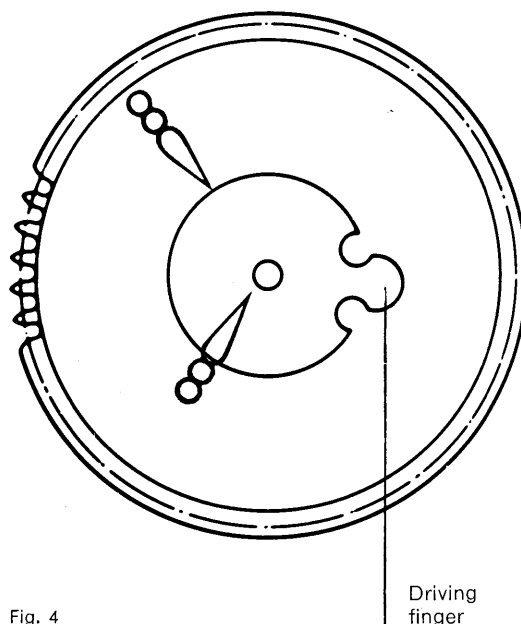


Fig. 4

Driving finger

- 7.1.11. Lubricate the setting-wheel pivots and fit the wheel in position on the plate.
- 7.1.12. Fit the minute-work cock in position and screw it tight. Check the endshake of the 2 wheels (setting wheel and minute wheel), which should be about .03 mm.
- 7.1.13. Fit the date-jumper spring in position, checking its tension (see fig. 5).
The active end of the spring should be in the direction of the point of the date jumper when the latter is resting against the teeth of the date-indicator. When the tension has been checked, place the end of the date-jumper spring behind the pin solid with the jumper.
Grease the point at which the spring rests against the date-jumper pin.
Grease the functional planes of the jumper and give the date-indicator half a turn, using a bone point; grease the jumper again, then give the date-indicator another half-turn.

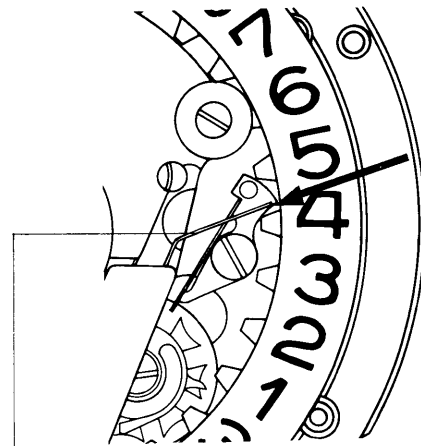


Fig. 5

2575 Date jumper spring

8. Re-assembling the movement

- 8.1. Check the tension of the double friction spring as shown in fig. 6. The 2 arms of the spring should be tangential to the jewels of the sweep-second wheel and the click wheel. Make sure that the 2 arms of the spring are parallel to the surface of the bridge. Correct if necessary.
- 8.2. Place the arm of the click friction spring behind the mounting pin, as shown in fig. 7.
- 8.3. In succession, place in position:
 - the sweep-second wheel, having lubricated its lower pivot;
 - the third wheel;
 - the click wheel.
- 8.4. Fit the train bridge in position and screw it tight.
- 8.5. Using an oil pike, place the springs in the respective grooves of the friction wheels.
- 8.6. Check the endshake of the 3 wheels (.02 to .04 mm).
- 8.7. Make sure that the return magnet of the lever fixed in the block of the guard pin is free from any metal

filings or particles that may have come from the cleaning baths. If this is not the case, they can be easily removed by pushing the lever notch into a piece of elder pith.

- 8.8. Fit the click lever and its bridge in position. Screw the bridge tight (endshake .02 mm).
- 8.9. Oil and re-assemble the shock-absorbers of the balance cock and the plate.
- 8.10. Make sure that the 4 balance magnets are free from any metal filings or particles. If this is not the case, they can be removed with self-adhesive paper.
- 8.11. Place the balance in position on the cock.
- 8.12. Check:
the action of the lever notch and the roller; the horns should be situated within the lowest third of the roller pin;
the beat with a watch-timing machine, giving the balance an impulse by hand (the graph obtained should form only a single line).

472 Double friction spring

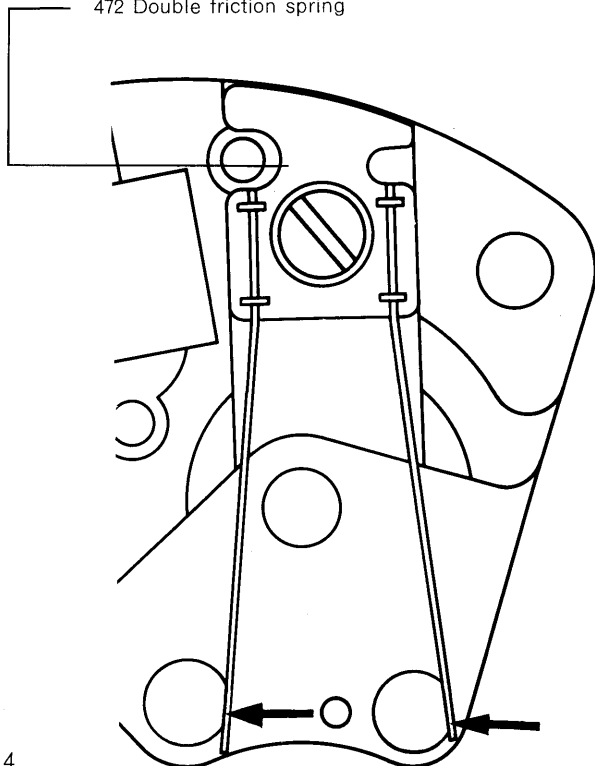


Fig. 6

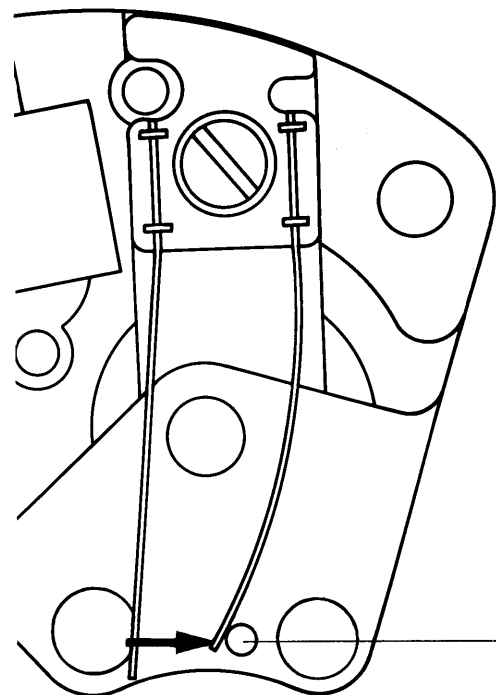


Fig. 7

Mounting pin

9. Fitting the circuit

- 9.1. Place the circuit-insulator on the plate.
- 9.2. Place the circuit in the position shown in fig. 3. Pull the balance aside as at (1). Turn the circuit in the direction opposite to that indicated by the arrow (2).

- 9.3. First tighten the outer screw of the coil rest, then the inner screw and the circuit screw.
Screw on the power connection, centering its 3 jaws in relation to the cell recess.

10. Hand-setting mechanism

- 10.1. Lightly grease the shoulder of the screw of the balance-stop lever.
- 10.2. Fit the stop lever in position and screw it tight. The interrupter spring should push it against the nylon block of the stem.
- 10.3. Place the hand-setting pinion in position.
- 10.4. Having greased the stem, insert it into the nylon block so that the hand-setting pinion is brought on to the square of the stem at the end of its travel.
- 10.5. Grease the shoulders of the 2 setting-lever screws.
- 10.6. Fit the setting lever in position and tighten its 2 shouldered screws.
- 10.7. Grease the setting lever at the point where it works with the stop-lever pin.
Important: The interrupter spring is insulated from the stop lever by a ruby. For this reason, the spring should on no account touch the body (metal portion) of the stop lever or the train bridge at the points marked by dotted arrows (fig. 8).
On the other hand, when the hand-setting stem is pulled out, the interrupter spring should rest, at the end of its travel, on the interrupter bridle, thus breaking the circuit and practically stopping the flow of current from the cell.
- 10.8. Check the reciprocal action of the balance-stop spring and the stop pin fixed to the balance. The spring should not be lower than half the pin, to prevent the spring from rubbing against the balance.

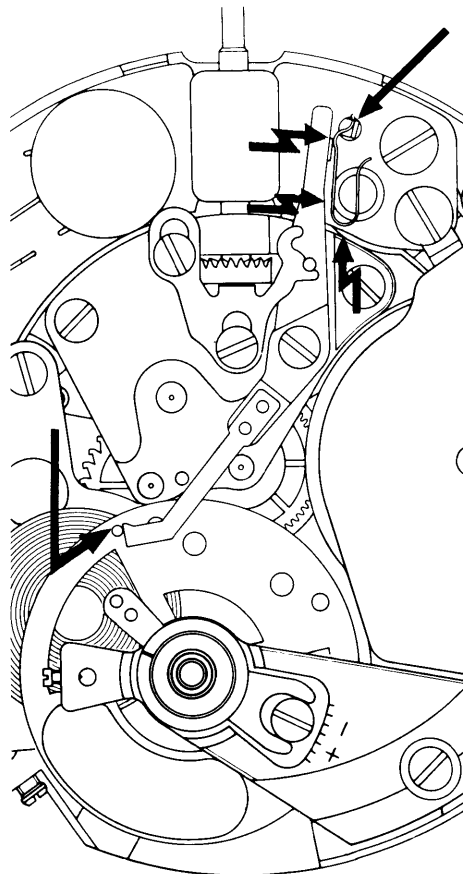


Fig. 8

11. Working and adjustment of the date mechanism

11.1. Working of the date mechanism driven by the movement

Every 3 hours, the driving finger which is solid with the minute wheel causes the date-indicator driving wheel to move forward one step. About half an hour before the date changes (fig. 9), the unlocking finger mounted on the driving wheel attacks the unlocking spring which is solid with the jumper (1). At that moment, the driving spring is not yet touching the indicator tooth (2).

Fig. 10: When the driving spring attacks the indicator tooth (3), the unlocking finger of the driving wheel has lifted the jumper (4), which releases the indicator. The driving spring then pushes the indicator tooth; at midnight, the unlocking finger releases the jumper, which then drops between the next 2 teeth of the indicator.

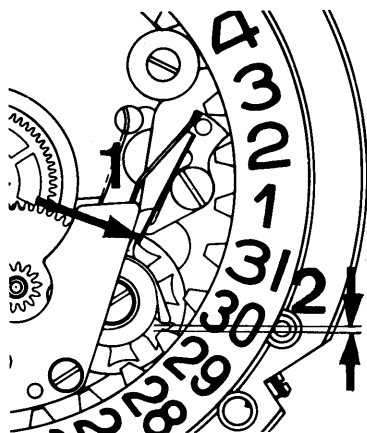


Fig. 9

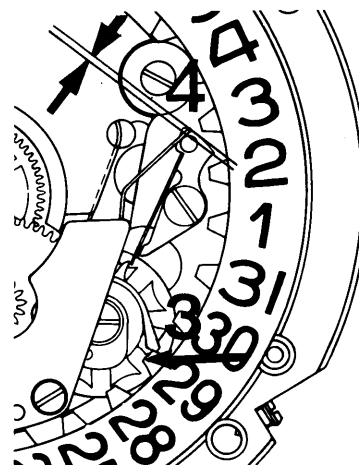


Fig. 10

11.2. Working of the date mechanism driven by hand

The indicator has just changed the date at midnight. To correct the date, it is only necessary to move the hands back about 40 minutes and then to move them forward again to midnight. This is the rapid date-setting system. In this case, the mechanism does not operate in the manner described under 11.1. (fig. 11).

When turning backwards, the unlocking finger strikes the unlocking spring which is solid with the jumper, which reinforces the action of date-jumper spring No. 2575 and holds the date-indicator still (5). This assisting action is sufficient to enable the driving spring to return to a position in front of a new tooth (6). When the driving spring moves forward again, it causes the jumper to slide on to the next tooth.

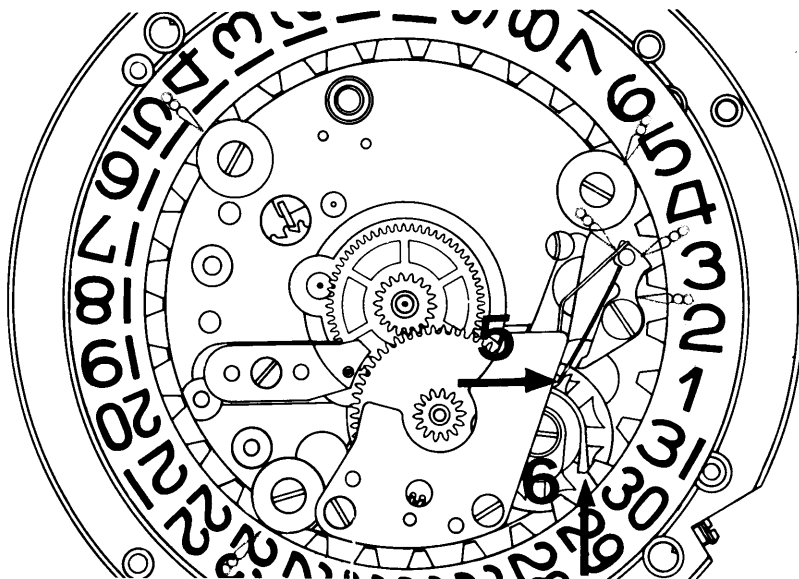


Fig. 11

11.3. Adjustment of the date mechanism

- 11.3.1. Make sure that during the entire action described under 11.1. and 11.2. the unlocking finger does not pass under or in front of the unlocking spring soldered to the jumper. If necessary, correct by reducing the endshake of the jumper (mill away material from shouldered screw No. 52576).
- 11.3.2. Place the movement in the position shown in fig. 10. When the driving spring comes into contact with the indicator tooth (3), its depth should be equal to half to one-third of the width of the tip of the driving spring. Also make sure that the reciprocal action of the driving spring and the tooth is correct, and that the

- jumper is slightly lifted, as at (4). If necessary, correct by altering the tension of the driving spring.
- 11.3.3. Place the movement in the position shown in fig. 10. Lifting the date-indicator driving wheel, make sure that the driving spring cannot foul the minute-work cock. If necessary, correct by reducing the endshake of the driving wheel (mill away material from shouldered screw No. 52556).
- 11.3.4. To make sure that the date mechanism is working perfectly, carry out the rapid date-setting operation, as under 11.2., for a complete revolution of the indicator.

12. Lubricating the movement

12.1. Dial side

oil the bearing of the click wheel
the bearing of the third wheel.

12.2. Bridge side

oil the bearing of the click wheel
the bearing of the fourth wheel
the bearing of the third wheel
the teeth of the click wheel.

For the last point, proceed as follows: oil every third tooth of the wheel, turning it successively.

13. Checking the damping of the balance

This check consists in measuring the time that passes from the moment when the balance is released from its overbanded position (expanded hairspring) until the click wheel stops

turning. This time should be between 20 and 29 seconds. If it is under 20 seconds in the case of a movement which has been working for over 2 years, the watch needs cleaning.

14. Checking the cell

Measure the voltage of the cell: 1.35 V. The voltage of a very fresh cell may be as high as 1.40 V.

15. Checking the interrupter system

Pull out the hand-setting stem, thus blocking the balance. Lift the stop spring: the balance should stop. If this is not the

case, the interrupter bridle is not touching the interrupter spring. Correct according to 10.7, see fig. 8.

16. Checking the amplitude

- 16.1. For a movement that is in order and is fitted with a cell giving a voltage of 1.35 V, the balance amplitude should lie between the following limits: fig. 12.
- Upper limit DD = 270°. This limit is reached when the stop pin of the balance is above the edge of the coils, as shown in the illustration.
 - Lower limit PD = 220°. In this position, the stop pin is on the line extending the upper edge of the ear of the balance cock.
- 16.2. If the value of the amplitude lies outside either of these limits, check the damping of the balance as indicated under 13. If the damping is correct, the fault lies in the electronic system. Refer to the table « Analysis of operational faults », page 10.

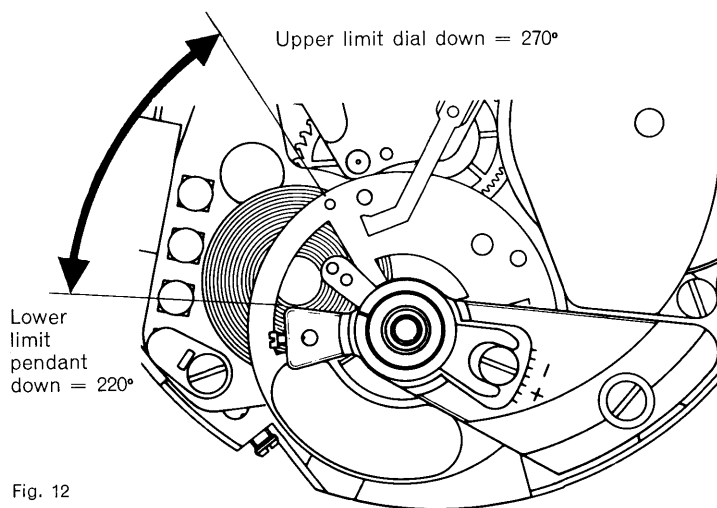


Fig. 12

17. Casing up

17.1. 2-piece case

- 17.1.1. Carefully clean the cell with a clean, dry rag and fit it into its compartment with the + side upwards.
- 17.1.2. Fit the cell bridge in position and screw it tight.
- 17.1.3. Fit the hour wheel in position.
- 17.1.4. Fit the dial and hands.
- 17.1.5. Unscrew and remove the setting lever.
- 17.1.6. Take out the hand-setting stem.

- 17.1.7. Fit the movement into the case.
- 17.1.8. Fit the plate-enlargement ring in position.
- 17.1.9. Fit the casing clamps and screw them tight.
- 17.1.10. Fit the hand-setting stem with the crown. Fit the setting lever in position and screw it tight.
- 17.1.11. Close the back of the case.

17.2. 1-piece case

- 17.2.1. Fit the hour wheel in position.
- 17.2.2. Fit the dial and hands.
- 17.2.3. Set the hands to the right time.
- 17.2.4. Fit the movement into the case.
- 17.2.5. Center the hand-setting stem of the movement in relation to the tube of the case.

- 17.2.6. Fit the crystal with a special wrench.
- 17.2.7. Couple the crown stem to the movement stem by pressing the former firmly on to the latter.
- 17.2.8. Fit the cell into its compartment.
- 17.2.9. Close the cell compartment.

18. Adjusting the daily rate

Using the watch-timing machine, take the daily rates in the "pendant left", "pendant up", "pendant down", "dial down" and "dial up" positions. Check the average for the different

positions. Correct the error of rate by means of the regulator-adjuster No. 358, to bring the average between 0 and 5 seconds.

19. Final check

Check the working of the balance-stop system by setting the hands, and make sure that the date mechanism works for a

complete revolution of the indicator when rapid date-setting is effected with the watch in the "dial down" position.

20. Analysis of functional disorders

When a "TISSOT" electronic watch is taken to the watchmaker to be repaired, it is necessary, as with any other watch, to examine it in order to locate the cause of the defect that has been noted.

The table, "Analysis of functional disorders", makes possible to diagnose the trouble quickly and accurately, by reference to three basic questions. We advise watchmakers to refer to this table before doing anything else; where necessary, it prescribes the more detailed operations described below.

20.1. Discharged dry cell

Measure the voltage of the dry cell in its normal working position: connect the voltmeter terminals to the plate (+) and to the power connection screw No. 54035 (-), respectively. If the voltage

is below 1.25 V, the cell is discharged. Fit a working cell (one which has already been used, but whose voltage is not lower than 1.25 V) in order to proceed with the examination.

20.2. Mechanical stoppage

20.2.1. The balance does not swing freely

Possible causes:	Corrections:
The balance-stop spring is pressing on the balance	Adjust according to (10.8)
Insufficient endshake of balance or lever	Adjust the endshake to .02 mm.
The height of the fork is too great in relation to the roller	Adjust according to (8.12)
The balance magnets foul the rest with coils	Lock the 4 screws fixing the coil rest to the circuit, as well as the screws fixing the circuit to the plate.

20.2.2. The balance swings freely, but the train fails to move

	The fault is due to one of the following causes: stoppage of the hands, the train wheel, the dial train or the calendar. Check all the wheels and make sure that they turn freely.
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20.3. Interpretation of the results obtained in checking the damping of the balance

Measure the damping of the balance according to 13. From the value obtained, it is possible to infer:

20.3.1. Whether it is under 20 seconds:

A complete overhaul is necessary, and a new dry cell must be fitted. If the watch has already been overhauled, the fault may be due to bad cleaning, incorrect adjustment of the double friction spring, or slightly insufficient endshake.

20.3.2. Whether it is between 20 and 30 seconds:

The fault lies in the coils or in the circuit; proceed with the examination.

20.3.3. Whether it is over 30 seconds:

You are measuring the damping without having the circuit in position! Replace the circuit in order to measure the damping.

20.4. Electronic stoppage

20.4.1. Checking the switch spring

Make sure that the switch spring is not causing a short circuit, according to 10.7 and check the movement with an ohmmeter the way indicated by fig. 14, the reading must be ∞. If necessary, straighten the spring.

20.4.2. Checking the coils

Loosen the 4 screws fixing the rest with coils, mounted, to the circuit, and remove the rest with coils. The coils are out of order if, when they are measured on the ohmmeter and according to fig. 13.

- between 1 and 2
or
between 3 and 4
or
between 2 and 3
- R = ∞
R = 0
R = ∞
R = 0
R is not equal to ∞

The rest with coils, mounted, should be replaced in any case.

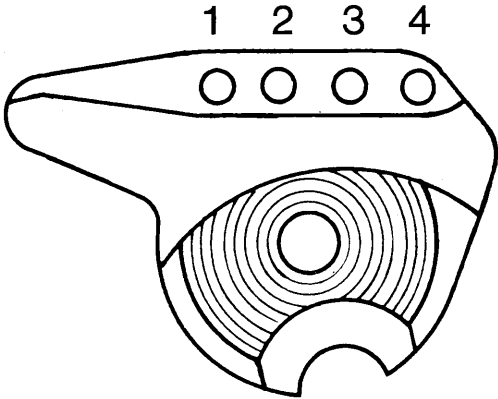


Fig. 13

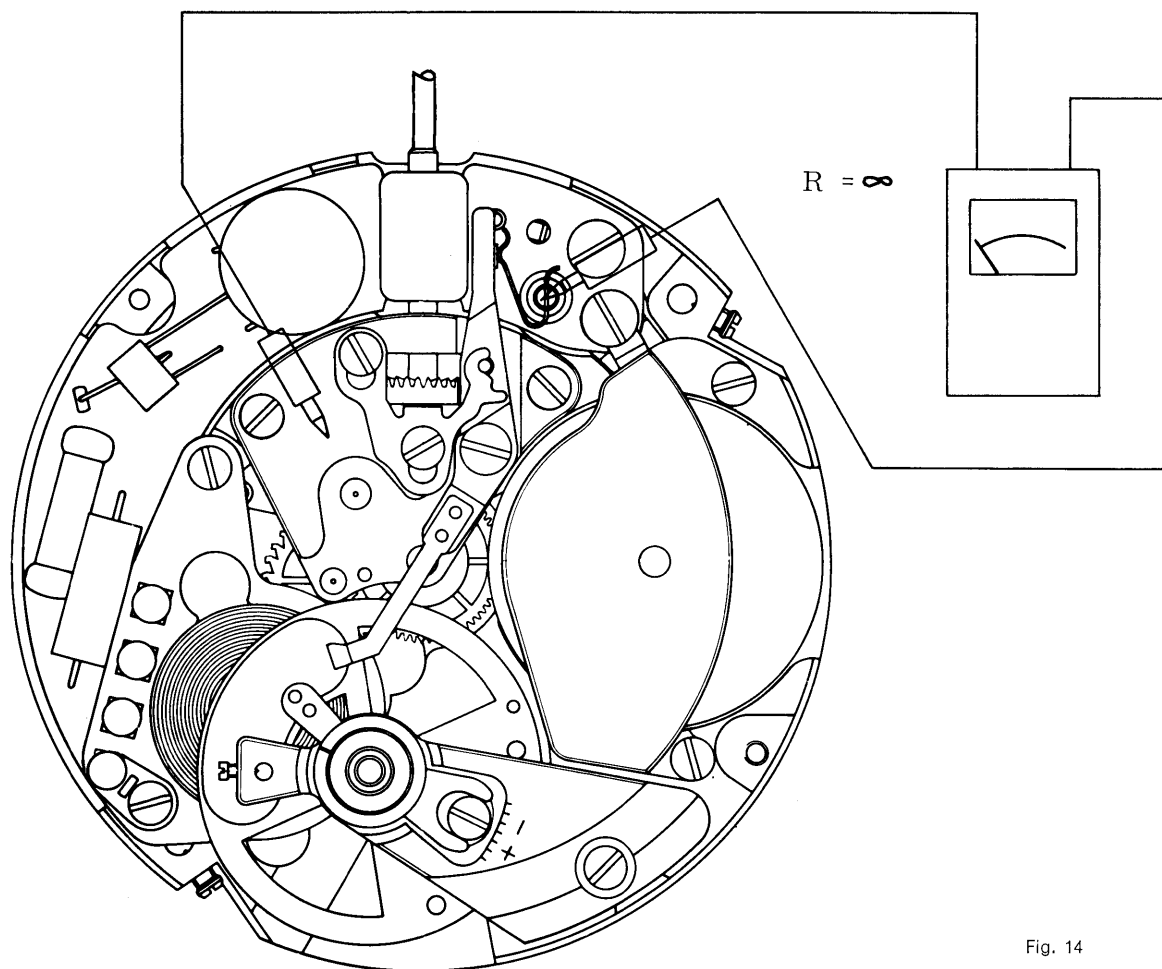
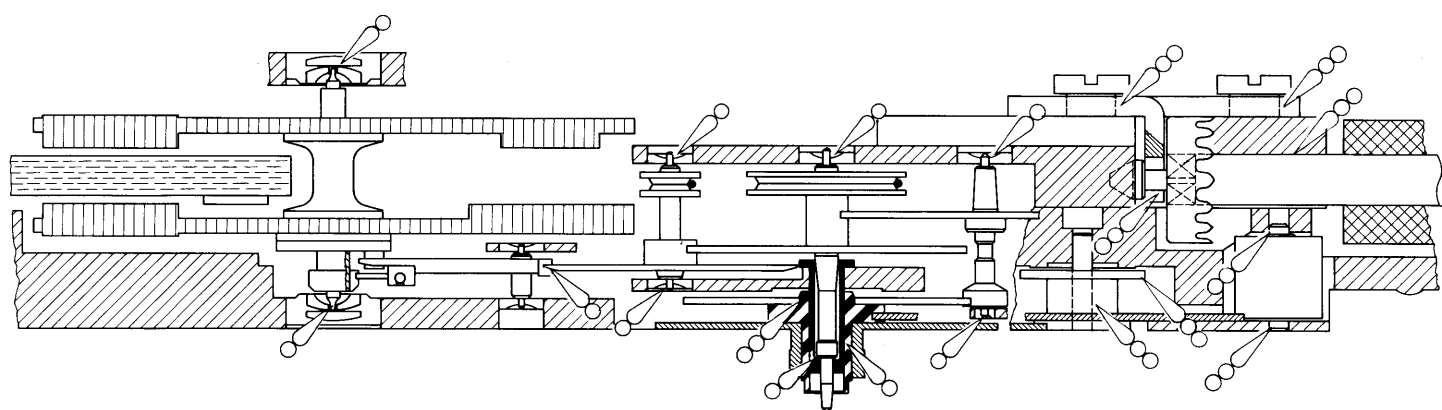
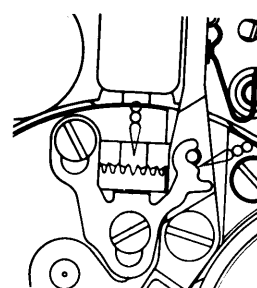


Fig. 14

21. Lubrication



-  Oil «Moebius 941»
-  Grease «Cuypers B.O.X.»



1. Is the balance stopped?

No
▽

Yes
▽

▶ in its rest position?

YES
NO
▽

is the voltage of the dry cell correct according to 20.1.?

NO
YES
▽

Discharged

▶ Does the balance swing freely without a dry cell?

NO
YES
▽

Mechanical

▶ Is the switch spring in order according to 20.4.1.?

NO
YES
▽

Straighten the spring, then fit a new dry cell.

▶ Take the movement out of its case and remove the circuit. Are the coils in order according to 20.4.2.?

NO
YES
▽

Replace the

▶ The circuit is faulty

▶▶

Replace the circuit then fit a new dry cell.

2. Is the train stopped?

No
▽

Yes
▶▶

Mechanical stoppage according to 20.2.2. Repair; the dry cell can still be used.

3. Is the amplitude correct according to 16.1. – 16.2.?

Yes
▽

No
▽

▶ Is it very high, or does knocking occur?

YES
NO
▽

The circuit is defective. **Replace the circuit**

▶ It is too weak

▶ remove the dry cell; is the damping correct according to 13.?

YES
NO
▽

The dry cell is almost

▶▶

Complete overhaul

▶ Is the instantaneous daily rate correctly adjusted according to 18.?

NO
YES
▽

Adjust the daily

Does the watch lose

dry cell; fit a working cell.

Is the balance still stopped?

NO
YES

Is the amplitude correct according to 16.1.—16.2. ?

Fit a new cell; if necessary, adjust the daily rate according to 18.

remove the dry cell and measure the damping according to 13.

It is: under 20 seconds Complete overhaul see 20.3.1.

over 30 seconds: see 20.3.3.

between 20 and 30 seconds

stoppage according to 20.2.1. Repair, then fit a new cell.

mounted coil rest, then fit a new dry cell.

Analysis of functional disorders

Legend :

- ▶ detection of the fault
- ▷ see below
- ▷▷ fault detected

completely discharged **Fit a new dry cell;** if necessary, adjust the daily rate according to 18.

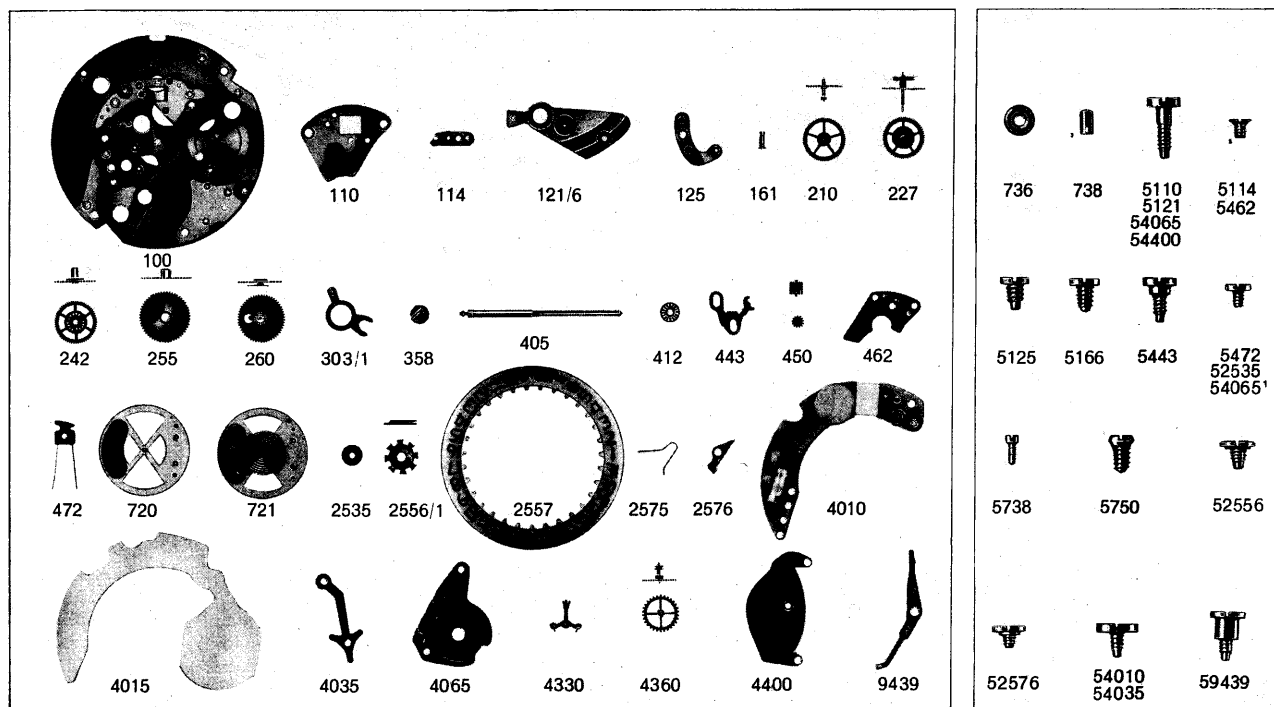
see 20.3.1.

rate by moving the regulator adjuster.

heavily when worn ?

The double friction spring has insufficient tension. Adjust the tension according to 8.1.

You have just tried out our table with a movement in perfect working order



No. LIST OF MATERIALS

100	Plate
110	Train wheel bridge
114	Third wheel bridge
121/6	Balance cock for regulating and shock-protecting devices, flat hairspring
125	Pallet cock
161	Center pipe
210	Third wheel
227	Sweep second wheel
242	Cannon pinion with driving wheel
255	Hour wheel
260	Minute wheel
303/1	Two-piece regulator for adjusting device, flat hairspring
358	Adjuster for regulator
405	Hand-setting stem
412	Hand-setting pinion
443	Setting lever
450	Setting wheel
462	Minute work cock
472	Double friction spring, mounted
720	Pivoted balance with roller
721	Balance with flat hairspring
2535	Date indicator guard
2556/1	Date indicator driving wheel, mounted
2557	Date indicator
2575	Date jumper spring
2576	Date jumper

No. LIST OF MATERIALS

4010	Circuit, mounted
4015	Circuit insulator
4035	Power connection
4065	Rest with coils, mounted
4330	Click lever, mounted
4360	Click wheel, pivoted
4400	Dry cell bridge
9439	Balance stop lever
5110	Train wheel bridge screw
5114	Third wheel bridge screw
5121	Balance cock screw
5125	Pallet cock screw
5166	Casing clamp screw
5443	Setting lever screw
5462	Screw for minute work cock
5472	Screw for double friction spring
5738	Hairspring stud screw
5750	Dial screw
52535	Screw for date indicator guard
52256	Screw for date indicator driving wheel
52576	Date jumper screw
54010	Circuit screw
54035	Screw for power connection
54065	Screw for coil rest (on plate)
54065'	Screw for coil rest (on circuit)
54400	Screw for dry cell bridge
59439	Screw for balance stop lever