



Ebauches S A Neuchâtel Suisse

9000
9001

Scale 1:1

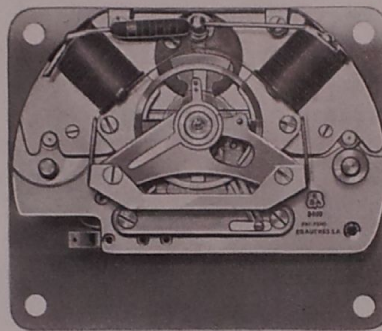


Fig. 1

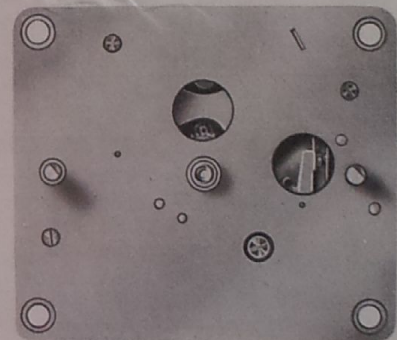


Fig. 2

Electro-mechanical movement with interlocking device

Technical and practical communication for the use of the watch repairer

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1. Introduction

This Technical Communication concerns the process of repairing and overhauling caliber ESA 9000. This is an electro-mechanical movement enabling an outside circuit to be switched on at a given time. However, the power of the circuit must not exceed 1 watt, and its voltage must not exceed 20 volts.

2. Feed - Connections

The movement is fed by a 1.5-volt cell of the Flashlight or Penlight type (mercury-oxide cells are especially recommended). The \oplus pole of the cell is connected to the red wire (ground) and the \ominus pole to the white wire (input terminal of the movement). The outside circuit to be switched on must be connected between the yellow and red wires.

3. Tools - Material and instruments recommended for repair work

3.1. Tools

Movement-holder, fig. 3.
Contact tweezers.
Two special hand levers.
Feed device, fig. 4.
Soldering iron (power: 6 to 15 watts)

The above material can be obtained from watch material dealers.

Distributors: Ebauches S. A., Spare Parts Department
Neuchâtel/Switzerland

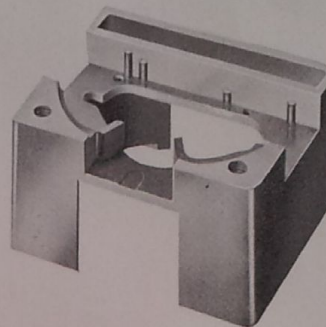


Fig. 3



Fig. 4

3.2. Instruments

Function

Instruments and manufacturers

Verification: of cell voltage;
of the ohmic resistance of the coils;
of the continuity of the circuit (broken circuit or short-circuit).

TAYLOR 127 A.
Universal measuring instrument
Distributors:
Ebauches S. A.
Spare Parts Department,
Neuchâtel/Switzerland



Fig. 5

Verification and observation of the instantaneous rate

The apparatus now on the market (18 000 vibrations per hour) is perfectly suitable.

By way of example, we refer to:
"CHRONOGRAPHIC"
Manufacturers:

GREINER ELECTRONIC
Langenthal, Switzerland

"VIBROGRAF"
Manufacturers: RENO S. A.
La Chaux-de-Fonds,
Switzerland

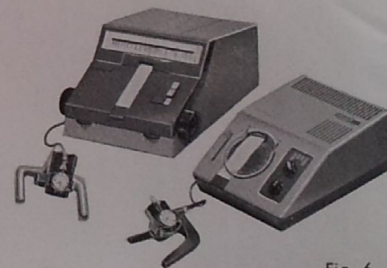


Fig. 6

4. Removing the case

Insert a knife blade between the framework of the interlocking device No. 7142 and the protecting cap No. 929, at the place where the clamps No. 974 are located. Pry the two elements apart, and then remove the movement from the protecting cap.

5. Overhauling the movement

For a complete overhaul, we recommend the following procedure:

5. 1. Disassembling.
5. 2. Cleaning the parts of the movement.
5. 3. Replacement of any parts eventually defective.
5. 4. Reassembling and checking during the process.

5. 1. Disassembling

5. 1. 1. Remove the minute hand, the hour dial disk and the interlocking disk, by means of the special levers mentioned under 3. 1.
5. 1. 2. Remove the hand-setting and contactor buttons by driving out the spring pins No. 975. If these buttons are in tightly remove them by means of the levers.
5. 1. 3. Remove the dial plate. If it is stuck down, it should be carefully removed by inserting a knife-blade in the four corners in succession (between the dial plate and the interlocking device No. 7142), drawing it from one corner to the next.
5. 1. 4. Place the movement on the movement-holder (dial side down).
5. 1. 5. Disconnect the connecting wires.
5. 1. 6. Loosen the two screws No. 54000 of the framework of the electric device No. 4000, then carefully slide out the latter.
5. 1. 7. Disassemble the shock-protecting device from the balance cock.
5. 1. 8. Remove the cock No. 121 and the balance No. 721, as well as the magnetic shunt of the electric device No. 4095, if any.
5. 1. 9. Turn the movement over.
5. 1. 10. Remove the framework of the interlocking device No. 7142 (3 screws).
5. 1. 11. Remove in succession:
 - the contactor stem No. 4120/3,
 - the hand-setting stem No. 405/1,
 - the stem spring No. 447,
 - the hour wheel No. 250/1,
 - the interlocking lever No. 7345/1,
 - the interlocking pawl wheel No. 7320/1,
 - the additional setting wheel No. 453,
 - the minute wheel No. 260,
 - the cannon pinion No. 242/1.
5. 1. 12. Loosen the contactor insulator screw and remove:
 - the contactor insulator, with feet, No. 4140/8,
 - the thimble-spring of the contactor, mounted, No. 4130/1, with yellow connecting wire,
 - the thin contactor insulator No. 4140/4,
 - the earth thimble of the contactor No. 4132, with red connecting wire.
5. 1. 13. Disassemble the shock-protecting device from the plate.
5. 1. 14. Turn the movement over, with the dial side downwards on the movement-holder.
5. 1. 15. Remove the friction spring of the click wheel No. 4385.
5. 1. 16. Remove the train wheel bridge No. 110.
5. 1. 17. Remove the train wheel bridge and the click lever No. 4330.

5. 2. Cleaning the movement

Important: The framework of the electric device No. 4000, the contactor insulator with feet No. 4140/8, the thin contactor insulator No. 4140/4 and the contactor stem No. 4120/3 should be washed only with light benzine or isopropyl alcohol.

The protecting cap should be cleaned only with light benzine.

The contact springs and the contact pins should be cleaned with two pieces of pegwood cut to the shape of screwdriver blades and dipped into isopropyl alcohol.

The plate No. 100 should not be demagnetized under any circumstances.

All the other parts of the movement should be washed in a cleaning machine, with the usual solutions used cold. They should be dried in warm air. The use of boxwood sawdust should be entirely avoided. Any filings that may have been attracted by the banking pins and the lever magnet should be removed with a piece of self-adhesive tape.

5. 3. Replacing any parts eventually defective

Before reassembling the movement, check the condition of its parts and, if necessary, replace any part or element that is defective. If there is any fault in the balance pivots, the contact finger or the roller, **the complete balance** must be changed. The watchmaker cannot replace the balance staff himself. Only use material supplied to watch material dealers by the Repair Parts Department of EBAUCHES S. A., Neuchâtel, Switzerland.

5. 4. Reassembling and checking during the process

Important: In caliber 9000 and its derivatives, the balance drives all the moving parts. It is obvious that any dirt, burrs or excessive friction points may cause the movement to stop. The greatest cleanliness should therefore be observed during the reassembling of the movement, and great care should be taken in fitting the dial, the hands and the case.

For reassembling, we recommend the following procedure:

5. 4. 1. Reassembling the shock-protecting devices.
5. 4. 2. Assembling and fitting the contactor unit.
5. 4. 3. Reassembling the wheel train and the clickwork.
5. 4. 4. Reassembling the interlocking mechanism.
5. 4. 5. Checking the contact springs.
5. 4. 6. Putting the balance into operation and checking the damping.
5. 4. 7. Checking the circuit for continuity and the fitting of the framework of the electric device.

5. 4. 1. Reassembling the shock-protecting devices

5. 4. 1. 1. Reassemble **the shock-protecting** devices and oil them.

5. 4. 2. Assembling and fitting the contactor unit

5. 4. 2. 1. Place the ground thimble of the contactor No. 4132 on the interlocking mechanism side of the plate No. 100.
5. 4. 2. 2. Place the thin contactor insulator No. 4140/4 on the ground thimble of the contactor No. 4132.
5. 4. 2. 3. Place the thimble-spring of contactor No. 4130/1 on the thin contactor insulator No. 4140/4.
5. 4. 2. 4. Place the contactor insulator with feet No. 4140/8 on the thimble-spring of the contactor No. 4130/1.
5. 4. 2. 5. Screw the entire assembly (screw No. 54140) on to the plate No. 100 on the interlocking mechanism side.
5. 4. 2. 6. Check the contact of the thimble-spring of the contactor for cleanliness; also check its position. If it is correctly bent, it should run to the edge from the center of the pivot hole of the contactor stem.

5. 4. 3. Reassembling the wheel train and the clickwork

Place the fourth wheel No. 220 and the third wheel No. 210 in position. Before inserting the click wheel No. 4360, deposit a drop of oil in the undercut of its pinion, on the plate side, fig. 7. Place the click wheel No. 4360 and the click lever No. 4330 in position, as well as the train wheel bridge No. 110 (two screws No 5110). Check the endshake of the arbors. Oil the click wheel pivot on the bridge side. Place the friction spring of the click wheel No. 4385 in position (one screw No. 54385), after having slightly greased the portion that rests on the tip of the pivot. Move the lever by means of the banking pins. Also check the space between the banking pin and the shunt (fixed under the click lever). This space should be approximately between 0.03 and 0.05 mm.

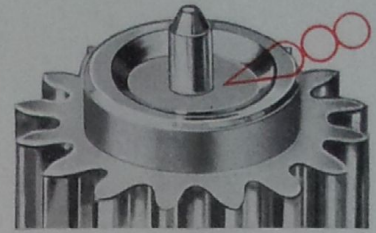


Fig. 7

5. 4. 4. Reassembling the interlocking mechanism

Check that the wire spring of the interlocking lever No. 7345/1 has sufficient tension. If this is the case, it lies in the direction of the pivot center of the contactor stem. Oil the pivots of the third and fourth wheels, the outside of the center pipe, the pivot hole of the interlocking pawl wheel, in between the cannon pinion and its driving wheel, and the minute wheel post. To oil the hour wheel, press on the interlocking cam with a pair of tweezers, in order to separate the cam from its maintaining washer. A large drop of oil should be deposited in the resulting space (fig. 8). Then grease the interlocking pawl wheel (the shoulder of the additional setting wheel No. 453), the hand-setting stem (along the actual stem and on the shoulders of its pinion), the contactor stem (along the actual stem, on the shoulders and on the locating angles of the cam). Place the contactor stem in position on the framework of the interlocking device No. 7142, taking care to move aside the jumper spring of the contactor. Then place in position on the plate: the cannon pinion, the minute wheel, the additional setting wheel, the interlocking pawl wheel, the hour wheel, the interlocking lever (putting its spring in its working position), the contactor stem, and screw it tight (three screws No. 57142)*.

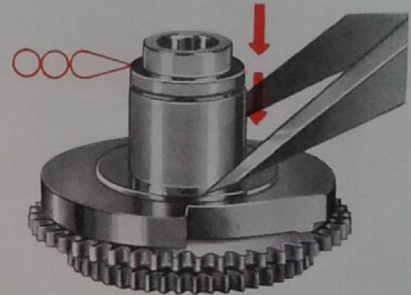


Fig. 8

***Important:** When fitting the framework of the interlocking device, it is advisable to push the thimble-spring of the contactor towards the inside, so that it is not crushed by the cam of the contactor. Also make sure that its tip does not touch either of the plates.

Checking the interlocking positions

Contactor stems with:

3 positions	2 positions
Position 1: unlocking The interlocking lever and the thimble-spring of the contactor should in no circumstances be touching each other.	Position 1
Position 2: constant interlocking The interlocking lever should not touch the interlocking cam, but should constantly rest on the thimble-spring of the contactor.	
Position 3: interlocking by cam control. 1st stage: when the interlocking lever rests on the rim of the cam, the contact is open. 2nd stage: when the lever has dropped into the recess of the interlocking cam, the contact is closed.	Position 2

5. 4. 5. Checking the contact springs

Place the movement with its dial side downwards on the other side of the movement-holder. Place the framework of the electric device on the plate. Make sure that the two contact springs are pointing towards the center of the balance jewel and that the space between the contact pins and the contact springs amounts to about twice the thickness of a spring (2e). Check the tension of the contact springs (i. e. the pressure with which the two springs push against each other at their tips). Proceed as follows: holding it by its free end, draw aside one of the contact springs with a pair of tweezers; thus released, the other contact spring should itself move away from the axis passing through the center of the jewel until it reaches a point about 0,80 mm. beyond the outside edge of the shock-absorbing device. This distance represents approximately $\frac{2}{3}$ of the total radius of the shock-absorbing device (see fig. 9). Proceed in the same way to check the tension of the other contact spring. When this verification has been completed, remove the framework of the electric device carefully and place it on one side until it is time to fit it finally in position.

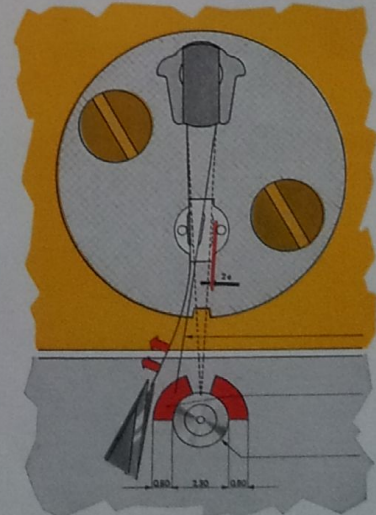


Fig. 9

5. 4. 6. Putting the balance into operation and checking the damping

Oil the third and fourth wheels on the bridge side. Lubricate the clickwork by depositing (5 to 6 times) a drop of oil on the exit pallet, while causing the clickwork to function. Check the levelness of the mobile armatures of the balance and make sure that they rest properly under the rim of the balance. Place in position: the balance cock and the balance. Put the balance into operation, check the beat and the clearance between the horns and the roller jewel and between the safety roller and the guard pin, as well as the height of the balance, the endshake of which should not exceed 0.02 to 0.03 mm.

Also check the damping action of the balance wheel. For this purpose, turn the balance as far as its extreme position (over-banking position), then release it and count the number of oscillations it makes until it stops driving the click wheel. This number of oscillations should be between 60 and 80, which corresponds to a period of 24 to 32 seconds in all. If the number of oscillations is lower than 60, the friction spring of the click wheel has too much tension. On the other hand, if the number is higher than 80, the spring has too little tension.

5. 4. 7. Checking the circuit for continuity and the fitting of the complete electric device

Before fitting the framework of the electric device, check the ohmic resistance of the coils with the testing instrument mentioned under 3. 2., referring to fig. 10.

Important: For these tests, make sure that the contact springs are not touching the contact pins.

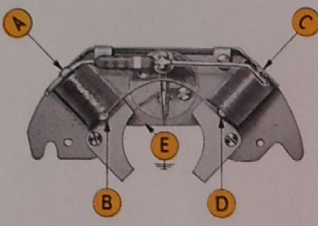
Measurements	Correct	Defective	Defect	
	A-B	125 Ω	0	Defective
	C-D		∞	Broken wire
A-C	235 Ω	0	Short-circuit	
		125 Ω	Short-circuit on one coil	
		∞	Broken wire	
A-E	∞	0	Short-circuit on first coil	
		125 Ω	Short-circuit on second coil	
C-E	∞	235 Ω	Short-circuit near point A	
		125 Ω	Short-circuit near point B or D	

Fig. 10

When these tests have been completed, fit the framework of the electric device and check that there is sufficient space between the mobile armatures and the fixed ones, taking account of the endshake of the balance.

6. Checking the finished movement

Feed the movement by means of a feed device (Fig. 4) fitted with a 1.5-volt cell and check the balance amplitude, which should be between 260° and 310° in the intermediate position (movement slanting 45°, dial up). Make sure that no over-banking occurs in the "dial up" position.

The balance cock of certain movements is fitted with a magnetic shunt for the electric device No. 4095. This shunt makes it possible to eliminate the over-banking of the balance and thus to reduce its amplitude. The maximum reduction will occur when the ends of the shunt touch the armatures (close to the screws) of the framework of the electric device No. 4000; by bending the ends of the shunt to shift them away from the armatures, the amplitude of the balance can be adjusted. The effect of the shunt is practically nil when its ends are 2 to 3 mm. away from the armatures.

7. Fitting the dial and hands

Note:

If the dial plate is provided with a self-adhesive substance, it is advisable not to apply any other coating.

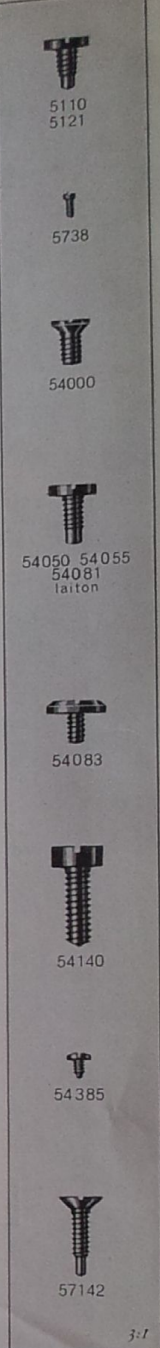
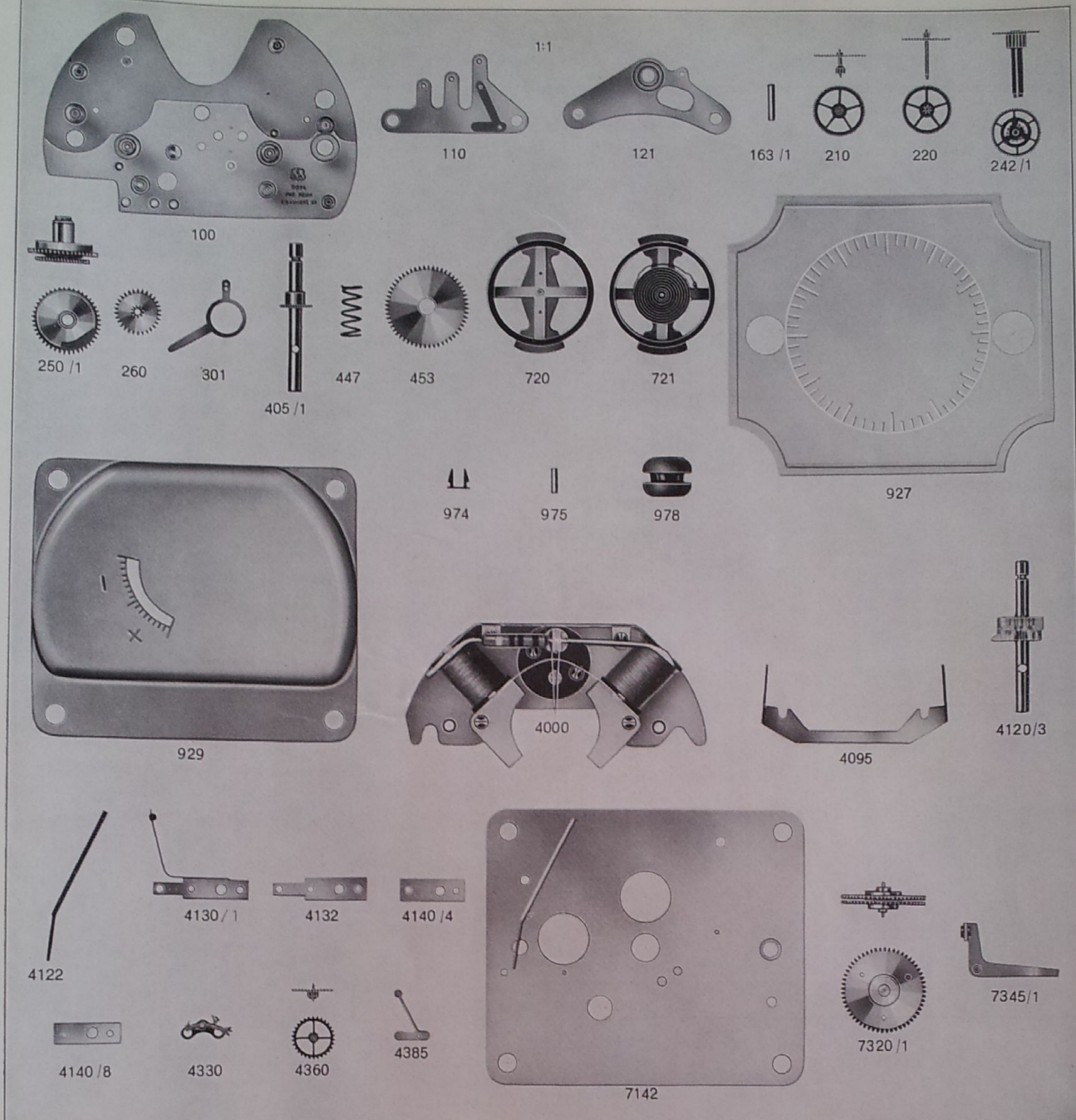
If the clamps holding the protecting cap have been removed at the same time as the dial, they should be placed in position again.

Refit the dial plate, making sure that it is in its correct position (with the numerals or hour-markers in the right position), and then apply it to the framework of the interlocking device by pressing its entire surface with a clean cloth.

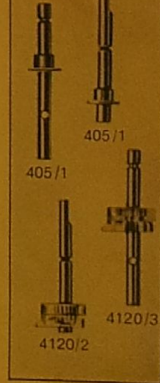
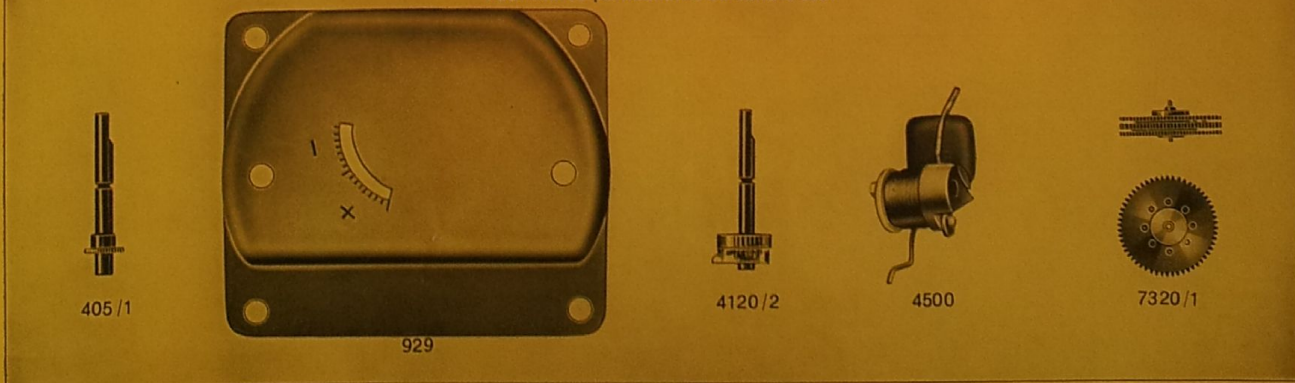
7. 1. Adjusting the interlocking action and fitting the interlocking disk

Turn the hand-setting stem until the exact instant when the interlocking lever drops into the interlocking cam. Fit the interlocking dial disk (its numeral 12 should be properly aligned directly above numeral 6 of the dial plate), then fit the hour dial disk so that the hour pointer coincides with numeral 12 on the dial plate. Fit the minute hand in the same position as the hand of the hour dial disk. Check the interlocking action at 3, 6, 9 and 12 o'clock. The tolerance for interlocking is plus or minus 5 minutes.

To avoid any risk of short-circuiting with the movement cased up, the protecting cap is coated with a protective insulating varnish. Before casing up the movement, it is advisable to check this protective coating to see that it is even, especially on the side facing the framework of the electric device. To prevent the wires from pulling on their solder points, it is necessary to tie them together. The knot thus formed will stop against the rubber grommet. Case up the movement inside its protecting cap (not forgetting first of all to insert the wires into the grommet). This is done by exerting pressure on the dial plate at the points where the fixing clamps are located. Once the movement has been cased up, it is very advisable to allow it to run for 24 hours and then to make a final check.



Fournitures particulières au calibre 9001



- No. LIST OF MATERIALS
- 100 Plate
 - 110 Train wheel bridge
 - 121 Balance cock for flat hairspring
 - 163/1 Center pipe
 - 210 Third wheel
 - 220 Fourth wheel without second hand bit
 - 242/1 Cannon pinion undrilled, with driving wheel
 - 250/1 Hour wheel, mounted
 - 260 Minute wheel
 - 301 Regulator for flat hairspring
 - 405/1 Hand-setting stem, mounted
 - 447 Stem spring
 - 453 Additional setting wheel
 - 720 Pivoted balance with roller and contact finger

- No. LIST OF MATERIALS
- 721 Balance with flat hairspring
 - 927 Protecting cap, dial side
 - 929 Protecting cap, bridge side
 - 974 Clamp for protecting cap
 - 975 Spring pins
 - 978 Rubber grommet
 - 4000 Framework for electric device, complete
 - 4095 Magnetic shunt for electric device
 - 4120/2 Contactor stem, mounted, 2 functions
 - 4120/3 Contactor stem, mounted, 3 functions
 - 4122 Jumper spring of contactor
 - 4130/1 Thimble-spring of contactor, mounted
 - 4132 Ground thimble of contactor
 - 4140/4 Contactor insulator, thin
 - 4140/8 Contactor insulator, with feet
 - 4330 Click lever, mounted
 - 4360 Click wheel, pivoted

- No. LIST OF MATERIALS
- 4385 Friction spring for click wheel
 - 4500 Radio anti-interference device, mounted
 - 7142 Framework of interlocking device
 - 7320/1 Interlocking pawl wheel, mounted
 - 7345/1 Interlocking lever, mounted
 - 5110 Train wheel bridge screw
 - 5121 Balance cock screw
 - 5738 Hairspring stud screw
 - 54000 Screw for framework of electric device
 - 54050 Screw for fixed armature
 - 54055 Magnet yoke screw
 - 54081 Screw for insulated framework of contact
 - 54083 Contact support screw
 - 54140 Contactor insulator screw
 - 54385 Screw for friction spring of click wheel
 - 57142 Screw for framework of interlocking device

Caution: There are several models of hand-setting stems and contactors. When ordering please supply a sample.