EMMYWATCH

VINTAGE RESTORATIONS

Landeron 4750 Movement Parts (2)

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When correctly tensioned and centered, the contact springs should be straight. Springs shaped as shown in fig. 22 and 23 will not work satisfactorily. Finally, make sure that the assembled contact is electrically insulated, from the plate, fig. 24.

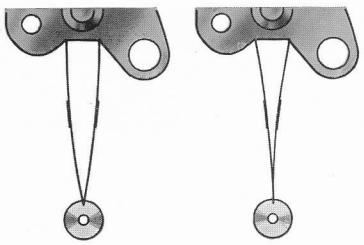


Fig. 22

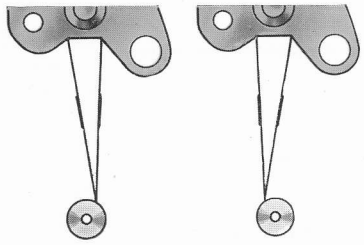
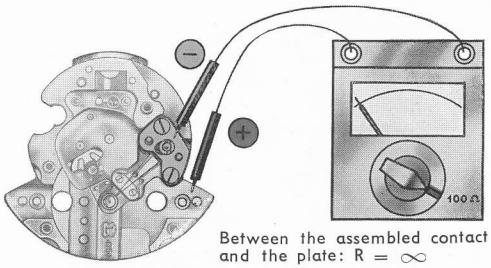


Fig. 23



Between the assembled contact and the plate: R = ∞

Fig. 24

5. 6. Checking and adjusting the magnetic return action

Check the click lever pivots No. 4330 and the corresponding jewels to make sure that they are clean. Fit the click lever alone. Check the endshake. The banking pins must be vertical. Do not touch the banking pins or the pallets of the click lever. Move the lever by shifting the fork to make sure that the attraction of the click lever towards the banking pins is of equal intensity on either side. If this is not the case, divide the attraction equally by turning the magnetic shunt located underneath the lever, fig. 25. This operation can be effected when the click lever is in position. If the attraction is too weak after it has been equalized, it can be made stronger by slightly bending the magnetic shunt to bring it closer to the lever magnet. This can also be done with the click lever in position, fig. 26.

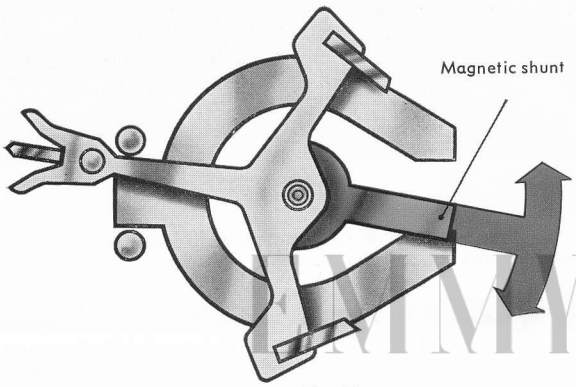


Fig. 25

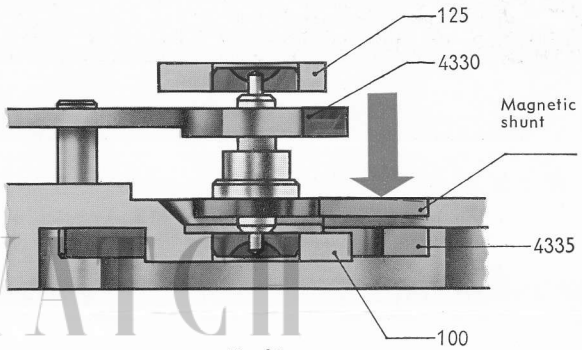


Fig. 26

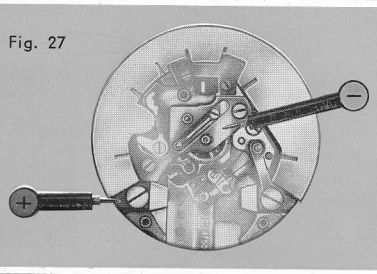
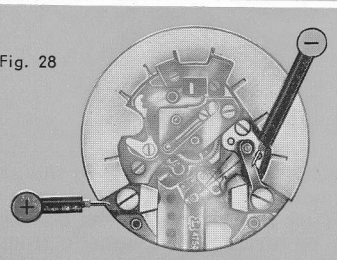
5. 7. Assembling the train

Remove the click lever 4330. Fit the center wheel No. 206 and the center wheel cock No. 126. Check the center wheel for trueness in the flat. Lubricate the upper pivot of the center wheel and the pip of the lower pivot of the sweep second wheel No. 227. Then, in the following order, fit: the click wheel No. 4360, the sweep second wheel and the third wheel No. 210. Fit the train wheel bridge No. 110 in position and, before screwing it down, check the tension of the friction spring of the sweep second wheel, No. 471/4. This is done as follows: raise the train wheel bridge 0.05 mm. The sweep second wheel should then run free without endshake. If the shoulder of the pivot of the sweep second wheel presses against its jewel, the tension of the friction spring of the sweep second wheel is too great. On the other hand, if there is any clerance between the shoulder and the jewel, the tension of the friction spring of the sweep second wheel is not sufficient. When this operation has been finished, screw down the bridge and check the train for freedom of action and the sweep second wheel for trueness in the flat. The friction spring of the sweep second wheel should not be lubricated. Before fitting the friction spring of the click wheel, No. 4385, check its tension as follows: place the spring in position by turning it. Screw it down. If the tension is correct, the end which normally presses on the click wheel pivot slightly projects beyond the surface of the train wheel bridge (by 0.05 mm.). If this is not the case, the tension should be corrected. Then replace the spring in its normal working position so that it presses against the tip of the click wheel pivot.

5. 8. Fitting the motor stator and lead, checking the continuity of the circuit

Before fitting the motor stator No. 4020, check it for proper insulation by connecting one of the ohmmeter plugs to the input terminal and the other to the laminations. The resistance measured should be practically unlimited. Then check the working of the contact protector elements (diode and resistance sunk in the plastic material of the stator). This check is effected as follows: connect the ⊕ plug of the ohmmeter to the input terminal and the ⊖ plug to the output terminal. Note the measurement shown by the instrument (value A). Reverse the plugs and take a second reading (value B). The difference between the two measurements (value A less value B) should be between 250 and 700 Ω. If no difference is registered, the protector elements are out of order; **they are no longer working and the motor stator must be replaced.** In this case, also check the condition of the contact finger and the beaks of the contact plate, which should show heavy traces of burning owing to the fact that the protector elements have not been working; the complete balance and the contact plate must then be replaced. When the motor stator is found to be in order, fit it in position. Do not forget to fit the stator wedges, if any (they should be carefully placed off to the side when the movement is disassembled). Before screwing down the motor stator, fit the lead No. 4160 to the output terminal, making sure that an insulator No. 4030 is placed under each screwhead of the motor stator. At this stage of assembly, the continuity of the circuit should be checked as follows: fig. 27 and 28.

Erratum:
For fig. 27, see fig. 28 and vice versa.

Measurements to be taken	Results obtained	Conclusion
Fig. 27 	R = measurement A (5.8).	In order.
	R = 0.	Short-circuit on input terminal of motor stator and on output terminal (or on the assembled contact).
	R = ∞.	Motor stator useless, broken winding.
Fig. 28 	R = ∞.	In order.
	R = 0.	Short-circuit on input terminal.
	R = measurement A (5.8).	Short-circuit on output terminal or on assembled contact.

The most common causes of short-circuits are the following:

a) on the input terminal: omission of insulator No. 4030; feed bridle No. 4035 or 4036 touching shank of stator screw No. 54020; dirt between stator screw and input terminal (filings).

b) on the output terminal: omission of insulator No. 4030; lead No. 4160 touching the shank of stator screw No. 54020; dirt between the motor stator screw and the output terminal (filings).

c) on the contact unit: omission of upper insulators No. 4086 and lower insulator No. 4085; contact springs touching one or both of the beaks of contact plate No. 4091; dirt between the assembled contact screws No. 54080, assembled contact unit No. 4080 and plate No. 100; metal filings embedded in the insulators No. 4085 and 4086.

5. 9. Assembling the hand-setting mechanism

Fit the hand-setting pinion No. 412. Lubricate the hand-setting stem No. 405 and place it in position. Screw on the setting lever No. 443. Lubricate the functional portion of the setting lever spring No. 445.

5. 10. Oiling the clickwork, fitting the click lever

Apply a small drop of pallet oil on the tip of every 3rd or 4th tooth of the click wheel No. 4360. Place the click lever No. 4330 in position.

5. 11. Assembling the minute work

Lubricate the setting wheel and minute wheel studs. Assemble the minute work and screw on the minute work cock No. 462. Check the wheels for free running and endshake. Lubricate the center wheel No. 206; grease the inside of the cannon pinion No. 245 and push it into position (be careful of the teeth of the minute wheel No. 260). Check the pip of the cannon pinion to see that it is slightly less prominent than in a watch of the usual type.

5. 12. Fitting the balance

With Indian ink, trace a vertical stroke on the inside of the rim of the balance No. 721, opposite to the hairspring stud. This will make it easier to check the amplitude, fig. 29 a.
Assemble the shock-protecting devices without oiling them.
Place the balance in position and put it into proper running order after having made sure that the contact finger is perfectly clean. The contact finger should point in the direction of the center of the balance staff, fig. 29 b.
Check the endshake of the balance. It should be very slight (0.01 mm.), otherwise the watch will be noisy in slanting positions with the dial upwards. Check the interaction of the fork and roller and of the contact finger and contact springs. Check the air gap (i. e. the space between the mobile armature soldered to the balance and the laminations of the motor stator). The space between these parts should be 0.13 mm. $\pm$0.04 mm. This clearance is equivalent to half or three quarters the thickness of the mobile armature. It is corrected by adding stator wedges No. 4040, which are placed between the plate and the laminations of the stator (wedges 0.02 mm., 0.04 mm., 0.06 mm. and 0.08 mm. thick are available). Then place the complete movement in a demagnetizing machine.

Stroke in Indian ink.

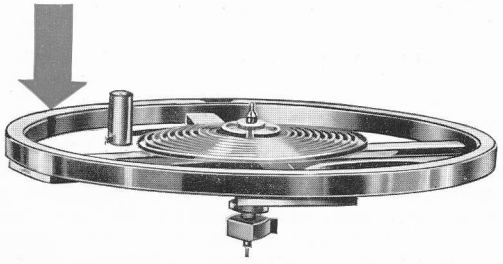


Fig. 29 a

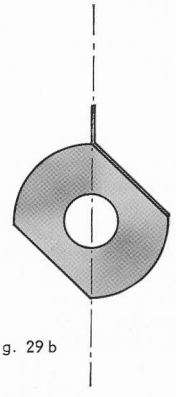


Fig. 29 b

5. 13. General lubrication

Balance No. 721, third wheel No. 210, sweep second wheel No. 227, click wheel No. 4360 (in the case of the last-named wheel, raise the friction spring of the click wheel, No. 4385, to drop a little oil around the pivot, then, withdrawing the oiler, apply the rest of the oil drop to the lower surface of the friction spring where it is in contact with the click wheel pivot).

6. Checking the finished movement

First of all, check the damping (freeness) of the balance by turning it to the knocking position, then releasing it and counting the number of complete oscillations until the sweep second wheel stops moving. The number of oscillations should be between 30 and 40. If there are fewer than 30 oscillations, the balance is subject to excessive braking. Then place the finished movement on a plain feed ring, and the whole on the microphone of the testing instrument (Multiscope or Electrotest). Adjust the apparatus according to the manufacturer's directions. To make sure that the movement is in perfect working order, it is advisable to take the measurements corresponding to the coloured areas in the following table. If the watch refuses to go, refer to paragraph 5. 8. and again check the continuity of the circuit and the passage of current into the feed ring.

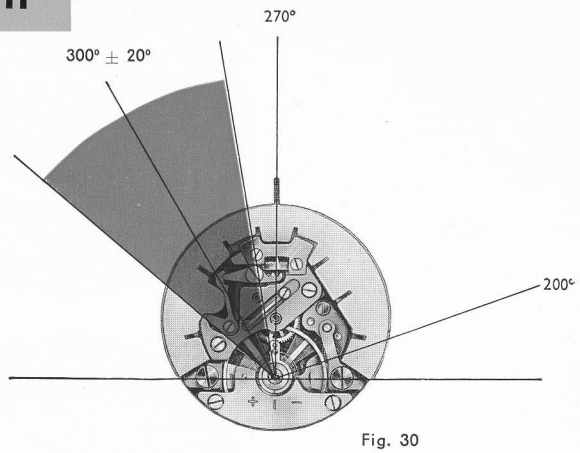


Fig. 30

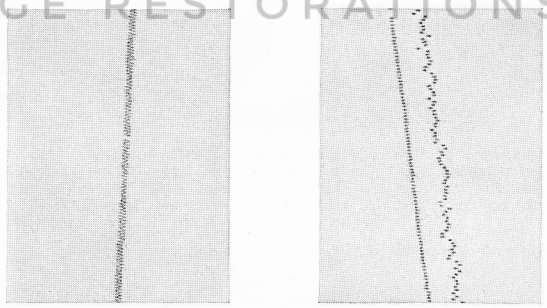
Position	Voltage	Amplitude	Current consumption
D. D.	1.6 v.	300° ± 20°	
P. D.	1.6 v.		less than 17 μA.
P. D.	1.2 v.	over 200°	

If the performances correspond to those laid down in the table and the contact image is closely similar to that shown in fig. 32, the final timing correction may be effected. If the performances are inferior to those given in the table, it is necessary to look for any possible defects. The most common defects are the following:

a) **bad contact images.** Images similar to those given in fig. 33, 34, 35, 36 and 37 are due to defects that must be corrected according to the captions accompanying the figures.

b) **bad rate.** The amplitude is lower than that shown in the table, and therefore the current consumption is increased. Make sure that the air gap is normal (v. 5. 12.), that the stator wedges, if any, have been replaced, that the movement has been demagnetized and that the hand-setting stem is uncoupled (pushed-in position). Check the freedom of rotation and the damping of the balance, the endshake of the runner arbors, the lubrication of the movement and its general cleanliness.

c) **bad rate tracings.** Dots out of alignment in the instantaneous rate tracings show that the magnetic return action is out of adjustment, fig. 31.



Good Fig. 31 Bad

6. 1. Contact images photographed by means of an oscilloscope

Fig. 32

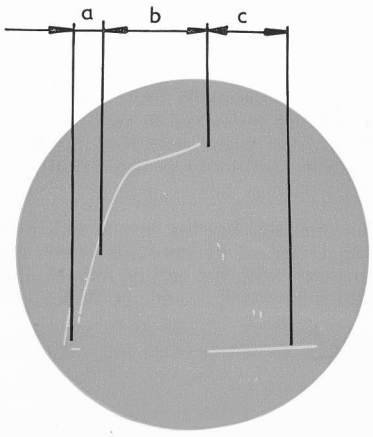


Fig. 32.
Satisfactory contact.
Succession of similar oscilloscope images superimposed.

a = **Single contact area**

Contact occurring only between the contact finger and the contact springs, v. fig. 38 and 39.

b = **Double contact area**

Apart from the contact described above, a second contact occurs between one of the contact springs and the corresponding beak of the contact plate, fig. 40.

c = **Rebound area**

The finger has come away from the springs which, by vibrating at the time of damping, cause a few very brief contacts between the springs and the beaks of the contact plate.

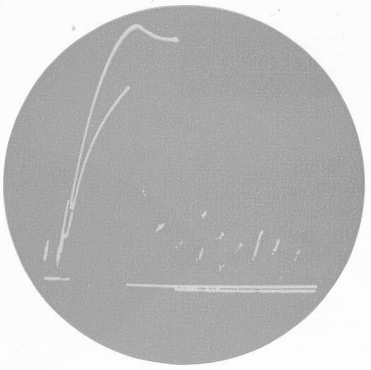


Fig. 33.
Badly centered contact.

Series of non-superimposed images formed alternately of small and large images.

Correction: center the springs (v. 5. 5.).

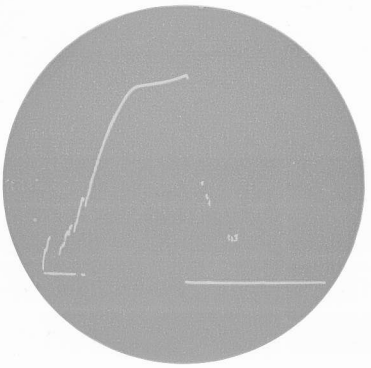


Fig. 34.
Faulty contact between finger and springs.

The line corresponding to the single contact area is broken in several places.

Correction: check the contact finger and the tips of the springs, as well as the tension (v. 5. 5), fig. 20 and 21.

Note: the contact between the finger and the springs is often faulty on one side only; images as above will then alternate with good ones.

Fig. 35.
Contact broken at the beginning of the double contact area.

Correction: check the cleanliness of the springs and the beaks of the contact plate. Check the distance between the contact springs and the beaks of the contact plate (v. 5. 5., fig. 19).

Fig. 36.
Excessive rebounds.

Correction: check the cleanliness of the springs and the beaks of the contact plate. Check the tension of the contact springs and the distance between them and the beaks of the contact plate (v. 5. 5., fig. 19 and 21).

Fig. 37.
Very bad contacts: several defects.

Correction: refer to 5. 5.

7. Fitting the dial and hands - Casing up - Final checking

Place in position and screw down the plate-enlargement ring No. 158. On it, fit the casing bridle No. 960 and the two special case screws No. 5102. Place in position the hour wheel No. 255 with its friction spring, which should be slightly tensioned. (If the friction spring has been lost, it is important to replace it by a sufficiently weak tension spring, to avoid any additional braking action.) Then fit the dial and hands. Remove the setting lever No. 443, the hand-setting stem No. 405 and the hand-setting pinion No. 412. Place the movement in the case, which should have been carefully cleaned beforehand. Fit the hand-setting stem, the hand-setting pinion and the setting lever. Drive home the special case screws. Screw on the feed bridle, i. e. No. 4035 for a dry cell case or No. 4036 for an accumulator case. Check the voltage of the source of current (dry cell or accumulator) by means of a voltmeter. Replacement is necessary if the voltage is below the values indicated in 2. 1. and 2. 2. Screw on and tighten the back of the case.* Place the watch in a demagnetizer. Then check the instantaneous rate on the timing machine. If the watch does not work, there may be:
a) a defect in the feed system, or b) a stoppage in the train.

In the event of (a), see that the dry cell or accumulator is properly and cleanly fitted in its compartment. Make sure that the voltmeter shows a voltage corresponding to the values indicated in sections 2. 1. and 2. 2., between the actual back of the case and the part on which the feed bridle rests. Also make sure that the feed bridle is sufficiently tensioned. If the watch will not work in spite of these checks, check the continuity of the circuit, leaving the movement in the case, but removing the balance, (v. 5. 8.).

In the event of (b), the ticking of the watch will be audible, but the hands will not turn. This is caused by a mechanical stoppage due to the click wheel, which is not being impelled by the click lever. Make sure that the hand-setting stem is pushed in, so that the hand-setting pinion is not in mesh with the setting wheel. If the watch still fails to work in spite of this check, examine the hands and see that the train is perfectly clean, (v. 5. 4.).

* n the case of accumulator-driven watches, it is necessary to check the voltage of the accumulator between the body of the case and metal center of the recharging socket.

8. Description and functioning

8. 1. Motor and contacts

The functioning of the L-4750 watch is explained by fig. 38, 39 and 40. In addition to the balance and roller found in watches of the usual type, the balance staff carries a " mobile armature " with four arms soldered underneath the balance (11) and a collet fitted with a contact finger (10). Suppose the balance, after having been moved away from its position of equilibrium, returns under the action of the hairspring, moving in the direction of arrow (I), fig. 40. At the point of rest, the contact finger (10) will touch the contact spring (6). The electric circuit is thus closed, and the current will flow as follows: from the ⊖ pole of the source of current, it reaches the input terminal (1) of the motor stator by way of the feed bridle. From the input terminal (1), it flows through the winding (2) and reaches the output terminal (3) of the motor stator. Then, by way of the lead (4), it reaches the contact unit (5) and the contact springs (6) and (8). The current then completes its circuit by passing from the contact springs (6) and (8) to the contact finger (10) and, through the balance staff, the collet, the hairspring, the hairspring stud and the whole of the movement, reaches the ⊕ pole of the source of current. The flow of current through the winding magnetizes the fixed laminations (12) of the motor stator. The mobile armature (11) is then attracted in the direction of arrow (I) while the current is flowing. As soon as it has touched the spring (6), the balance, in turning, causes the spring (8) to press against the beak (7) of the contact plate, which is also connected to the ⊕ pole, fig. 40. This closes the second contact, the purpose of which is to make for more reliable functioning. When the impulse has been given, the balance turns through its supplementary arc and swings back in the direction of arrow (II), fig. 38 and 39, until it reaches its position of rest. The finger (10) touches the contact spring (8), fig. 39, and the current again flows through the circuit in the same manner. The balance receives a new impulse, and the second contact is then closed between the spring (6) and the beak of the contact plate (9). An impulse is thus given on each vibration.

The following parts are grounded:

The ⊕ pole of the source of current.
The contact plate.
The contact finger, by way of the balance staff, the collet, the hairspring and the hairspring stud.
The whole movement.

The following parts are insulated from the movement:

The ⊖ pole of the source of current.
The feed bridle.
The input terminal of the motor stator.
The output terminal of the motor stator.
The lead.
The assembled contact.

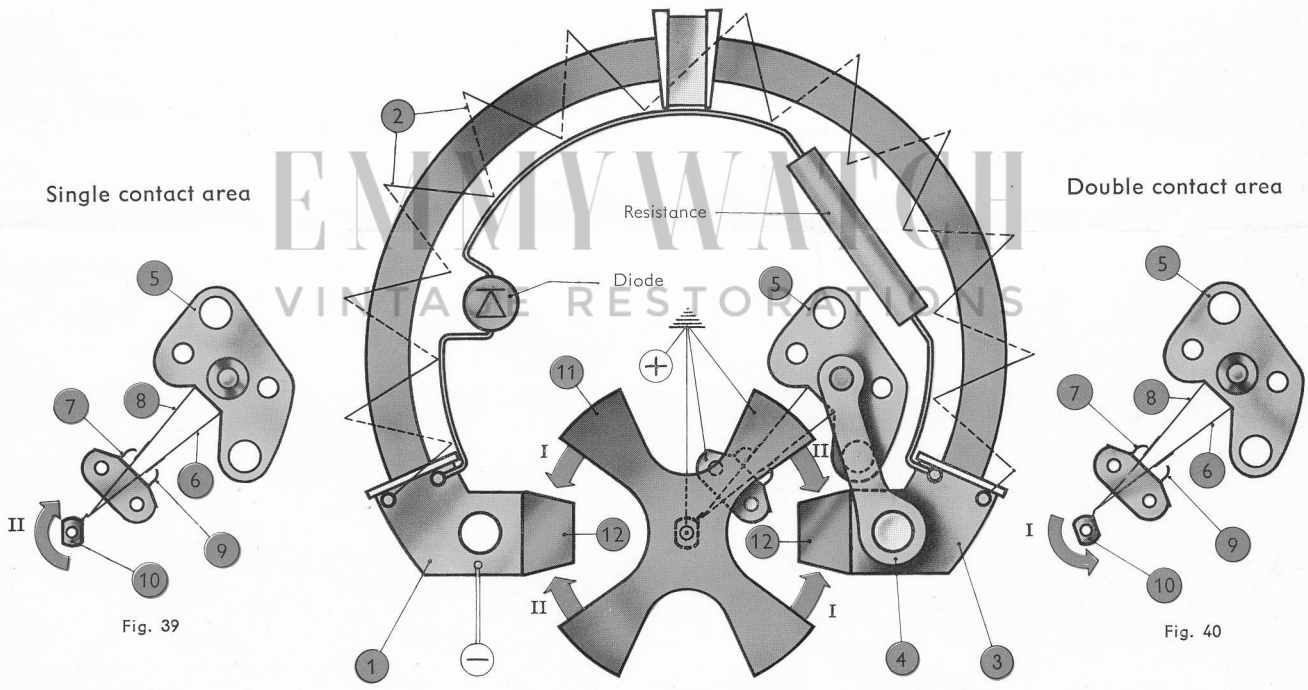


Fig. 39

Fig. 38

Fig. 40

8. 2. Clickwork and train

The movement of the balance is transmitted to the train by way of the clik mechanism, as follows:

a) Each time the balance passes its point of rest, the impulse pin shifts the click lever from one banking pin to the other. During the supplementary arc, the click lever is held against the banking pins by the attraction of the lever magnet (fixed under the plate) on the magnetic shunt (fixed on the arbor of the click lever).

b) Each time it swings, the clik lever drives the click wheel half a step. The click wheel is stopped by the friction spring of the click wheel after each angular shift.

c) From the click wheel, the motion is transmitted to the hands by a train of the usual type.

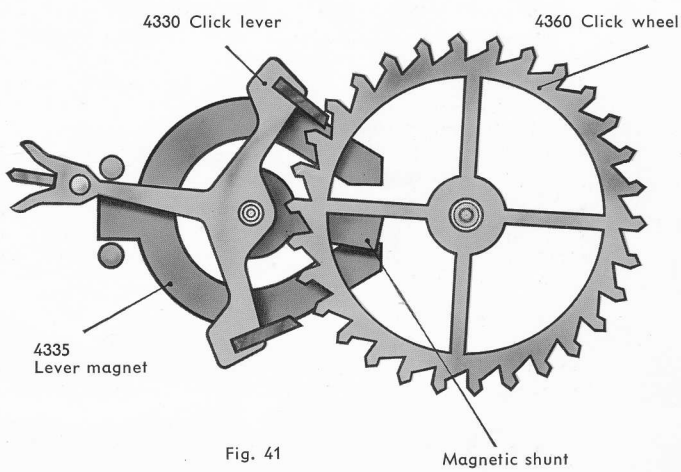
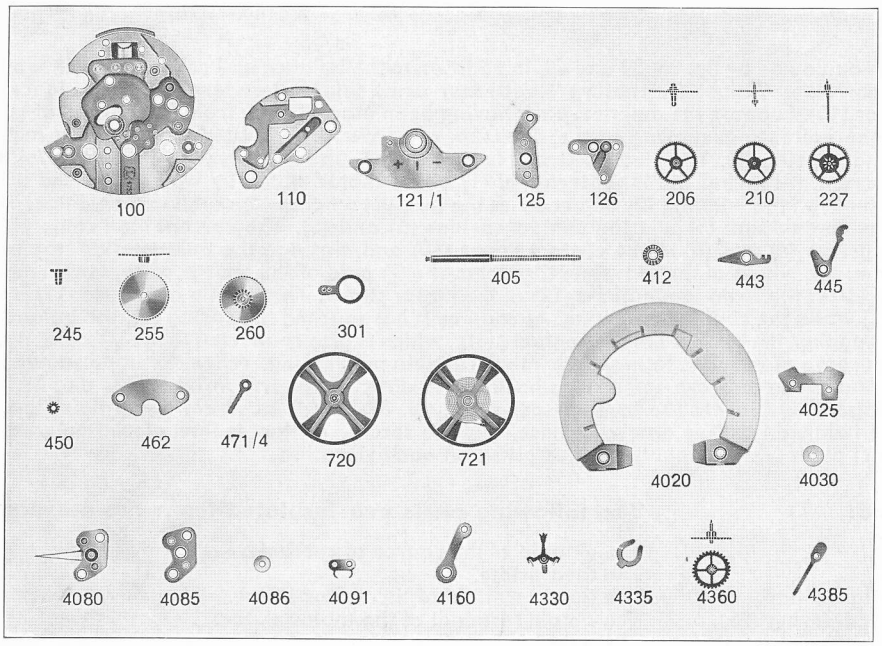
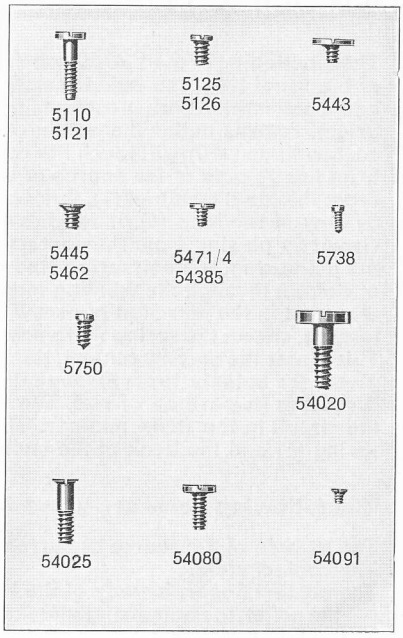
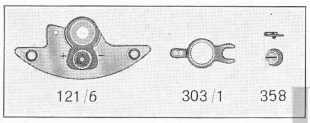
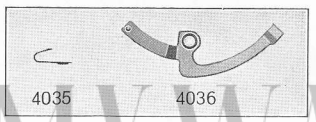


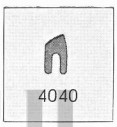
Fig. 41

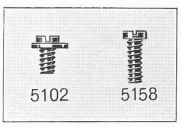












Nr.	LIST OF MATERIALS
100	Plate
110	Train wheel bridge
121/1	Balance cock for shock-protecting device or combined in-setting, flat hairspring
121/6	Balance cock for regulating and shock-protecting devices, flat hairspring
125	Pallet cock
126	Center wheel cock
206	Center wheel
210	Third wheel
227	Sweep second wheel
245	Cannon pinion
255	Hour wheel
260	Minute wheel
301	Regulator for flat hairspring
303/1	Two-piece regulator for regulating device, flat hairspring
358	Adjuster for regulator
405	Hand-setting stem
412	Hand-setting pinion
443	Setting lever
445	Setting lever spring
450	Setting wheel
462	Minute work cock
471/4	Friction spring for sweep second wheel
720	Pivoted balance with roller and contact finger
721	Balance with flat hairspring
4020	Motor stator, mounted
4025	Stator fixing clamp
4030	Stator screw insulator

Nr.	LIST OF MATERIALS
4035	Power connection for battery watch
4036	Power connection for accumulator watch
4040	Stator wedge
4080	Contact, assembled
4085	Contact insulator, lower
4086	Contact screw insulator
4091	Contact plate
4160	Lead
4330	Click lever, mounted
4335	Lever magnet
4360	Click wheel, pivoted
4385	Friction spring for click wheel
5102	Case screw
5110	Train wheel bridge screw
5121	Balance cock screw
5125	Pallet cock screw
5126	Screw for center wheel cock
5158	Plate-enlargement ring screw
5443	Setting lever screw
5445	Screw for setting lever spring
5462	Screw for minute work cock
5471/4	Screw for sweep second wheel friction spring
5738	Hairspring stud screw
5750	Dial screw
54020	Screw for motor stator
54025	Screw for stator fixing clamp
54080	Screw for assembled contact
54091	Contact plate screw
54385	Screw for click wheel friction spring

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