

## **Hermle Floating Balance**

### *Summary of Inspection, Diagnosis, Cleaning and Repair Procedures*

.....prepared by David Robertson

#### **Description:**

- The assembly consists of a balance wheel, 2 jeweled bearings on each end of a hollow tube riding on a pivot wire supported in a U-shaped frame.
- The most common reasons for a sluggish balance are dirt, rust/pitting/roughness of the wire, bent wire or excess oil on the wire & jewels.

#### **Removal of floating balance from clock:**

- Remove both screws and tilt balance assembly so as to avoid bending pallet fork.

#### **Inspection and testing of balance:**

- Visual inspection (with balance assembly held upright):
  - Check for bent wire.
  - Check for corroded/pitted/rough wire.
  - Check for equal gaps between top and bottom tube ends and frame.
  - Examine top and bottom jewels for cracking.
  - Balance wheel should bounce freely up and down on wire.
  - Top and bottom of frame should be parallel to each other and perpendicular to the back of the frame.
  - The balance should be in beat – the roller pins should be in the exact center, viewed from the front.
- Put balance in motion.
  - Upper and lower sections of hairspring should spiral in and out concentrically.
  - Hairspring should not move sideways or up and down.
  - Tube should not move up and down on wire.
  - Observe safety roller. It should rotate on center and be true in round and in flat.
- Secure balance in bench vise.
  - Rotate balance wheel 270 deg and release.
  - The balance wheel should oscillate 3-5 minutes.
  - If it passes test, do not clean.
  - If it fails test, clean balance assembly.

#### **Cleaning balance:**

- Use several small jars.
- Use watch cleaner or non-aqueous clock rinse.
- Agitate in cleaner by hand or briefly in ultrasonic.
- Use one or more containers of clean solution to rinse.
- Dry assembly using heat and piece of absorbent paper at lower jewel hole to remove cleaner/rinse from tube.

#### **Lubricating Balance:**

- Most repair persons recommend no lubrication.
- At most, apply a miniscule drop of watch oil where the wire passes through each jewel hole. Wipe off excess after lubrication.

### **Correcting balance problems after inspection & testing:**

- Bent wire – straighten by bending opposite direction using pressure on tube.
- Rough or broken wire – replace wire as follows or replace balance assembly.
  - Pry upper and lower tabs sufficiently away from frame to allow removal of wire. Diagonal pliers or flush-end cutters are good for this task.
  - Remove old wire.
  - Determine proper size of wire (usually .25mm). Use spring steel wire in largest size available that does not exceed diameter of old wire.
  - Cut 6 in piece. If unable to get straight section, place 10 in piece in vise and pull apart with pliers. This will leave a shorter piece of very straight wire.
  - Feed wire through top frame and through tube. Make 90 deg bend in wire at bottom of frame.
  - Fasten wire to lower tab with 2-3 wraps and press tab back into bracket
  - Squeeze upper and lower frame arms together slightly and fasten wire to upper tab. Don't permanently deform frame.
  - Release pressure to allow wire to become more taught.
  - Press upper tab back into frame.
  - Cut off excess wire.
- Tube not centered between upper and lower part of frame – correct as follows:
  - Move lower collet on tube to align, or
  - If misalignment is caused by bent hairspring, correct hairspring distortion.
- Safety roller not aligned - Adjust by slight twisting of roller pins.
- Sluggish action - if not corrected by cleaning or straightening wire, replace wire or balance assembly.
- Cracked jewels – replace balance assembly.
- Irregular action of hairspring – manipulate/form hairspring to correct problem.
- Bent frame – bend to proper shape.
- Out of beat – rotate top (or bottom) collet so that roller pins are exactly in center of balance assembly when viewed from front.

### **Escapement inspection and repair:**

- Check and adjust fork as follows (these will establish initial, “ideal” conditions but may need fine tuning after full assembly):
  - Fork neck parallel to plates
  - Fork slot parallel to pallet arbor
  - Safety guard parallel to fork neck
  - Inside corners of fork slot at 90 deg angle
  - End caps smooth and not binding pallet arbor
  - Slight end shake on pallet arbor
- Check and adjust pins on anchor so that they are parallel to pallet arbor and perpendicular to anchor. If adjustment is needed, try to bend brass rather than pins themselves to prevent breaking.

### **Reinstallation of balance assembly:**

- Reinstall in clock, holding assembly at an angle as you lower it between the plates.
- Tighten screws just enough to remove slack. Do not tighten fully.

### **Inspection and adjustment after installation:**

- Penetration of roller pins into fork slot should be  $\frac{1}{2}$  to  $\frac{3}{4}$  pin diameters – adjust by bending fork neck forward or back.
- Check for slight clearance (side shake) between roller pins and sides of fork slot. Open slot if necessary.
- Wind clock a few turns to put some power on escapement.
- Check for adequate and equal slide on both sides as follows:
  - Operate balance wheel manually. Observe the exact instant of drop-lock on escape wheel.
  - At drop-lock the gap between the fork neck and the guard pin should be 1-2 pin diameters and equal on each side.
  - To adjust equality of drops, loosen balance assembly where it mounts to clock plate and twist appropriate direction to move guard pins and equalize distances to fork neck. Balance assembly may have to be twisted (mild deformation) to achieve desired result.
  - Alternately, fork can be bent appropriate direction.
- If roller pins do not clear corners of fork slot, twist fork slightly to provide clearance.
- If guard pin binds on safety roller,
  - Adjust safety roller to be concentric to tube, or
  - Bend guard pin to avoid interference.

### **Testing Balance:**

- Wind clock fully.
- Balance should develop 1-1  $\frac{1}{4}$  turns of rotation after 2-3 minutes.
- Balance should maintain  $\frac{3}{4}$ -1 turn of rotation after running 7 days.

### **Timekeeping and regulating:**

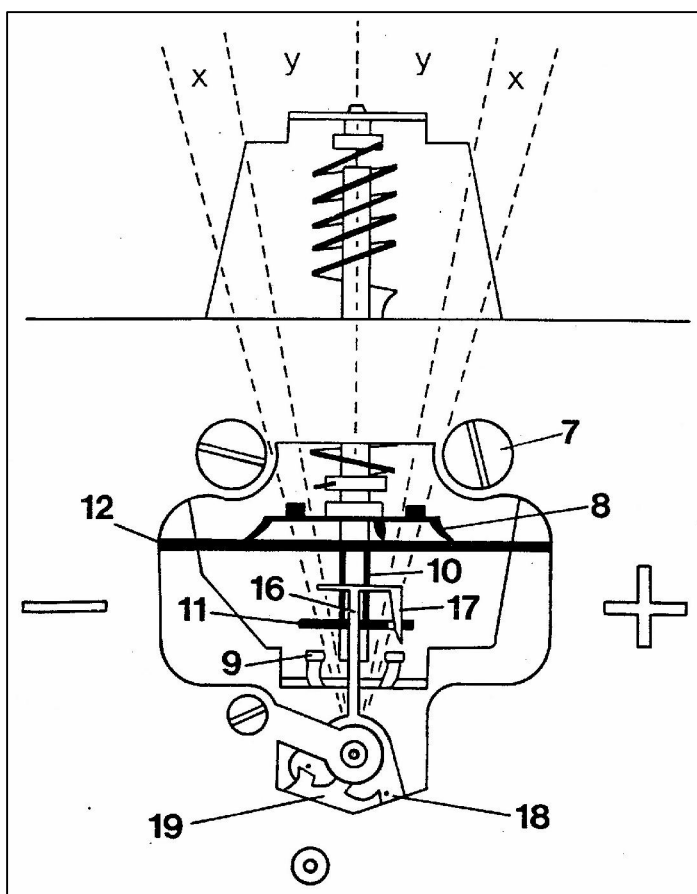
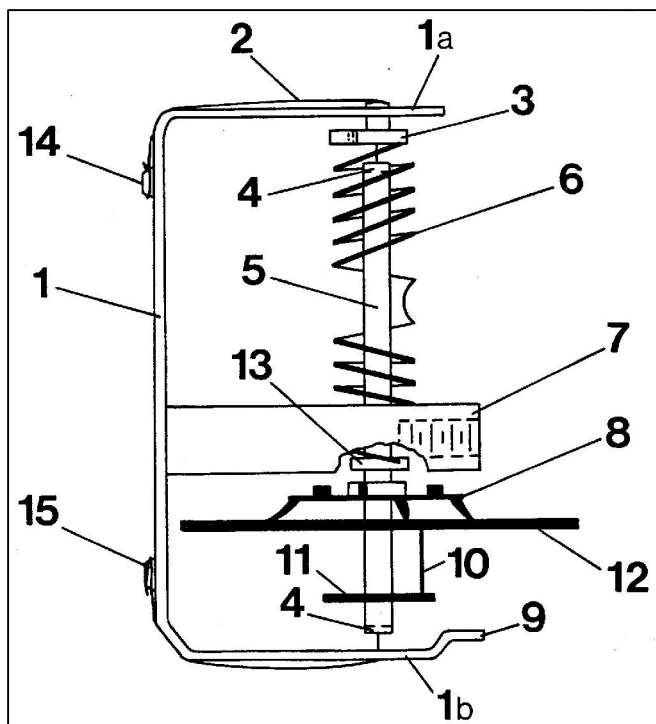
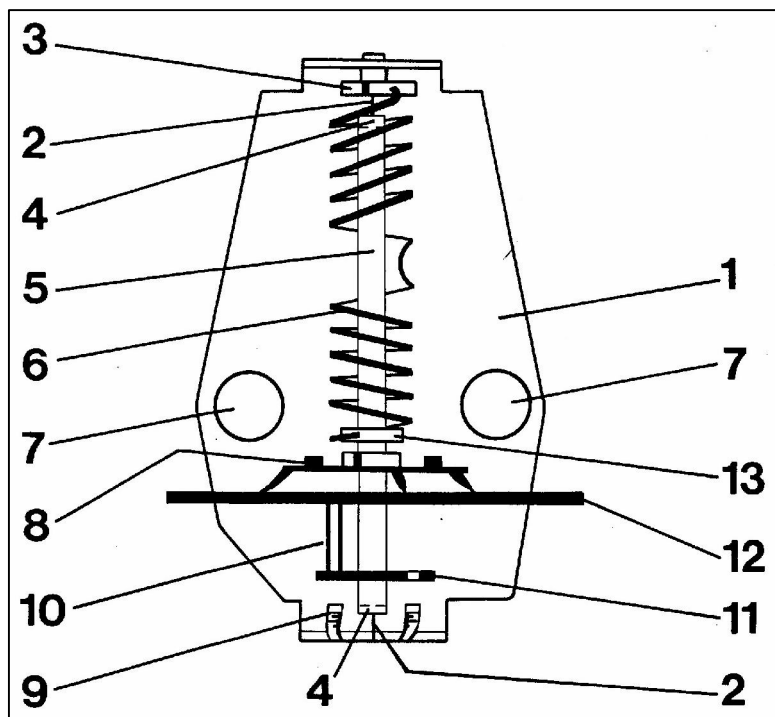
- Use clutch assembly on top of balance wheel for minor adjustments (3 min per day).
- Add or remove weights (in 180 degree opposite pairs) for greater adjustments (see diagram).
- Add weights= slower
- Remove weights=faster

The preceding summary was prepared as a “memory jogger” for the repairperson who already has a working knowledge of floating balance testing, adjustment and repair procedures.

Information for this summary is taken from the following articles reinforced by personal observation:

1. “The Floating Balance by Joseph Cerullo, CMW published in Clockmakers Newsletter September 1987 – December 1987.
2. “A Practical Guide to the Floating Balance Escapement” by Timothy R. White, published in the NAWCC Bulletin, Whole Number 224, June 1983.

The following four diagrams are relevant to the preceding discussion. They are extracted from the cited references.



1. Frame, 1a. Upper frame bridge, 1b. Lower frame bridge, 2. Pivot wire, 3. Hairspring stud, 4. Jewelled bearing, 5. Hollow tube, 6. Hairspring, 7. Mounting post, 8. Regulator with disc, 9. Banking pins, 10. Roller pins, 11. Safety roller, 12. Balance Wheel, 13. Hairspring collet, 14. Upper frame hook, 15. Lower frame hook, 16. Pallet fork, 17. Safety Guard, 18. Pallet pins, 19. Escape wheel. x – slide, y – lateral swing of pallet .

(three drawings above used with permission from Clockmakers Newsletter)

The following drawing illustrates the effect of adding or removing 180 deg opposite pairs of weights

