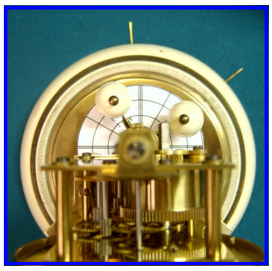
400-Day (and "Torsion") Clocks Part 2—Trouble-Shooting *by Verlyn Kuhlmann*

The "Horolovar 400-Day Clock Repair Guide" (referred to here as "RG") is essential for repair of 400-Day Clocks. A good policy to follow when working on a 400-Day clock is to identify the clock from the "RG—Back Plate Illustrations" section. It contains actual-size plate Illustrations. The identified Illustration gives necessary information for repair, such as suspension-spring units to use, and regulation information, as clarified in the "RG—Suspension-Spring Unit Identification" section.

Analyzing a non-working 400-Day clock:

1. Is the clock complete? [Does it have all the parts necessary to run—complete movement (from the mainspring barrel through the anchor); suspension-spring unit (suspension-spring; upper & lower blocks; & "fork"); and pendulum]. Obviously, if parts are missing, they must be obtained. ***Missing parts usually indicate a failed repair or that the movement has been cannibalized.***
2. If the suspension-spring is broken (or distorted), measure it—go to step 4.
3. If the suspension-spring is missing: The "RG—Back Plate Illustration" section identifies the suspension unit to use—go to step 4.
4. The "RG—Suspension-Spring Unit Identification" section contains actual-size illustrations of suspension units. The blocks & fork are to be attached to the specified spring exactly as illustrated. ["Timesavers" (and other clock-parts houses) carry complete ready-to-install *Suspension Units.]*
5. Make sure the clock is level! This is simplified if the clock has leveling-legs. Adjust the position of the leveling-cup, if necessary!
6. Check the beat. This is easier with a "**beat amplifier**" (enhances the escapement's "locking" sound); a **"beat-setting tool"** (long-handled device which attaches to the suspension-saddle for improved position control; and some means of marking the pendulum's position at the time of the escapement's "locking". ["RG" advocates the use of a protractor, which I find very confusing, so I prefer the use of square taper-pins as markers (used in the following procedure).]

   My beat-checking procedure—Gently give the pendulum a full-turn (in either direction) and release. Observe the pendulum from directly above the movement, marking the position of the pendulum (such as at one of the balls) when escapement "locking" is heard (as the pendulum swings clockwise and again as it swings counter-clockwise). *[The figure shows the placement of pin-markers (the protractor advocated in "RG" is also shown demonstrating how confusing it is!). The taper-pin at the right has been placed where the "lock" in the "CW" direction was heard (pendulum continues to swing), while the taper-pin at left indicates the pin-to-pendulum-ball relation at the end of the pendulum's swing in the "CCW" direction (showing the "over-swing"). Pins show the precise positions, while the positions using the protractor must be remembered!]*



   The pins should not be placed directly on the brass base *(may result in scratches).*

   After checking the markers over several cycles, note the distance the pendulum-ball swings past each marker: this is called the "over-swing". To be in-beat, both "over-swings" must be equal, and should be about an inch to sustain healthy operation! If the "over-swings" are not equal, the saddle [top piece of the suspension-unit] will have to be rotated. [The majority of clocks use a screw atop the suspension-bracket to secure the saddle (which must be loosened so that the saddle can be rotated) while some use friction-fit saddles, simplifying adjustment.] Turn the saddle very slightly with the "beat-setting tool" in the direction of the least "over-swing". Repositioning the saddle results in new escape "locking" points**,** *meaning the pins are no longer in their correct position***,** and must be moved. Repeat this procedure until the proper beat is achieved—a minimum amount of repositioning comes with experience. The saddle-screw is to be tightened when the "over-swings" are equal (to lock the suspension-saddle in place). This is very tricky since the saddle tends to turn as the screw is tightened, and sometimes requires several tries! It may even require a tiny bit of *fudging* (to off-set the saddle a bit to account for the saddle turning)! The pendulum should swing a minimum of 270^0 to sustain operation.

   [When you understand the tedious task of putting the clock into beat, (or correcting for mistreatment of a suspension-spring) it behooves one to be more careful with the suspension-spring—always lock or remove the pendulum when moving the clock!]
7. If the clock is in-beat, but still doesn't run, the clock might need to be cleaned, just as any other clock.
8. Check regulation by counting the *number of beats per minute* (of the pendulum) as specified in the *"RG—Suspension-Spring Unit Identification" section [let the pendulum settle sufficiently before checking].*
9. If unable to regulate, test at max & min regulation positions. Clock should run slow at one extreme and fast at the other. Remove pendulum from the spring to avoid damage for large adjustments! [Regulation is by means of an adjustment on the pendulum: on disk pendulums, 2 small weights are moved toward or away from center by means of an arbor which has a square on its end similar to a winding-key; with 3- or 4-ball pendulums, a thumbscrew adjustment is used to move the balls in or out.] If the clock cannot be regulated, the suspension spring will have to be changed: to speed, use a thicker spring; to slow, a thinner spring. Sometimes the precise thickness necessary for good regulation is unavailable and a thicker spring must be thinned!