A balance vibrating tool – 2

by Guy Gibbons

The casing

The casing is a short length of brass tube that has a snap fit flat mineral glass in one end on which the balance assembly to be tested rests.

Materials required

- 18 mm length ($^3/_4$ in.) brass tube 1 $^3/_4$ in. dia. x 16 gauge wall thickness ($^1/_{16}$ in. or 1.6 mm)
- flat mineral glass 1.5 mm thick x 42 mm dia. Suitable glasses are available from material suppliers as replacements for pocket watches.

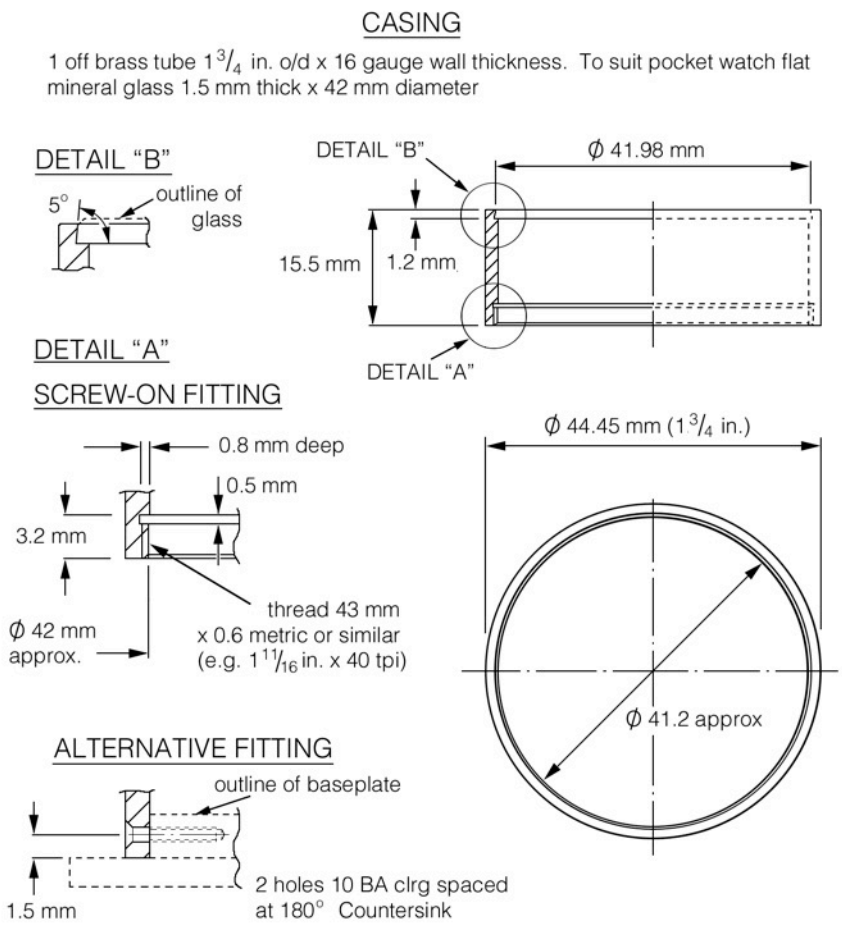
Design and drawings

The casing is ideally screwed onto the base, but this does mean you need a screwcutting lathe. A screw-on casing offers the security of a screw back to a watch; if the vibrating tool is picked up by the casing, the base assembly will not drop off which might cause damage to the delicate balance staff. The casing is also easily removed without the risk of marking from a screwdriver or case opening knife slipping as might happen with a casing secured by screws or by being a snap or push-fit. If you do not have the facilities to screw cut the lower end, I recommend you use two screws set into the side as shown in the exploded diagram and alternative fitting detail on the drawing.

I do not recommend a push-fit casing as it may allow the base and balance to drop off if it is not that secure and is lifted. Moreover, making a snap-fit would be very difficult to achieve as both the casing and base are relatively rigid and will not allow any significant flexure necessary to make a snap fit "work" without the use of some considerable force.

Construction

Lightly grip the brass tube in a three-jaw chuck making sure that the tube is gripped truly; as the sawn end is unlikely to be square, do not press the sawn end against the back of the chuck body. Face one end flat, and remove the burrs to provide a clean, true face. Reverse in the chuck and face off the other end to bring it to 16 mm in length (slightly over the finished length of 15.5 mm). Deburr the edges.



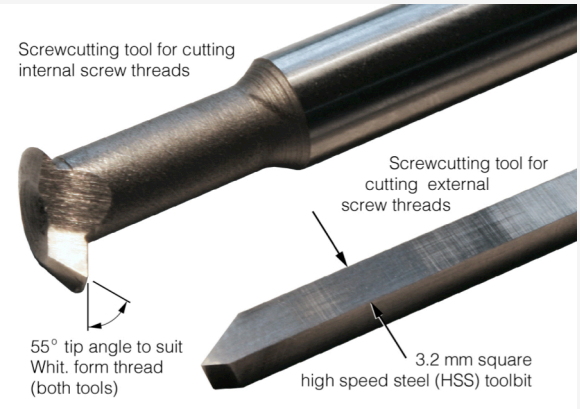
Lower end – screw-on fitting

If you are screwcutting the tube, the tube will need to be bored to a length of 3.4 mm (slightly over the finished length of 3.2 mm). The exact diameter is not important; the main purpose is to remove any eccentricity in the tube wall. Once the tool is cutting for the full (360 degree) internal periphery of the tube, stop.

With an internal screw-cutting tool create a 0.8 mm deep recess 0.5 mm long to allow the tool to run-out when cutting the thread. Now set up the lathe for screwcutting and cut the thread, making sure that the 'V' of the thread is to its full depth so that the thread crests are not truncated. The depth of thread (the in-feed of the cutting tool) is determined solely by the pitch and thread form; the diameter of the thread is not relevant.

A note on screwcutting

Screwcutting using the lathe leadscrew (as distinct from a tap and die) is not an essential part of a horologist's work. However, many may well find it a useful process to master, especially if you intend to make replacement parts for larger clocks or even screwcut watch cases. If you do wish to learn and practise screwcutting but have never done it before, you should refer to one of the several books that describe how to select, sharpen and set-up the cutting tools, and how to set up the lathe and use the leadscrew arrangements fitted to your lathe.



The depth of the recommended threads is given in the table, but if you use an alternative, this can be got from engineering tables for the thread form and pitch you have chosen.

Thread pitch and form	Thread depth (tool in-feed)
40 tpi Whitworth (Whit) form (55°)	0.016 in. (0.41 mm)
0.6 mm pitch metric form (60°)	0.32 mm

As you approach the finished size, make sure you remove any burrs from the crests of the thread so you are left with a perfectly shaped thread that will have a smooth action. In practice you will need to cut the depth of the thread very slightly (about 0.1mm) deeper to get a good crest form; this is because the tip of the screw-cutting tool usually comes to a point whereas in a real thread the root "valley" is radiused off. Moreover, there will be a little spring even in the sharpest of internal screw-cutting tools which will probably be of fairly slender form for such a fine pitch thread.

Once you are satisfied with the thread form, re-face the end of the brass tube to bring the total thread length plus run-out space to 3.2 mm length and chamfer the outer end internally to remove any finger-cutting sharp edges and give an easy lead-in when screwing the cover onto the base.

Lower end – alternative fitting

At one end of the faced tube, mark two screw positions as shown in the drawing and drill two holes at the tapping diameter of the chosen screws (10 BA shown). The holes will be opened up to the clearance size once the casing has been used as a jig for marking and drilling the holes in the base.

If you think you might use roundhead screws and you have a staking tool set with piloted spotfacing (counterbore) cutters, you should drill these two holes to suit the pilot on the counterbore rather than the tapping size of the screw. We will discuss this a little more when we finish the baseplate.

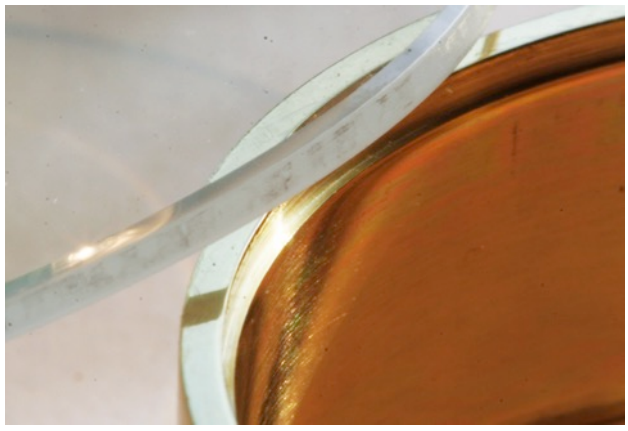
You will also need to make (or buy) 2 off 10 BA x $^{3}/_{16}$ in. slotted screws (roundhead (rh) or countersunk (csk)). Steel screws are preferable to brass as the slots will quickly become bruised if used frequently during assembly and disassembly later on. Other similar sizes are acceptable. Making screws is described later in these notes.

Upper end

Before going any further, measure the exact diameter of your mineral glass (normally they are very accurately ground to the stated diameter) and make a note of it.

The brass tube is chucked in the lathe and the upper end brought to its finished length of 15.5 mm. Using a graver or boring tool cut a recess 1.2 mm deep to 0.02 mm smaller than the diameter of the glass. The 5 degree angle is nominal and can be formed by the rake of the tool bit; it is merely to ensure there is a slight undercut rather than the reverse – look on it as "draw" as in a lever escapement.

Continue to make very fine cuts, making sure you clean and remove all burrs after each cut. After each cut check the glass for fit by firmly pressing it into the bore. Sooner or later it will snap into position at which stage you will not be able to get it out, which is why it is important to keep the bore free of burrs and any debris.



To get the glass out, remove the brass tube from the lathe and place in a shallow bowl. Heat up a domestic kettle to about 60 degrees Celsius (60°C is just too hot to keep your finger in, if that makes sense) and add a small quantity of water to the bowl so that it comes about half way up the sides of the tube (filling the bowl much deeper

will cause the casing to float). Try not to splash hot water on the glass or it may break under the thermal shock.

After a minute or so the internal diameter of the brass tube will have slightly expanded from the warmth of the water. Take the tube out of the water (it will be hot so you may need to use a cloth or gloves) and the glass should pop out under gentle pressure applied near the edge by your finger and thumb. If it does not, it is probably because the cold tube has taken too much heat out of the water, so keep on refilling the bowl with fresh hot water and trying again until the glass does pop out.

If you are unlucky and you make the recess too large in diameter, do not worry. If it is by just a tiny amount (a barely perceptible 'side-shake') it will probably be fine once the tube has been lacquered (which will be described towards the end of its construction) as inevitably some lacquer will find its way into the recess. Alternatively you can secure the glass with adhesive designed for fixing and "waterproofing" loose watch crystals. However, if you feel the fit is too loose for either of these options to be successful, you can open out the bore to the next commercially available size of glass (43 mm).

Once the glass has been removed, tidy up any final rough edges on the brass tube and bring it to its preliminary finish with 600 grade wet and dry paper. Wash thoroughly in warm water and detergent (washing up liquid) making sure there is no dirt remaining in the threads. Rinse in clean water and dry.
