A balance vibrating tool – 5

by Guy Gibbons

The Index, index clamp and endstone chatons

As mentioned last time, the rate is adjusted by the index. It is made from a piece of sheet brass and will require skilful sawing and filing if it is to look good. The index clamp and chatons also require some precision in their manufacture if they are to fit well.

Materials required

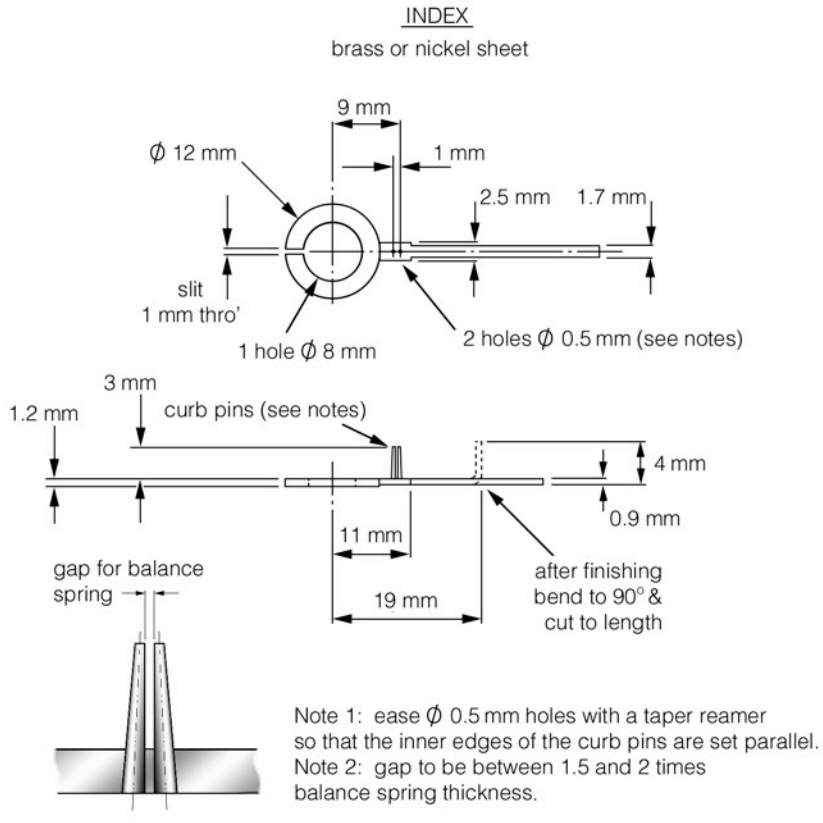
- 1.2 mm (18 gauge) brass or nickel alloy sheet approx. 40 mm x 15 mm
- selection of brass taper pins (to make curb pins)
- 10 mm ($^3/_8$ in.) dia. brass bar about 50 mm long
- (optional) 1 off commercial 10 BA x 10 mm ($^3/_8$ in.) screw, nut and two washers.

Design and drawings

The index lever is relieved by 0.3 mm on its underside so that it does not scrape on the upper surface of the baseplate when adjusted. The 8 mm dia. hole fits on the retaining clamp, which has a shank diameter that is a light interference fit, the slit providing a good friction fit to the index so that it stays put.

The index

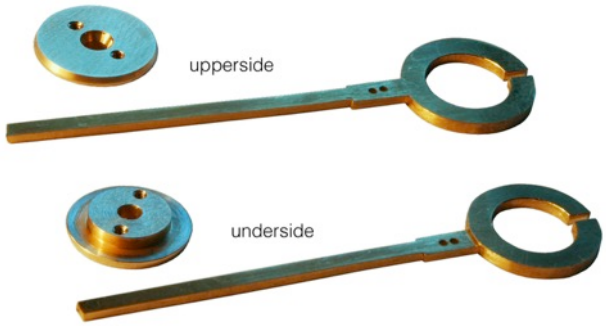
After marking out the brass sheet the first thing to do is to bore the hole to 8 mm dia. This can be done in the lathe by holding the brass sheet on a wax chuck or a faceplate. Do not profile the outer edge until you have made the 8 mm dia. hole.



Note 1: ease Ø 0.5 mm holes with a taper reamer so that the inner edges of the curb pins are set parallel.
Note 2: gap to be between 1.5 and 2 times balance spring thickness.

I do not recommend that you use a large drill to drill the 8 mm hole; even if the brass is firmly clamped as it is very likely to 'snatch' and damage the work, and this tendency to snatch is made much worse by the fact that it is thin sheet. Better is to drill with a small drill of about 3 or 4 mm dia. and open the hole up to 8 mm in the lathe by boring or by using a graver.

The outer shape is profiled using a selection of files. To shape the boss you may find it useful to make up a pair of filing buttons as described in the balance cock section. The underside of the lever is relieved as mentioned before, and here you will find the filing buttons come in useful to avoid filing into the 0.3 mm up-stand to the boss.



The holes for the curb pins now need to be drilled 0.5 mm, and some notes appear on the drawing. Use commercial brass taper pins pressed-in and filed of flush once cut to length with nippers. No 3 taper pins are about right, but the key thing is to get the gap between the curb pins correct. While it might be possible to use slightly larger diameter pins to reduce the gap, bear in mind that too large a diameter pin on the inner-side may foul the next coil in on the balance spring.

The slit in the index is now cut, and this can be done either with a slitting saw or by hand. Deburr the sharp edges and bring all surfaces to a good grained finish either by draw filing or by rubbing on a fine diamond stone. You could also use 600 grade paper, but you will need to make sure you do not round the edges. Measure the thickness at the boss end at three points; all readings should be within 0.02 mm (i.e. have a tolerance of ± 0.01 mm). If it is not within this tolerance stone it down until it is and make a note of the maximum thickness.

The index is relieved on its underside by 0.3 mm so that the lever extension cannot scratch the baseplate when it is adjusted. Do not be tempted to omit this relief as not only is it good practice for when you may have to make clock or

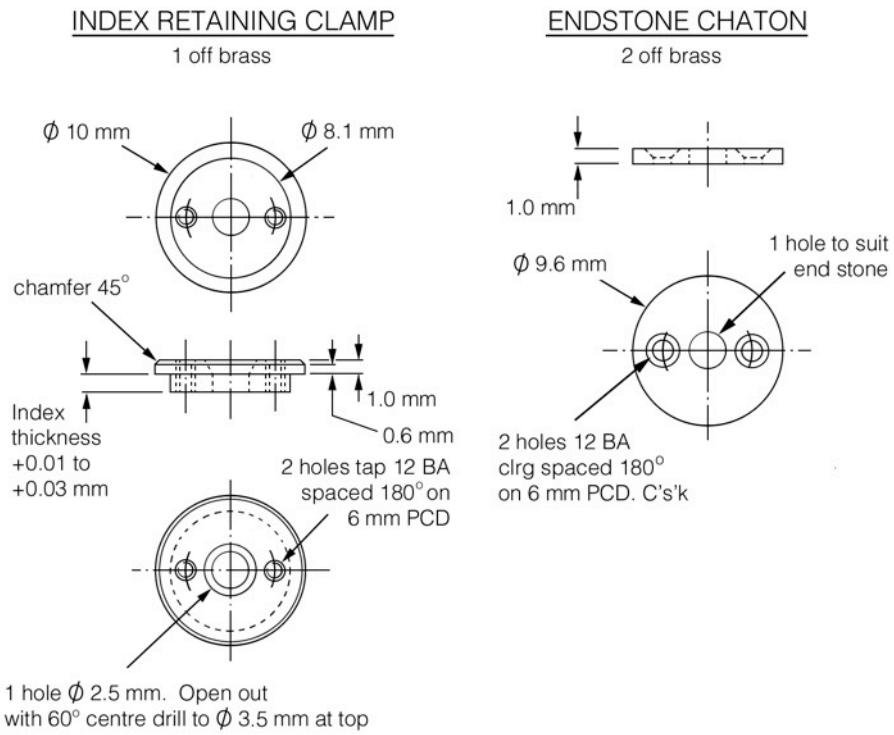
watch hands, but it marks out the difference between a high-quality tool (and workman) and one made by someone with an 'it'll do' attitude.

The index retaining clamp

The retaining clamp is a simple brass turning to the dimensions shown, but does require some precision in its dimensioning to suit the actual dimensions of the index.

After chucking and facing a short length of 10 mm brass bar, the first thing to do is drill the central hole to 1.7 mm dia. to suit the drill shank or 10 BA screw we will be using to centralise the components on the balance staff axis. It will be opened up to its final size of 2.5 mm later.

Next turn the stepped portion to 0.1 mm oversize to 8.1 mm dia. which will provide good friction for the index. If your index hole is greater or less that 8 mm you will need to adjust the clamp diameter accordingly.

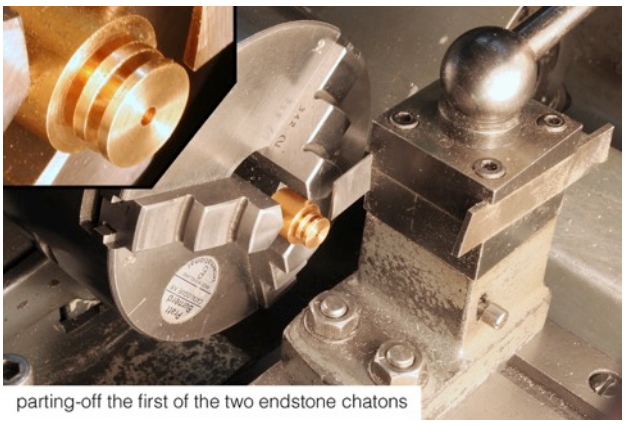


The length of the shoulder should be brought to 0.03 mm longer than the thickness of your index, which will be finished to length once we have made the index screw holes so that it can be fitted into position.

Now mark and lightly centre punch the two screw positions on the underside (the smaller diameter side) and drill through truly vertical for the tapping size of the retaining screws (1.0 mm if using 12 BA screws). Remove the burrs from the entrances to each hole.

The endstone chatons

Before going any further, it is appropriate to make the two endstone chatons.



parting-off the first of the two endstone chatons

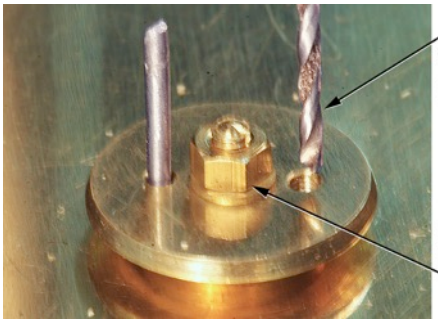
There is really not much to say about these items which can be made from the same piece of 10 mm dia. brass bar used for the index retaining clamp. The central hole is again pilot-drilled 1.7 mm. However bringing the two chatons to 1 mm thickness requires the discs to be set up perfectly square in order to face them off. This can be done in a number of ways; you can use a wax chuck, or very carefully grip them in a three-jaw chuck. If you have parted the discs off with less than 0.1 mm excess length you can rub them on a coarse stone to bring them to their correct thickness, always taking care that they are kept an even thickness all round.

Bear in mind that if you part off thin discs from 10 mm dia. bar with a less than perfectly sharp parting tool the disc is likely to dish, so it is always as well to take the parting tool to three-quarters of the cut-off depth at which point you should stop. Re-face the outer end of the disc flat before finally parting off completely. The second side can be finished flat on a stone, and both faces brought to a reasonably good finish in preparation for final polishing later on.

Index clamp and endstone chatons – drilling the securing screw holes

Fit the index clamp on the baseplate, locating it by its central hole with a commercial 10 BA x 10 mm ($^3/_8$ in.) long screw (or longer) together with a nut and a pair of washers. The 10 BA screw will be found to be a snug fit in the 1.7 mm hole and will provide both accurate location as well as reliable clamping for the two components. If you do not have a 10 BA screw, you could always thread a short length of brass rod turned to 1.7 mm dia. and use two nuts to make a clamp. You should also set up one of the endstone chatons below the baseplate at the same time.

Using the holes previously made in the index clamp, the two securing screw holes are drilled 1.0 mm dia. through the baseplate and lower endstone chaton. After drilling the first hole, fit a short length of 1 mm dia. wire through this first hole so that the index clamp and chaton cannot rotate when drilling the second hole (a broken 1 mm dia. drill shank is suitable). Use a drilling machine to ensure the holes are truly upright; if you do not have a drilling machine, drill from the lathe headstock, resting the baseplate on a tailstock pad.



Disassemble and make sure you have marked the correct orientation with light centre pop mark on the top-side of the clamp near to one of the holes and similar one on the baseplate and endstone chaton; this is to aid assembly because the accuracy you achieve is unlikely to result in the holes aligning perfectly if the clamp is rotated through 180 degrees. Stone off the raised edge around the pop marks and tap the holes in the clamp to the clearance diameter of the screws. Open out the holes in the baseplate and endstone chaton to 1.4 mm dia. and de-burr.

The other endstone chaton for the balance cock is now marked for the two securing screws and centred in its correct position. Drill through the two holes 1 mm dia. Using the same temporary 10 BA screw used for the lower (baseplate) assembly and the chaton as a drilling guide, the cock is drilled before removing the chaton and tapping the cock securing screw holes 12 BA.

Both pairs of endstone chaton holes are opened out to 12 BA clearing (1.4 mm dia.) and countersunk to a depth so that the previously-made countersunk screws come just level or slightly below the surface of the chaton.

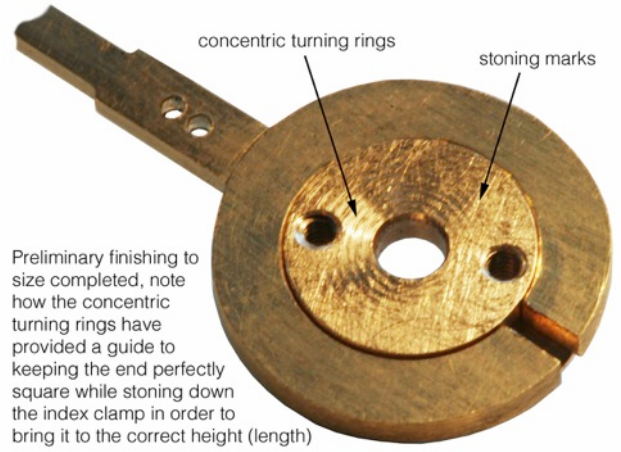
Once you are satisfied that the index securing clamp is fitted correctly, the central hole is opened out to the dimensions shown in the drawing so that it clears the balance staff. However do not do any more work on the central holes in the balance cock, the baseplate or the endstone chatons at this stage; these will be opened out when we come to jewelling.

Bringing the index clamp shoulder to length

The length of the clamp on which the index rotates needs to be brought to a precise length which lies between the as-measured maximum thickness of the index + 0.01 and + 0.03 mm.

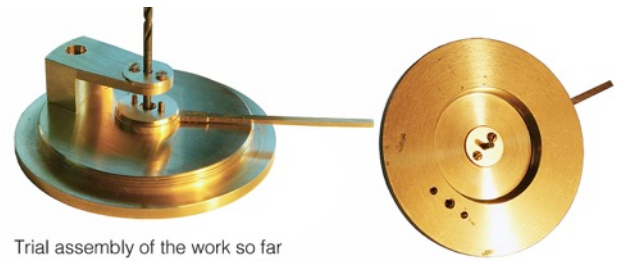
To achieve these tolerance limits is truly demanding, and many lathes and measuring instruments will not be up to it. Not only does the underside of the flange have to be faced truly flat, but the average cross-slide index and feedscrew will be at the limits of their accuracy. Moreover, measuring to this accuracy with a vernier caliper will again demand a degree of precision not likely to be achievable, and a micrometer is by far the preferred instrument.

With all these possible errors conspiring against you, it will probably be necessary to leave the under-flange part of the clamp slightly over length (say by 0.1 mm) and rub it on a diamond stone to bring it to the required length. In so doing, keeping an even pressure is not easy; the clamp must be checked regularly to ensure that it remains of equal length at three points around its periphery. A good guide as to whether things are going well can be the concentric turning tool rings; if they are worn away more on one side that the other, it is time to make an adjustment.



Preliminary finishing to size completed, note how the concentric turning rings have provided a guide to keeping the end perfectly square while stoning down the index clamp in order to bring it to the correct height (length)

When rubbing anything on a stone, the leading side (edge) on the pushing-away stroke tends to be worn away faster than the other side (the side being pulled towards you). Rotate through 180 degrees regularly to keep things even. (Aide-memoire: think of moving a long plank of wood with one end resting on the ground; dragging it behind you is far easier that pushing it ahead of you (there is far less friction and likelihood of it digging in).)


Trial assembly of the work so far
