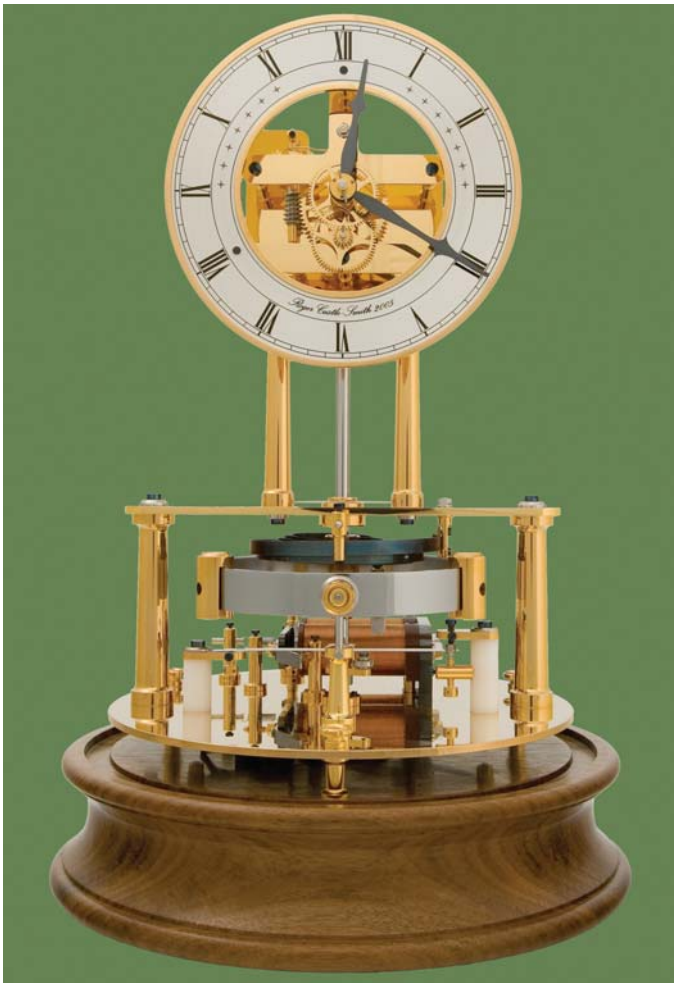
Finishing Screws and Nuts

Roger Castle Smith describes the methods he used for his clock which was awarded a Gold Medal at the Centenary Model Engineering Exhibition, Ascot.



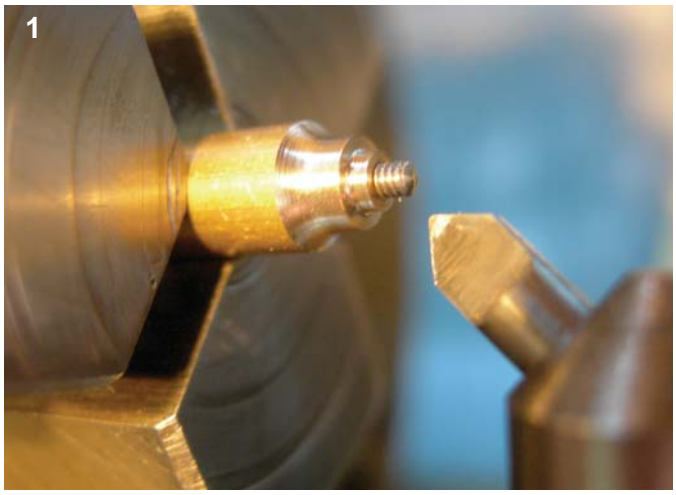
I was prompted to offer this article for two reasons; firstly because I had a number of enquiries as to how I finished my screws and nuts and, secondly, because the editor called for articles on workshop subjects. Although there is little new in this article for the experienced, I hope that my methods might prove useful for those with limited know-how albeit that there are undoubtedly many ways of achieving the same end.

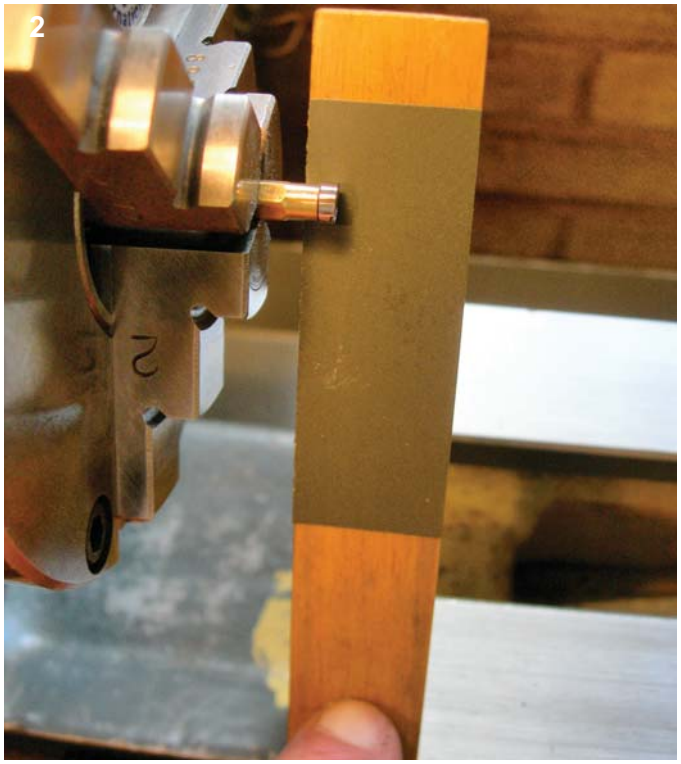
Holding screws for machining

Several methods have been described for holding screws using bespoke 2-part fixtures, not least by John Wilding for whom I hold great respect. However, I found that for small sizes, say 8 BA and below, and for watch sized screws, a different approach was required. After much thought, this proved to be very simple. For small screws, take a length of hexagon or round bar, say 3/4" long, and bore a blind hole, which doesn't quite reach the end, with a diameter which is slightly larger than that of the screw head. Bore a further hole from the other end with a tapping size to suit the screw and tap. Now insert the screw down the hole and see how much of the thread protrudes. If insufficient, machine a little off the end of the holder; it is easier to do this in steps rather than trying to bore the blind hole to the required depth. Finally, relieve the threaded end of the holder so that its diameter is a little less than that of the screw head. The screw end can now be machined by inserting the screw into the holder from the bored end; only a gentle tighten is required to stop rotation in the holder if light cuts are taken. Finally, insert the screw in the holder from the other end which enables the head to be finished. **Photo 1** shows a 12 BA screw being held for machining the end of the thread. Using this method it is possible to accurately finish a screw which is only a few threads long. Making holders for all the common BA sizes from 2 to 16 takes a very short time and pays dividends in the long term. For the larger sized screws, a holder comprising a long threaded collar is all that is required but its diameter must be larger than the screw head size. I contemplated making D bits so that the holder bore had a flat bottom. But after trial and error, it was found that the conical end made by a drill ensured that the screw head was accurately centred.

Polishing screws

The thread end and circumference of a screw head may be polished by holding it as above after machining to the finest finish possible. For polishing the circumference of the head, stick the abrasive paper, for which see below, on a flat piece of hardwood, or metal strip, and hold one end of it against the lathe bed to prevent any barrelling of the head as in **Photo 2.** My preference is to hold the abrasive under the head so that it is possible to see how the polish is progressing.The abrasive must be kept moving from side to side otherwise tiny scratch rings will result. This then leaves the question of how to finish the top of the head to a mirror polish whilst still keeping it dead flat. To achieve this, make a ring with 3 tapped holes to take 3 screws as shown in **Photo 3**. If a multiple of 3 screws is not required, the extra ones are simply placed in the might-come-in-handy-one-day box ! One ring can be made to suffice for several screw sizes by boring intermediate holes.The holes have a slight countersink to ensure that the screws fit snugly against the ring. Stick the abrasive on a flat piece of hardwood, or a piece of float glass, using 3M photo mount spray; if this is not done some rounding is bound to occur. The tip of a finger is then placed in the large hole in the ring which is moved with a circular motion on the abrasive, pressing only very lightly in the process. Different abrasives appear to work best for different people. But for me, I found that starting with no coarser than 3M Perfect-It 1200 grit (a trade name for 3M's Wetordry), followed by 1500 and finally 2000 grit, produced an almost mirror finish. The 3M product in the finer grits only seems to be obtainable through suppliers of automotive finishing products. Lastly, I tried 2 methods for obtaining the final polish. The first





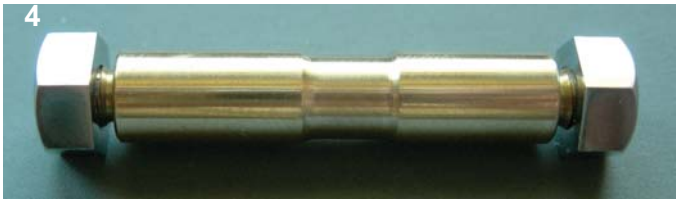
was to use a copper or type-metal lap embedded with rolled in diamond dust, often trade named Diamantine. The second was to use 3M's lapping film which is available from horological suppliers in several grades down to 3 microns. I settled for the second method which is easier and which gave the same final appearance. But when using lapping film, only rub over the same area once otherwise the engrained particles will produce micro-scratches. Only a few strokes are necessary. Finally, I also tried Crocus paper and 2500 grit wet-or-dry. Some seem to like the former but I found that the sample which I had scratched badly. The 2500 grit from a less reputable producer than 3M seemed to contain random larger particles which produced a far worse result than 3M's 2000 grit ! I should just mention Micromesh for those who have seen it advertised or heard about it. This is a superb sheet abrasive when used for its originally intended purposes; but for horological work I consider it useless as its relatively soft backing in both the MX and Regular variants is guaranteed to produce rounded edges.

Holding and polishing nuts

Holding a nut to finish machine the ends is easy; simply insert a piece of threaded rod into the lathe chuck so that it protrudes a little less than the nut thickness and screw on the nut. The 30° bevels on the end of a nut can be polished in the same way as described for the circumference of a screw head only with a bevel cut on the strip which bears the abrasive paper. For finishing the ends, use the same ring as used for polishing the screw heads. Screw short pieces of threaded rod or screws into the ring so that they protrude a little and screw the nuts onto them. Then rub on the abrasive as for the screw head. Finally, the nut flats. **Photo 4** almost speaks for itself. The nuts are loosely screwed onto the end of a rod and then rubbed on the abrasive sheet taking care to give the same number of strokes per flat. The neck in the rod is to assist with holding it. For a tiny nut, and hence rod, wrapping a piece of double sided Sellotape around the rod enables it to be moved easily with the pad of one finger.

Blueing screws

Never heat a screw directly as it is almost impossible to get an even blue in this way. But rather bore a hole, whose diameter



is some 25% larger than the screw thread, not less than about 3/4" from the end of a narrow brass strip around 1/16" thick. Before blueing, the screw must be absolutely clean otherwise even a small finger mark will result in an uneven result. Spotless dry cleaner available from supermarkets works well after which use tweezers to insert the screw in the hole. Heating directly under the screw may result in a nicely blued head but the end of the thread will overheat and will consequently have gone past deep blue to a light colour; this is no good for screws whose ends will be scrutinised closely by an exhibition judge ! So, instead, gently and alternately heat the brass strip on either side of the screw so that the heat runs upwards from the strip to the head and downwards to the thread. I find that, by so doing, it is possible to get an even blue across all sizes of screw from 2 BA to tiny watch screws. Use a very gentle flame. An old fashioned type of meths lamp is ideal. The one I purchased from a reputable horological supplier, imported from India, was useless; it had a fibre glass wick which burned before it soaked up enough meths to produce a steady flame. So I made one from a Heinz baby drink bottle with a piece of cotton wick obtained from a local ironmonger — see **Photo 5** in which a small screw is being blued. Once a deep blue has been achieved, quickly dump the screw into oil to quench. Hot steel being quenched in water will produce minute rust pits which may not be evident to start with, but certainly will be later. Screws which only require a little nip-up to tighten sufficiently can be made from mild steel. But for the occasional one which needs firmer tightening, or which has a large thin head, silver steel is better. Either way, don't ruin your lovingly finished screws by using an ill fitting screwdriver !

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