

# smith & smith

## TECH HELP ARCHIVE 2004

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### TECH HELP January 04 - PIVOT REPAIR AND POLISHING : PART 3

A reasonable range of collets is required to ensure the arbor is held correctly. Because the arbor is not being supported, a collet which is too small requiring the arbor to be forced in will not hold at the front - **Fig5**. Or if the collet is too large it will hold at the front but the arbor will not be supported inside the collet - **Fig6**. Both practices are totally unacceptable and must be avoided at all costs. In practical terms the arbor will wobble as the file or burnisher is applied, making the task of restoring the pivot impossible.

The arbor is set up and the lathe is turning, in this case by a motor and of course in one direction. Because the pivot is in such poor condition I am firstly using the file end of my newly purchased file and burnisher. Filing is an art form and it is surprising how few have learned the basics, so lets get started. A file cuts on the forward stroke and light pressure is needed to get the file to cut, but only on the forward stroke. Remain in contact with the pivot on the backward stroke but do not apply pressure. No! Don't try it yet! A couple of things still to cover. Because we are working under the pivot and the lathe is turning clockwise, as you push the file forward the lathe will run it forward almost out of control and it will not cut. You can do two things to make the file cut. Firstly you could turn the file around and cut on the backward stroke ( a bit silly ) or make a "figure 8" with your drive belt and the lathe will turn anti-clockwise - **Fig7**. Phew!

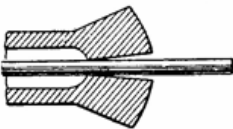


Fig 5

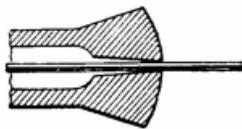


Fig 6

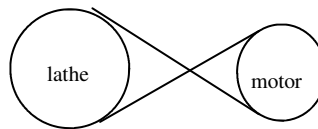


Fig 7

### TECH HELP February04 - Pivot Repair Part 4

Continuing from last Monthly, lets get on with filing the pivot. Don't apply too much pressure and don't hurry, a careful approach gets the best result. Bring the file up to the pivot which is running slowly and gently feel it make contact across the full length of the pivot. Unless a "feel" is developed by the technician, producing parallel pivots will be difficult. Proceed to remove all traces of wear and stop immediately when this has been achieved. Reducing the pivot beyond what is necessary can weaken it and even cause it to break when operating in the clock.

The burnisher can now be used to finish the operation by removing all traces of filing and give the surface a bright finish. The burnisher must be lubricated to prevent the surface from getting clogged which will stop the burnisher from doing its job. A firm pressure should be applied, and unlike filing, the pressure can be maintained on both the forward and backward stroke. After a few seconds the condition of the pivot can easily be seen. The pivot residue will mix with the oil and blacken the surface of the burnisher with the high spots on the pivot appearing as black lines. ( Fig8 )

It may be necessary to go back to using the file if the pivot still has some wear marks. Applying pressure may cause fine arbors to deflect, reducing the pressure will eliminate this in most cases. As previously mentioned pivot support will be covered later. The burnishing is completed when it comes into contact with the pivot across its full width. The

surface of the burnisher will have a clear track where the pivot has been in contact, with no oil residue visible. A good lubricant is neatsfoot oil, this can be picked up from hardware stores or suppliers of leather goods.

Fig 8



#### TECH HELP March04 - Pivot Repair Part 5

Traditionally polishing pivots was done using a Jacot tool driven with a bow. I advocate this method for watch pivots but not for the restoration of clock pivots. Why not? Simply because in most cases clock pivots are robust enough to be finished using the method previously mentioned. Having said that, I always use a bow and I use it with my 6mm Lorch. My feeling is a pivot is best finished with a backward and forward motion rather than a single direction of rotation. I made my bow from a wire coat hanger about 30 years ago and have used it ever since (fig 9). Fishing line is the string because it is long lasting. Make a small loop in the end of the line at a point that when it is hooked to the bow, the bow is under tension.

Pass the line under the smallest pulley and bring it back toward you and pass it back under the pulley a second time and attach it to the bow (fig 10). This determines the direction of rotation. Start by pushing the bow as far forward as it will go. Place the tip of the burnisher under the pivot. Push the tool forward and at the same time draw back on the bow maintaining a light pressure under the pivot. Next, push the bow forward and draw back on the tool without releasing the pressure. Continue in this fashion until the desired outcome on the pivot is achieved. Because the cutting action is working in both directions pressure can be maintained whereas in a single direction pressure must be relieved on the backward stroke. This backward and forward motion can be done quickly and results in a very pleasing finish. A 6mm lathe can be used quite successfully, but 8mm are too heavy and are best used in the normal way.

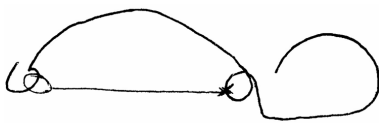


Fig 9

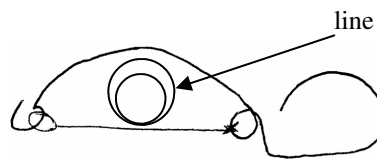
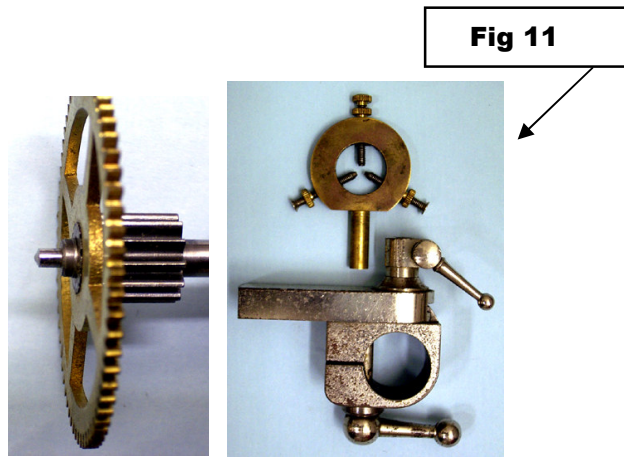


Fig 10

#### Tech help April04 - Pivot Repair Part 6

Securing the arbor so it will not flex when the pivot is being worked on is extremely important, no work should be carried out unless you are certain the arbor will not bend when pressure is applied to the pivot. If the arbor is robust, one end can be held in the lathe collet whilst the pivot at the opposite end is being worked on. Simply reverse the arbor to refinish the other pivot, however, other problems can arise and even though the arbor is robust, holding it can still be a challenge. For instance if you have the first wheel from a Chime clock where the wheel is almost touching the plate, how do you best tackle this? Sometimes the pivots are long enough to be held in a collet so the opposite pivot can be refinished. Experience shows however that most pivots are not long enough and under pressure from the file or burnisher will work their way out and cause damage to themselves or the collet. The traditional solution is to use a Jacot tool or Lathe so equipped because the wheel is held between centres therefore the pivots do not get damaged. The problem with the Jacot drum is the pivot can only be worked from the top and for the beginner it is better for the pivot to be seen at all time to be certain the desired result is being attained. Some years ago when I had less to do I made up a tool **Fig 11** to tackle the problem we are now facing, how to hold a Chime wheel and more importantly how to hold very light wheels such as those fitted to French clocks. How to use this tool will be described in what (I hope) will be the last part of this topic in the May edition of the Monthly.



### Tech help - Pivot Repair Part 7—Final

The tool I made ( see fig 11 ) is simple and easy to construct ( details of how to make one are available on request ). Fit the tool into the Tool Rest holder (*not a flip over type*) in preparation to setting up the lathe for commencement of the polishing procedure. Lets assume the wheel to be repaired is similar to the one illustrated, in part 6, almost no length under the wheel. Take a suitable collet and securely lock the wheel in place holding the pivot. Bring the tool onto the arbor just past the pivot. This gives enough distance for the file and burnisher to clear the tool. Make sure the tool follows the line of centre of the lathe and lock the tool rest holder in position. Turn the wheel in the lathe and if it is wobbly just touch it gently to bring it close to running true. Next, screw each of the three centring screws until they just touch the arbor. Again rotate the wheel to make sure it is now running dead true and clear of the tool. If it is not, adjusting the screws can quickly bring it to centre. Tighten the locknuts and away you go. It is important not to allow the arbor to have any side play because the tool will not prevent the wheel from slipping out of the collet, particularly if only held by pivot. A fine pivot can easily break. To repair the opposite pivot loosen the Tool Rest clamp and slide back along the bed, do not loosen screws. It may not be necessary to use the tool in this operation because the wheel arbor can be held in the collet quite safely. However a fine arbor such as found in a French clock must be supported by the tool. Before we lock the arbor into the collet we bring the Tool Rest close to the collet and feed the arbor through tool into the collet and tighten it up. The arbor can be held as far into the collet as is necessary to clear the tool but the tool must be close to the back of the wheel to minimise the overhang, remember the wheel is outside the tool for this operation. **The thing to remember** is to minimise the overhang when working on a pivot, other than that its just plain sailing. The tool can also be used for repivoting as it is impossible for the arbor to deflect and cause crank shaft pivots.

**Fig 11**



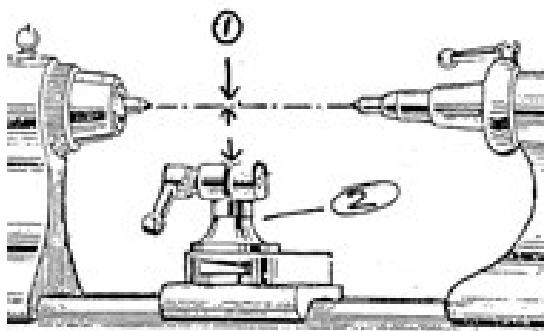
Good luck, **Michael.**

### TECH HELP - Making a Steady

Bowing to pressure I have decided to show how easy it is to make the steady I use for pivot polishing and some repivoting (last Monthly).

Firstly, decide how you will mount the steady post, I use the tool post (fixed, not tip over) as the steady holder, from this you can calculate the dimensions of the design. Work out the distance from the top of the rest to the centre height of the lathe, this is the centre of the tool. All the dimensions can be altered to suit individual needs as long as the basic design is followed.

Select a piece of brass and turn the outside. Drill and bore the centre hole on the outer edge mark 3 equidistant holes and drill. For selected tapping size, tap holes, the hole for the steady post can be tapped or plain for friction fitting or soldering. Turn the post to the correct diameter for your tool holder. Next, file a flat on the brass ring directly opposite a screw hole and drill for post. Any further refinements can be done to suit individual requirements.



1. Centre Height  
2. Tool Rest



3. Body of Steady  
4. Steady post  
5. Centring screws x3  
6. Lock nuts x3

\*Not to scale\*

### Tech help July 2004 - Clock Mainsprings, Barrels and the Like

I am going to attempt to provide information which will allow easy calculation of spring specification for a given barrel, the repair of the barrel and the restoration of the barrel arbor. The difficulties found in achieving a favorable result when faced with problems in this area are not unique to the amateur repairer - many trade skills learned long ago are now forgotten and until now clock repairs have been ignored by the watchmaker. Because the need for skilled clockmakers has never been higher, re-learning these skills should be a priority.

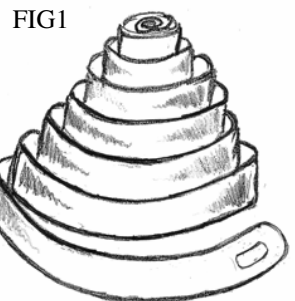
Although there are some exceptions, a clock barrel is made up of distinct components. Firstly, we have the barrel arbor, all the various aspects of which are important to the running of the clock. Next the barrel with its toothed section (in French clocks this is made separately and soldered to the barrel drum). Its internal construction plays a major role in how the arbor and mainspring interact with each other. Thirdly, the barrel hook, little attention is paid to this small component yet ignoring it can bring about disaster. Lastly the barrel lid. For some reason totally ignored by many tradesman yet perhaps the most important component.

Now we come to the mainspring and how it functions in the confines of a barrel, how potentially dangerous it is and the importance of careful selection.

In our next issue, we will cover the repair of a mainspring, whether it should be reused or replaced and if it is the correct spring for the barrel.

### TECH HELP August 2004 - Clock Mainsprings, Barrels and the Like Part 2

Replacing a mainspring is not a job for the fainthearted. Because some springs are large and strong, the chances of personal injury are huge. The wrong approach, even though a tried and true one of many years can have dire consequences. A bit like jacking up your car and crawling underneath without the proper supports in place. EVERY mainspring must be removed from EVERY barrel of EVERY clock that comes into the workshop. To do this properly you must have a mainspring winder which is capable of removing the spring as well as putting it back in. Before removing the spring, make sure the height is correct. There must be a small clearance between the underside of the lid and the coiled spring. You would expect to find about 1mm in a larger barrel, say 20mm diameter, but this is not a hard and fast rule except to say if the gap is larger, consideration must be given to the possibility that the spring is incorrect. Next, check the space taken up by the spring inside the barrel in its unwound state. The generalization is 1/3 arbor, 1/3 gap and 1/3 mainspring, if the spring does not meet any of the above criteria the expectation is it is not the correct one for that barrel. How to determine the size of the correct spring will be shown later on. For now we will look at the mainspring being correct. After removing the spring, place it on a flat surface to make sure it is flat, any pyramiding—FIG1 and the spring should be replaced. Also, if the spring does not expand to a reasonable diameter, it should be discarded. A spring either of these conditions will not give reliable service over 8 days.



### TECH HELP - Clock Mainsprings, Barrels and the Like Part 3

If the spring is in good condition it makes sense to re-use it. One of the most common problems is the hole used to attach the spring to the barrel is either torn or completely or fractured in some way. This can come about by the clock owner being too vigorous when coming to the end of the winding procedure and is most often seen in French

clocks because of their very light springs. Because it is in otherwise good condition, and possibly original, it makes sense to repair it. Although this is a simple task there are a few things to consider and these will be explained as we go along.

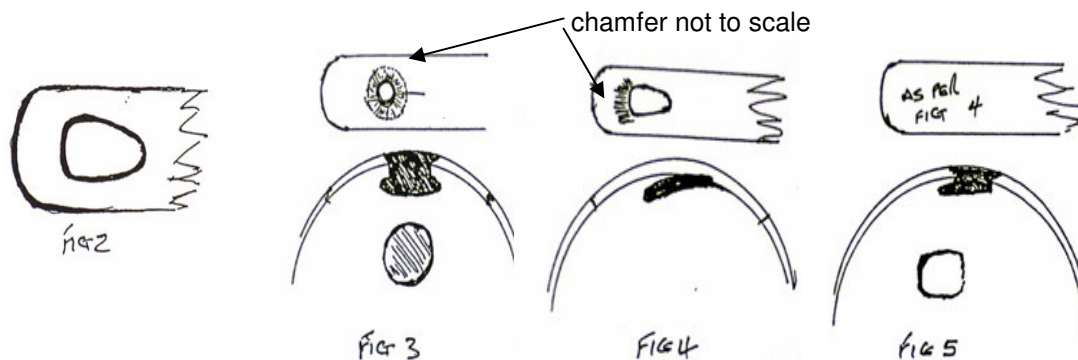
Firstly remove the damaged piece as close to the end to retain the maximum length. Next soften to the end by heating to cherry making sure the heat travels along only 4cm or less if it is narrow. Beware that some modern springs will turn glass hard when heated to cherry and therefore must only be heated to a blue colour. Next a hole must be made and the easiest way is to punch it out. I use an old staking punch polished and flattened on the end. I place the end of the spring over the end grain of a very large log, placing the punch on the appropriate spot and hit it *sharply* with a large hammer. This is not the only way to make a hole, but the way I have found best to do it. Don't drill unless you take extreme care as nasty things can happen!

Where do you start the hole? Common sense must prevail here but the original will give you the clues. Not too close for obvious reasons and not too far away. As you cut off the end of the spring you would have noticed how nice and rounded it was. To achieve this, and you must, use your tin snips to remove most of the excess and file the end to shape. Hold the spring at 90° to the surface of a fine cut (cut 4) 12mm or wider file and by adopting the radius filing method finish the end appropriately (don't dare ask what is radius filing!).

Next month we determine the shape of the hole and how to achieve it.

#### Clock Mainsprings, Barrels and the Like Part 4

If you take a look at a new mainspring you will notice the shape of the hole will probably look like **fig2**. However when you look at a number of clock barrels you will find a difference in the hooks used to secure the mainspring, **figs 3,4,5** are common, **fig3** is round, **fig4** is punched out and **fig5** is shaped, has a knife slot for the mainspring and is often very close the barrel wall. When deciding what shape hole to put into the end of the spring the following information will be of some help. Round holes are used for **fig3** and having already punched a centre hole it is a simple matter to enlarge it by reaming using a tapered fluted engineers' reamer. These are available in a large range of sizes and are ideal. Make the hole about 2mm larger than the hook, this will make it easier for the next person to remove the spring from the barrel when cleaning. Next take a countersink or even a large drill and countersink the hole on the inside of the spring to about 2/3rds the thickness. This helps the spring to slide onto the hook and into its correct position rather than catch on the head. If it does this there is a tendency for it to dig into the soft hook and stay there. If the barrel has a punched out hook its hole would be like **fig4** File the hole to the shape illustrated, again about 2mm wider than the widest part of the hook. If the hole is not large enough the spring will not go to the back of the hook and there will be a tendency for the hook to break away from the barrel wall. Make certain there are no square corners on the hole. There is a tendency for the spring to fracture if the corners are left dead square. File a chamfer at the front of hole, again from the inside and again about 2/3rds the thickness. The hole required for **fig5** is the same as **fig4** but perhaps not quite as long, however this will depend on the size of the hook.



#### TECH HELP - Clock Mainsprings, Barrels and the Like Part 5

Fitting a mainspring is easy enough provided the rules are followed. Safety first and then cleanliness. A mainspring winder is an essential tool, it provides all the safety you need and ensures the mainspring stays clean and untouched by sweaty hands during the fitting process. The devastating injuries caused by mainsprings on the loose are many and most are permanent. The same tool is also used to remove the spring with added security. If I didn't have ten fingers I could not do my math.

The centre coil is soft and must be the same diameter as the barrel arbor. The frustration of having a spring slip after the clock has been assembled has been experienced by most of us at one time or another. A winder comes with several winding arbors and more can be made. If the correct arbor is selected the centre of the spring will conform to the same diameter as the barrel arbor, no pliers needed here - fig 6.

The other end of the spring also needs attention to make sure it will properly locate onto the hook. The end is bent over so when the spring is unwinding inside the barrel the next coil will push it onto the barrel wall and the hook will

more readily connect - fig 7. The curve should be just in front of the hole and caressed into shape, not bent so as to form a kink or a ridge.

Once the spring is placed on the mainspring winder and properly located the winding process begins. Do not wind too tight, this is not necessary and may cause the spring to pull out of the clamp. You can hold the spring using a clean cloth or wear a leather glove but you must make sure you have complete control. The spring must not move sideways or it will come out of the winder. Slip the barrel over the spring and turn it to make sure it is located over the hook. You can release the tension on the spring by one or two turns if you have enough room to do so but not so as to jam the clamp. Again check the hooking by now the curve put onto the end should have come into play. Release the clamp and carefully remove it. Next, remove the spring from the arbor and lubricate it in the usual way. The assumption is both the barrel and arbor have been checked and are in good condition.

Next month, the barrel arbor.

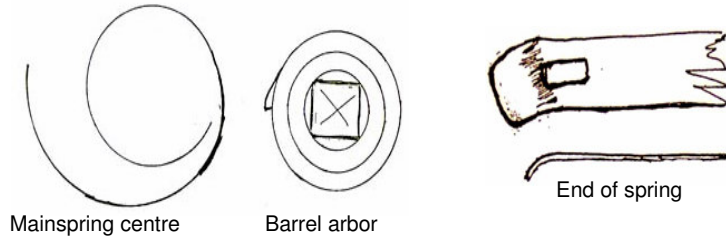


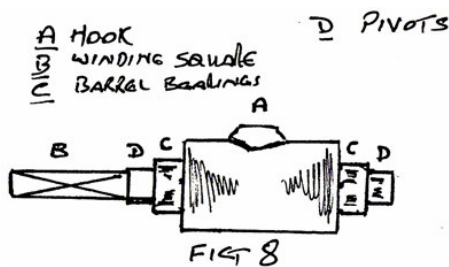
FIG 6

FIG 7

### TECH HELP - Clock Mainsprings, Barrels and the Like Part 6

The last piece of the barrel assembly for us to look at is the barrel arbor. Although arbors tend to be taken for granted they have an important role in the effective running of the clock and great care needs to be taken to ensure they work properly. A barrel arbor mostly looks like FIG8, is made from one piece of mild steel and has a number of features. Firstly, lets take a look at the hook, generally you would expect the manufacturer to get it right, but this is not always the case. In the cheaper clocks, hooks are often a compromise and not quite as they should be. For instance, if the hook is too long it will impact on every coil of the mainspring FIG9. It is obvious a mainspring distorted in this way cannot perform at its optimum.

The hook should be only slightly higher than the thickness of the spring and undercut to enable the spring to hold firmly FIG10. In some high quality clocks the barrel arbor is undercut to make the spring an integral part of the diameter of the arbor FIG11. It becomes clear to see how important it is to finish the mainspring to make certain it conforms to the diameter of the arbor. If the hook is too high it must be reduced and if it is not already undercut this must also be done. If the hook is too short, this can happen if the spring slips a number of times, then the arbor can be filed or machined in the manner of FIG11. This effectively raises the height of the hook to allow the suitably adjusted spring to lock firmly against the reformed hook.



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