VACUUM AND PRESSURE OIL TREATMENT OF WOOD.

I have been enthralled by all the recent and exhaustive Comms by Jan Bouterse on instrument measuring and making. I wonder if he has plans to turn them into book form? If, by some magic, I had been able to read this book 35 years earlier, my life as an instrument maker might have been less fraught with difficulties, challenges and mistakes!

In Comm 2044 he writes that he will give us his experiences of impregnating and sealing wood with oil in a later article. Here I offer my own practical account of the treatment that I have been using for over 20 years for all the turned wooden parts on the various types of bagpipes that I make.

A concern that all instrument makers must surely have is that once a new wooden instrument leaves the workshop it may be subjected to a variety of temperature, humidities and other unsuitable conditions, so it makes sense if one can find ways to increase the stability of the wood.

My vacuum and pressure oil impregnation process involves submerging each completed part of the instrument in a container filled with linseed oil and turpentine. The container is then sealed and the remaining air is removed with a vacuum pump. This causes the air in the wood cells to be drawn out. The next step involves reversing the action of the pump and pressurising the container, while gently warming the oil to reduce its viscosity. Finally the pieces are removed from the container and the oil is allowed to dry. Once the oil has hardened in the surface wood cells it should prevent the wood from absorbing any moisture. That is the intention, anyway!

My oil container consists of a strong vertical steel tube with a welded bottom. Around this tube is coiled a heating element (similar to an electric blanket element), which is fitted with an adjustable thermostatic control. The entire tube is encased in an insulated box. The steel lid for the container has a rubber seal and can be tightly bolted in place. A flexible tube is attached to this lid which is connected to an air pump that can operate either as a compressor or a vacuum pump.

Over three decades ago I was advised by Dave Armitage to use two thirds of boiled linseed oil to one third of genuine turpentine. In practice, when topping up the oil, I never accurately *measure* the quantities, but rely on the traditional and non-specific Scottish measurement of liquids known as a s*coosh*. (as in "*I'll just take a wee scoosh of milk in ma tea, thank you kindly*"). So I always pour in two scooshes of oil to every one of turps and it seems to work..... Of course it is not beneficial to seal an undue amount of humidity into the cells of the wood so it is essential to ensure that it is as dry as possible.

My oil container is large enough to accept several pieces at once, depending on their size. I bind them together into a bundle with wire and take considerable care that they are all secure, leaving one piece of thicker wire protruding from the top of the bundle and bending the top of this wire to form a hook. This wire ensures that all the parts stay submerged in the oil and that I can fish them out after treatment. Initially the pieces will be buoyant, but after treatment they may have absorbed enough oil to make them sink. I have not fully emptied my oil container for about 15 years and sometimes wonder if there are any stray pieces of pipes that have somehow broken free and lurk there in the primeval depths.... (*Memo to self;* I <u>must</u> drain the oil container someday).

It is essential to leave an air gap of about four inches above the oil level as it forms an impressive amount of froth during the initial vacuum stage, and it would be disastrous if this was sucked into the pump. The pump just happens to produce a maximum vacuum pressure of 90 kPA, and once it has achieved this I isolate the container with a valve and switch off the pump. Ideally I would leave it at this vacuum pressure for about half a day. However in practice for the last few years there has

been a slight a leak in the vacuum valve which I have not yet taken the time to locate, so my tactic is the bring it up to maximum vacuum several times over a period of a few hours). (M*emo to self;* I must sort that leak someday).

The second stage involves compressing the air up to 75 psi and isolating the container with the valve. (My pressure valve actually works). I then switch on the heating element to warm the oil to about 35 degrees Centigrade. (I am not clear how I arrived at choosing that temperature, but it works for me). I usually leave the container at this maximum pressure for at least a day. Then I switch off the heater and allow the oil to cool to room temperature before decompression.

I lift the bundle of pieces out and leave them hanging above the container so the oil on the surface of each piece can drip back. It is exciting to see each piece as this treatment can change the appearance of the wood considerably and the initial thick coating of oil makes each piece look rather luscious! In a few hours the majority of the surface oil has drained back and I unpack the bundle, wipe away the surface oil from each piece and leave them in the cool room for a few days, giving them a daily wipe. If I omit to wipe them regularly at this early stage the oil may sweat out in patches and congeal into gooey areas *on top* of the surface of the wood. This can be tricky to remove. Once I am confident that the oil on the surface wood cells has begun to dry I transfer them to a warmer place to speed up the drying process.

How long to leave them? Basically; the longer the better. The drying process begins at the surface of the wood and it has been interesting to observe how this occurs at considerably different speeds with different woods. In my experience pear and apple wood absorb a lot of oil and they certainly take the longest to begin to dry on the surface; I try to leave them for well over a month. Plum and boxwood can achieve a hard outer surface in a couple of weeks.

How deep does the oil penetrate? Some of my chanters have a wall thickness of about 1/8”and in these pieces I assume that the oil penetration is almost complete and it will harden sooner. Other pieces may be over 1” thick and the penetration is less likely to be complete. Inevitably on thicker pieces of wood the oil contained deeper within the cells will take a lot longer to harden. There have been occasions when I have left a chanter for over a year after the oiling process and yet I can still observe little beads of liquid oil emerging from the wood around the area when I am drilling the finger holes. This will be caused by the slight heat and disturbance made by the drill bit and is clear evidence that the oil contained within the wood has not hardened. I wonder if the oil that is contained deep within a thick piece of wood will *ever* harden, as it will never be in contact with the air? I am not clear how the depth of penetration could be researched. To be honest I am not sufficiently clear about the mechanics of the drying process of the oil and if it ever actually fully dries/ hardens. (Discuss)

In my ideal world (Bagpipe Heaven) I would leave each piece for months or even years before assembling the pipe. However in practice there comes a time when I judge that they can be assembled without this affecting the outer finish. I then re- ream all the bores and spin each individual piece on the lathe to give them a friction coating of beeswax. This is not essential, but it adds a pleasing sheen. It is equally possible at this stage to start building up more thin layers of oil on top of the oiled wood, to create a layer similar to a varnish. However the tactile satisfaction for me with oil impregnated wood is that you can *feel* the actual surface of the wood, rather than touching a thin protective varnish balanced on top of it.

The treatment highlights the wood grain and gives it depth and lustre, which will darken and mellow over the years. It can also dramatically darken any areas of wood that may have been affected by a fungal attack. I assume that the action of the fungus will have broken down the cell walls and the affected area acts like a sponge in oil. In my experience it is best discarded as I find that this wood, though it may look splendid, is never stable as the oil can still stream out of it for years after the treatment and it is once again prone to being affected by moisture. Once, as an

experiment, I made a chanter out of some very dodgy box wood which emerged out of the oil process looking almost black. But even after years of allowing it to dry I still do not have any confidence in this chanter's stability. Recently I used a batch of holly, which seemed fine, but had slight grey markings in certain areas. I did not detect any weakness in these areas when I was turning it, but after the oiling treatment these areas took on a striking dark brown colour. More firewood...

The one wood I have found does not respond well to this treatment is yew wood (taxus baccata). *I love yew,* but the treatment sometimes tends to leave dry looking patches on the surface. My approach with yew is to submerge it in the oil container and leave it at atmospheric pressure for a few days with the oil heater on. The oil seems to penetrate quite deeply and the results are very satisfactory. This does lead me sometimes to question if there really is a need to use the vacuum and pressure treatment on wood at all…

However I do believe that this treatment undoubtedly adds to weight, stability and resilience to the wood and it suits me to believe it improves the tone of the instrument. It would be fascinating however to do some experiments to analyse what effect it actually has on the sound of the instrument and whether it alters over the years as the oil within the wood continues to harden.

The result is that my instruments seem to prosper in various countries and very contrasting climates. I have no idea how many other instrument makers use this treatment. Undoubtedly there are possible modifications and improvements, but I have not pursued any as the process works for me... and life is short. Certainly if I had a more scientific mind, and an accurate set of measuring scales, I might derive pleasure from doing tests to determine the quantity of oil that is actually absorbed by weighing of different types of wood before and after treatment.

One of the outcomes of using this wood treatment is that it creates organisational and economic challenges for a professional instrument maker as one always has to plan production *months* ahead. When I am assembling a set of bagpipes and at the last moment find that there is a defective piece I cannot rush over to the lathe and create a replacement part that will be ready on the same day. It only takes finding one dud to delay the completion of an instrument by a couple of months.... and the dreaded email to the customer explaining the unexpected delay.

This is a practical account of what I do. Writing it has been enlightening as it has helped me to focus on aspects that I had taken for granted and others that I had not even considered. I now realise how little I know about the mechanics/physics of oil 'drying' or 'hardening'. I hope this Comm stimulates more discussion and clarifications from others. Jan has promised to give us his. Meanwhile I wait with anticipation to read about Jan's experiences of impregnating or sealing wood with oil.

FURTHER VIEWING

There are a few colour photos of my oil tank in action on my website in an article in the *My Writings* section entitled *Pipes Progress* that can be seen at
http://www.goodbagpipes.com/goodbagpipes/pipes-progress.html

There is also a tantalising short video snippet on Vimeo https://vimeo.com/54528497 that can be seen on *The Bagpipe Maker.* If you blink *at* 1.30 minutes you will miss it.

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