1.04 Rolling metal ferrules and tubes for Uilleann pipes.

Geoff Wooff.

A notable feature of old pipes (made prior to the 20th century) is the use of 'rolled' ferrules, made from sheet metals and solder jointed. The earliest sets have generally a minimal amount of metal parts, used only for support of joints or the transfer of wind between the wooden tubes. These old makers used the rolled tube out of necessity, seamless drawn tubes or 'round hollow section' not being available to them. However they made a virtue of this and produced work of fine proportion and exquisite craftsmanship in a variety of metals.

At the end of the 20th century, with access to ready made metal tubes, why should we bother to try to copy the old masters?

When I began pipemaking, over twenty years ago, I quickly found that the sizes of tubes and types of metals available were seriously limited. Brass was readily available but had the following drawbacks; usually it was too heavy in wall thickness, not available in enough variety of sizes and often contained lead for ease of drawing which did nothing for its finished colour. The resulting set made using these bought tubes can so easily be heavy and disproportionate. Other metals that one might wish to use were even less available or unreasonably costly, such as nickel silver or sterling silver. I considered neither copper or stainless steel as alternatives.

Examining the old sets available to me at that time and realising that all the tubes were made from sheet metals and seamed, I decided to look into the possibility of doing the same.

The earliest sets were made with brass or sometimes silver metalwork, later classic sets by Coyne, Egan and Harrington could also be found with nickel silver fittings. Sheet metals were readily available in these types and in varying thicknesses. I also realised that if I could make a good rolled ferrule, the costs would be greatly reduced.

On closer examination of the old makers work I found that some of the ferrules were tapered and whilst being aesthetically pleasing they had a function, of smoothing diametrical transitions and having a better supporting role on drone slides, because they can be "fitted" more accurately.

So, the making of a rolled tube, tapered or straight, in a variety of thickness', at any slight increment of diameter, in a variety of metals, was looking to me like a much more flexible alternative to bought-in tubing.

The method of making 'rolled' ferrules and tubes described below is that which I have used happily these past twenty years.

How to make Rolled tubes.

Materials: Sheet metals are available in various thicknesses. I use 0.5-0.6mm (approx. 0.020" – 0.024") for the lighter ferrules, drone joints and slider supports, 0.7-0.8mm (approx. 0.028 – 0.031") for more strength/weight and the 'Bends' of bass drones. 1.0-1.5mm thick for really heavy pieces like the Bass regulator connector tube, which is incidentally, tapered on the inside but not on the outside, as it is part of the bore.

Steel mandrels will be needed in all the inside diameter sizes you wish to make. These should be cut with plenty of length, ends turned square and centre drilled both ends. A slight chamfer is also needed at both ends of straight mandrels to ease drawing the soldered tubes onto them. Tapered mandrels need to be even longer than straight ones to allow for rounding up of the half-finished ferrule and to allow for a variety of sizes.

The angle of taper required must be decided upon before making the taper mandrels, I use (about) 1 degree included angle, or 0.01" per inch on diameter or 1mm diameter change in 100mm of length. A greater angle could be used too.

Soft iron wire (non-galvanised) is used to hold the seam closed during soldering. Use of galvanised wire will leave a zinc stain on the finished tube.

Silver brazing alloy (SBA) or silver solder rod.
Flux for the silver solder.
Pickling bath of dilute sulphuric acid (optional).

Other tools; metal snips or shears, bench vice, files, burnishing tool (very smooth hard polishing steel), hide mallet, steel rule, scriber, fine measuring callipers, wire cutters and small pliers, carborundum paper (wet and dry), polishing mops and machine to turn them, polishing compounds (buffing soap), heat source, gas torch etc and oh yes, a lathe!

The width of the ferrule, in the flat, is arrived at by taking the desired inside diameter, adding to that the thickness of the sheet metal and multiplying this figure by Pi, 22/7 or 3.142.

Example:

Internal Dia. 15mm + thickness of sheet 0.6mm = 15.6 x Pi = 49mm.
or 0.59" + 0.0236" = 0.6136 X Pi = 1.928"
(Whether or not this is technically correct, it works).

Remember that you have calculated the circumference and any errors will be divided by three on the diameter, so if you can make your piece to within 0.003" of the size then the diameter will be within one thousandth of a inch of correct.

Mark out your sheet to the calculated width and carefully shear off your piece. Some bending of the edges is inevitable so, with the hide mallet flatten any deformations in the piece on a flat surface.

With a good quality Vernier, dial or digital calliper, measure the width of the cut piece across its seam edges to determine size. This should ideally be a little larger than your calculated dimension.

On a flat abrasive surface (I use a large flat file mounted in my vice) draw the seam edge carefully across to straighten it. I use a steel ruler to check straightness. When you have the first edge straight, turn over the piece and straighten the other edge and carefully bring the width to the required dimension, checking that both faces remain parallel (in the case of a straight ferrule or tube).

A tapered ferrule is made by taking the maximum and minimum diameters required from the tapered mandrel, making the calculation for each of these and marking out the piece accordingly. It is even more important with the tapered ferrule to have the joint faces perfectly straight as one is only measuring at each end. It should be possible to achieve good accuracy with a little practice.

With the piece at the correct size the next step is to very slightly bevel the joint faces on the edges that will be inside.

As some metals are sold in a ‘half-hard’ condition your piece may need to be annealed. To anneal any copper based alloy (soften it), heat it till it glows dull red and quench in water. Care should be taken when annealing sterling silver that the metal is not too hot or the water too cold because silver conducts heat so rapidly that the sheet could shatter!

Before rolling an annealed piece, clean the joint surfaces back to bright metal with fine carborundum paper or a very smooth file to aid soldering.

Mount the mandrel in the vice with its top half above the jaws so that you can lay the piece along the mandrel and with the hide mallet start to turn the joint edges down. When you have the edges evenly beginning their curve (move the piece to line up centrally along the mandrel) you may need to position the mandrel such that you can, by hand, roll the piece right around it, which is what you should do next. With your hands press down, squeeze the piece around the mandrel, keeping the piece straight in line with the mandrel during this operation. Sometimes a little help from the vice is needed towards the end of the rolling to bring the seam edges close (soft jaw faces are useful here).

When the piece has been ‘rolled’ around the mandrel as uniformly as possible, mount it, with the mandrel inside, in the vice with the seam up. Using the smooth steel burnisher drawn along the seam any bumps or irregularities can be removed. The next stage is to remove the piece from the mandrel and bind up with soft iron wire to close the joint. A length of wire is wound round the piece at intervals, two or three turns and its ends twisted to tighten and close the joint. Ideally the joint should be fully closed, to give correct size and because silver solder is not a gap filler. So, the piece is ready for soldering. Although soft solder or lead solder is sometimes seen on old sets, these are usually repairs, the original work having been brazed or hard soldered. A flux has to be applied to the joint (usually a borax compound) ; this keeps the joint clean and allows the solder to run only where the flux is present. Apply flux to both sides, inside and out, of the joint, hopefully the solder will sit in the small gusset formed by the inside bevelled edges.

The piece must now be heated, in a safe place, on a fire brick using a gas torch. I use a simple propane torch as this is far cheaper to run than oxygen/acetylene sets. As the piece begins to glow red touch the end of the solder stick to the joint, momentarily. Capillary action should carry the solder along the joint line and very little solder is needed. You will need to move the torch along the joint and add very small touches of solder to get the job completed. When the solder has run successfully the whole length of the joint, remove the heat and allow to cool slowly.

When cool, carefully remove the wire bindings. The wire can become soldered to the surface of the piece and extra care is needed at each end. Wash the unwired piece in water and carefully remove any flux deposits, especially from the inside. Or dip into a pickling bath to remove all fire scale etc.

The soldered piece has now to go back on its mandrel, on which it should be a tight fit. With a parallel ferrule you will need to tap the mandrel in with the hide mallet. A tapered ferrule will slide onto its mandrel quite easily until it gets near to its dimensional position up the taper. The mandrel and ferrule are now mounted in the lathe for cleaning up, which can be done with a smooth file and abrasive papers. The burnishing tool can be used to improve circularity and to help draw a tapered ferrule to size.

Progressively finer grades of abrasive paper are applied to the spinning piece until the surface is smooth. Whilst still in the lathe the ends can be cut square and any line decoration added. Final polishing can now be done, with the ferrule still on the mandrel and using a buffing wheel or mop mounted on a spindle that rotates very rapidly on a high speed motor, such as one end of a small bench grinder. Various grades of buffing soap or compound can be used and the finer ones will give a mirror finish.

The parallel ferrule might slide off the mandrel at this stage or it might need to be driven off using a smaller mandrel and a large steel washer that just fits over the work mandrel. The whole lot being stood in the vice and the hide mallet used to drive the mandrel out of the ferrule. The ends of the finished ferrule will need cleaning up or de-burring and polishing.

The tapered ferrule usually needs to be removed from its mandrel by hand and is best loosened before polishing. Twisting this type of ferrule by hand with the end of the mandrel in the vice is my normal method of removal, a process not recommended for improving your tight triplets!

Tube bending.

Bending a hand-rolled tube needs special care as the wall thickness chosen is often much less than that of bought-in tubes. With the tube nicely soldered and rounded and driven off the mandrel the bending process is begun by first filling the tube with a malleable and low melting point metal. I use lead for this stage. I have heard of using soft or plumbers solder. Another metal, which is designed for this job, is a bismuth alloy called “Woods metal” which melts at 70°C. This metal has to be heated under water, to prevent oxidation, so it can make a bit of a mess when poured into the tube to be bent. However, after bending, the pieces can be dropped into the pan of water and heated, when all reaches 70°C the filler metal melts out leaving a very clean interior tube. This alloy is a little more brittle than lead and quite expensive too.

The use of the filler metal helps stop the tube collapsing when bent. My method is to stick the tube into a block of hardwood, into which suitably sized blind holes have been bored to hold it upright and stop the lead from running out. I then heat the lead in an old saucepan and when it is molten warm up the tubes to be filled with the gas torch and pour in the lead. It is necessary to keep the torch on the tube to be certain the lead has arrived at the other end still molten and thus fully fill the tube with no cavities or air pockets. If the lead has not solidified as a complete bar inside the tube it will not support the tube when bending and a fractured tube will be the result. When satisfied that the tube is fully filled with lead, allow it to cool slowly. When cool the tube can be bent using a suitable pipe bender. I carefully position the seam so that it is on the side of the bend as

I feel that it comes in for less stress in that position and gives easy access for repair should it open.

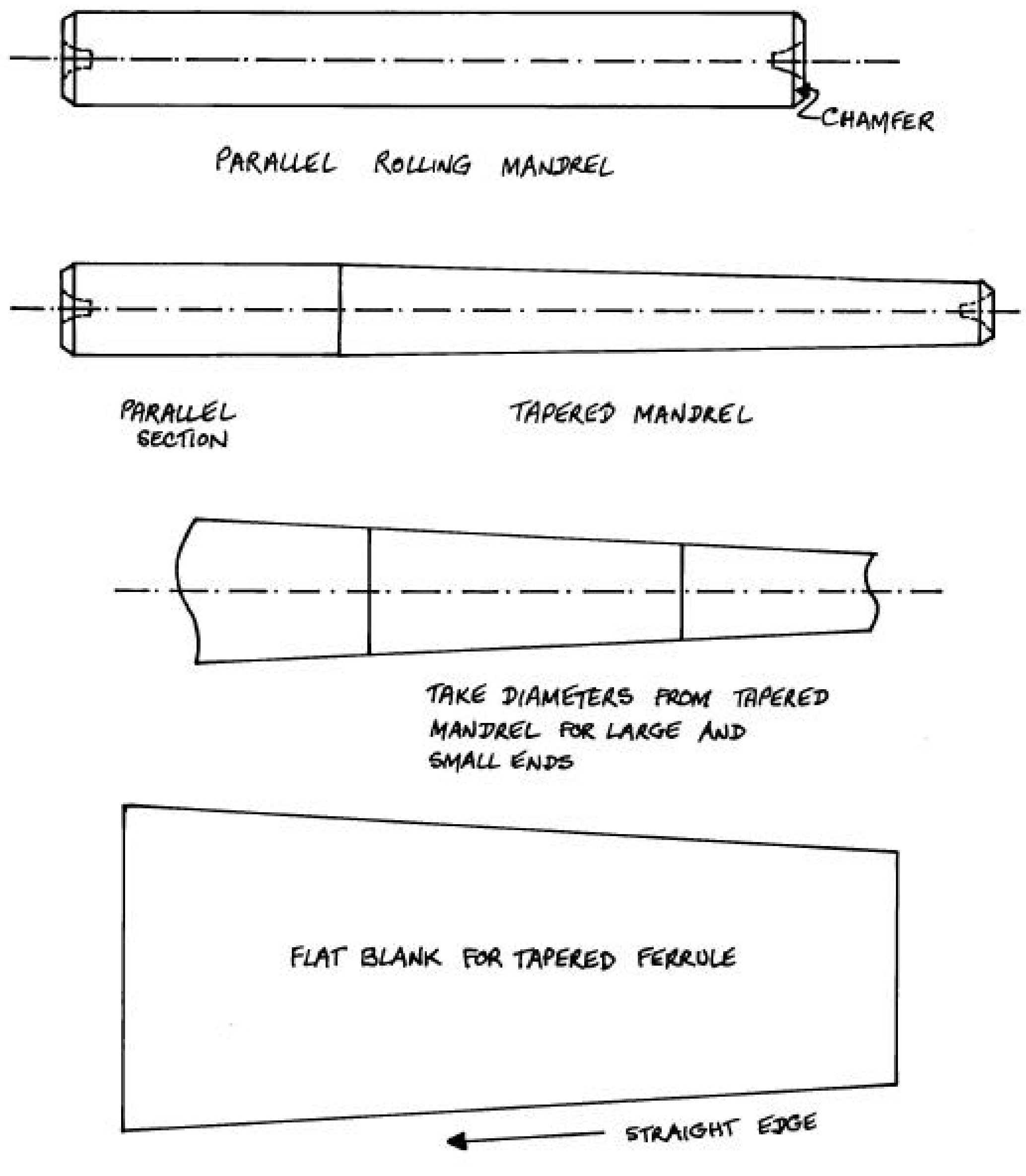
When the bend has been made successfully I beat the sides whilst the lead is still in, with a smooth faced steel hammer, in such a way that I change the cross-section to pear shape, the pointed end of the pear to the outer curve of the bend. This greatly strengthens the bend by work hardening the metal and forming a steeper outside curve to protect against flattening (when one drops the bass drone slide on a concrete floor, which is an inevitable event for this piece). The bend is also prevented from opening or closing its angle by this change of cross-section profile.

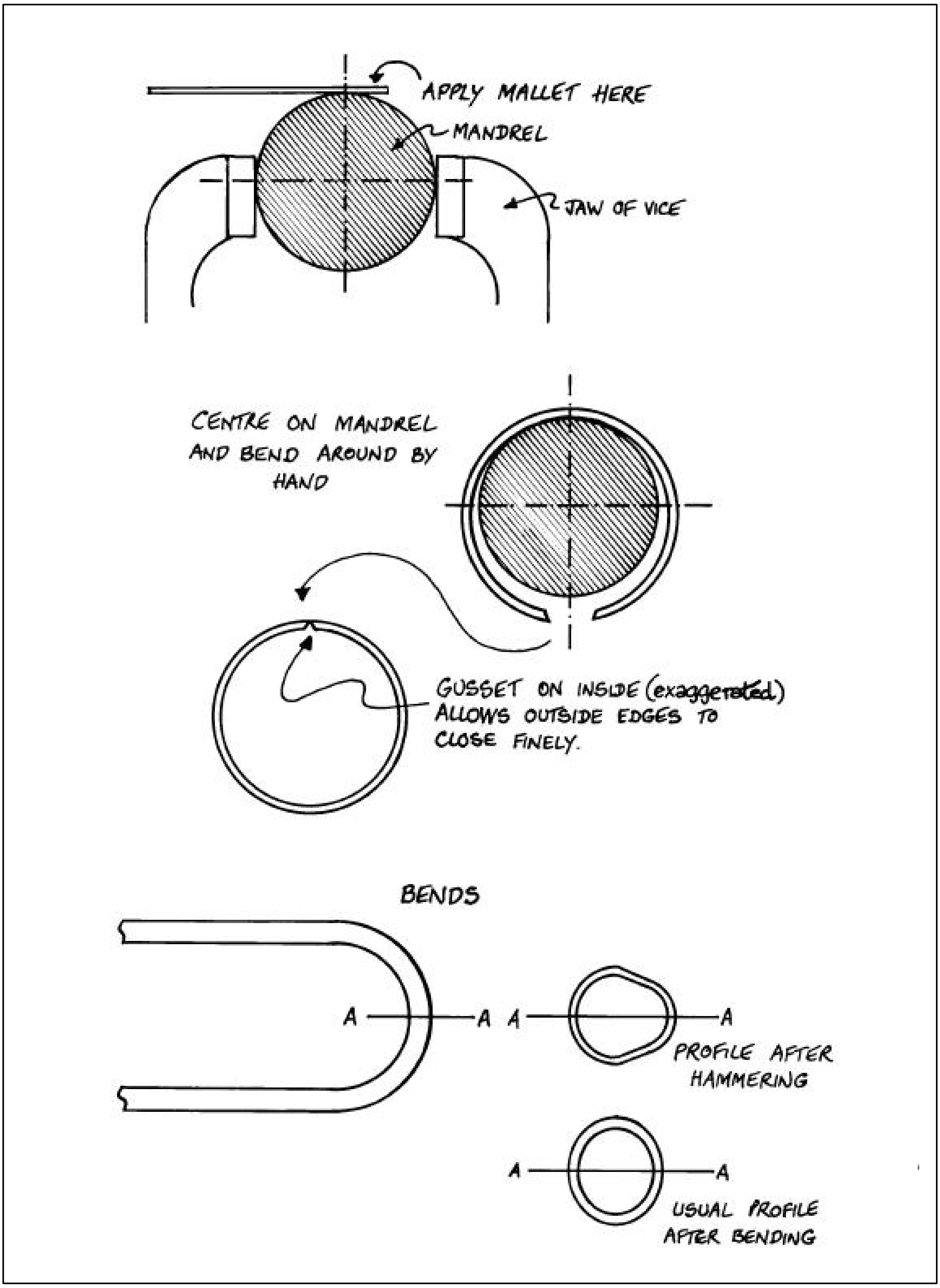
The next stage is to heat up the bend again with the torch - gently, to melt out the lead. Lead has a much lower melting temperature than silver solder but be careful not to apply too much heat at this stage nevertheless.

Although most of my tubes and ferrules are rolled from sheet there are some areas where the bought in ‘drawn tube’ is more ideal such as the tubes inside the hollow stock that carry the two smaller regulators. A smoother internal surface is the criterion in this case.

The tapered tubes are used on most of the bass drone ferrules and the sliders of the two smaller drones, the bass regulator separator cover and its wind cap. Making the metalwork in this way might appear difficult and time-consuming but with a little practice good work can me produced relatively quickly and at reasonable cost, with great satisfaction.

The following pages help to illustrate the technique.


CHAMFER
PARALLEL ROLLING MANDREL
PARALLEL SECTION
TAPERED MANDREL
TAKE DIAMETERS FROM TAPERED MANDREL FOR LARGE AND SMALL ENDS
FLAT BLANK FOR TAPERED FERRULE
STRAIGHT EDGE


APPLY MALLET HERE
MANDREL
JAW OF VICE
CENTRE ON MANDREL AND BEND AROUND BY HAND
GUSSET ON INSIDE (exaggerated) ALLOWS OUTSIDE EDGES TO CLOSE FINELY.
BENDS
A
A
A
A
PROFILE AFTER HAMMERING
A
A
USUAL PROFILE AFTER BENDING

End.