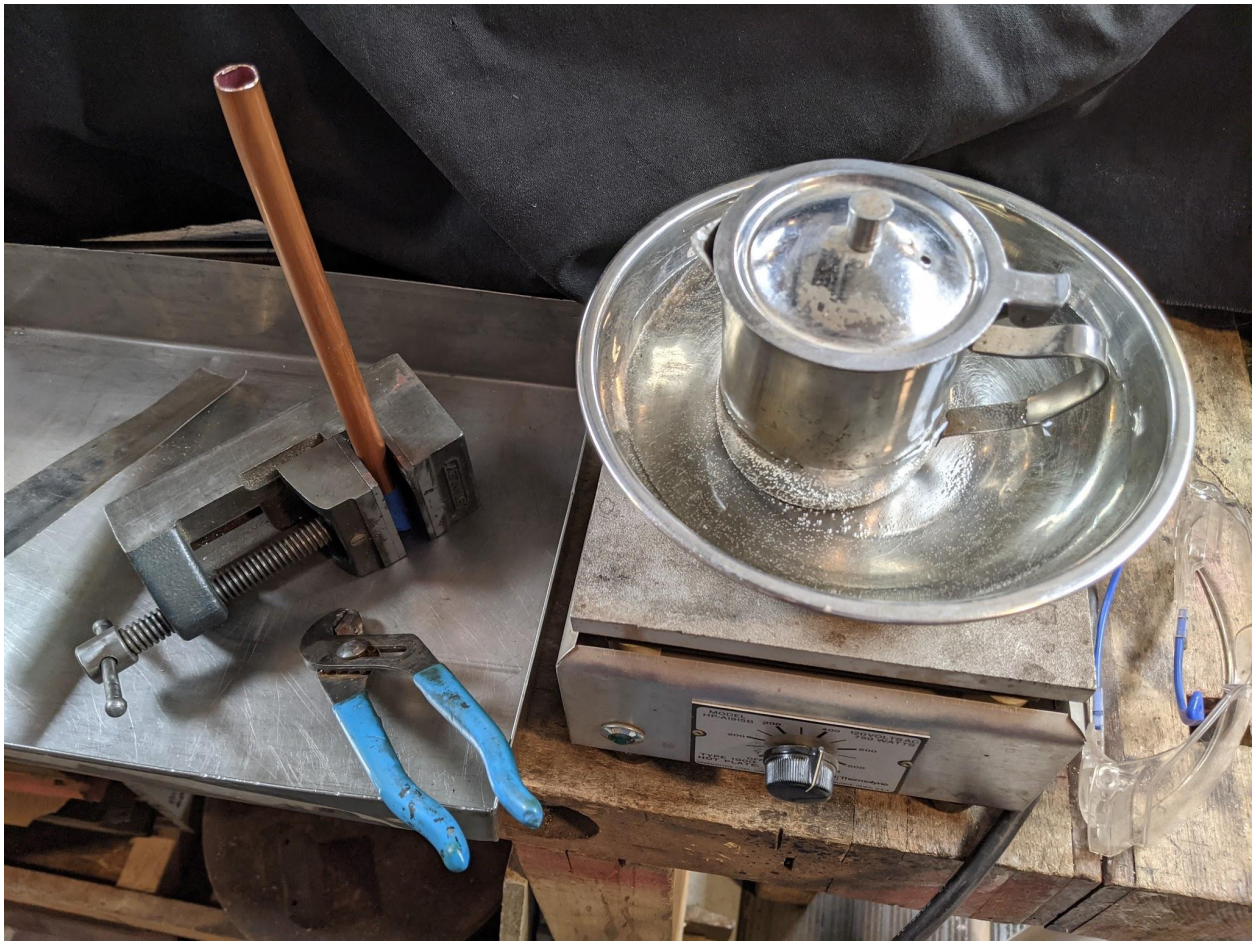
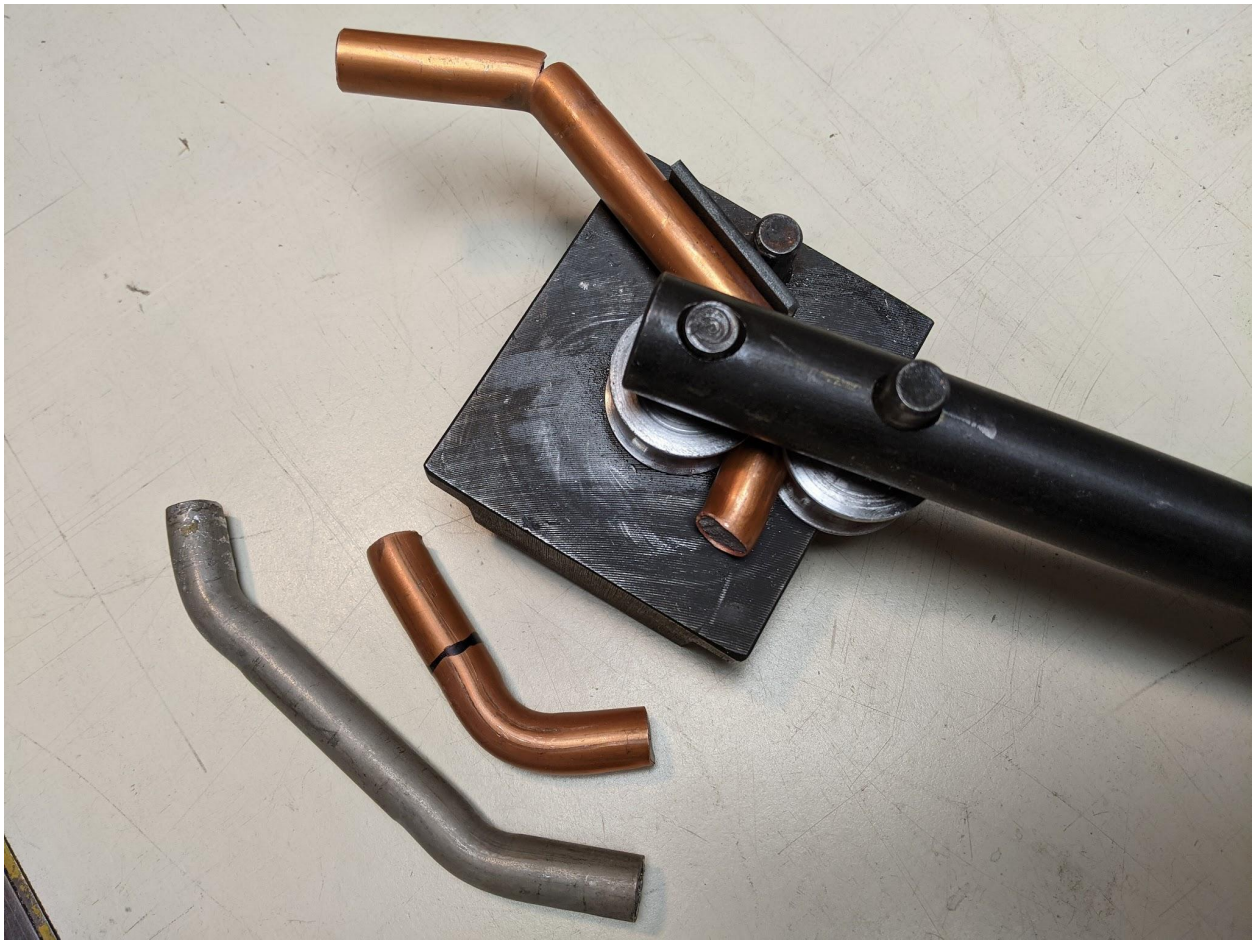
Shop Practice 9,
Charlie Reiter
Bending with “Woods” metal as a filler

The need to bend pipes for live steam projects is ever present. Most of the time a simple set of bending tools will suffice, but sometimes the shape or size of the bend requires filling the pipe with some material to make the pipe appear solid to the bender and to not just flatten or crush.
One very good method is to fill the pipe with a light sand and seal the ends shut. The captured sand then keeps the pipe from collapsing. I have heard of using frozen water as the medium too but have never seen it done. Another method is to fill the pipe with a low temperature alloy usually referred to as Wood’s metal or sometimes Lipowitz alloy. This alloy is a mixture of Bismuth, Lead, Tin, and Cadmium. Suppliers for this material were numerous but the main ones were American Smelting and Cerro. I believe American is closed and Cerro has been taken over by Bolton. Knowing the names is valuable because these materials can often be found on the recycling market, (ebay) and estate sales. The material to look for is Cerro Bend, which is their 158 degree version of the material. There is also Cerro Safe which is a 160 to 190 degree version formulated for castings like “tin soldiers”. The temperature required to melt is less than that of boiling water and this is the method most often used. You should have noticed that two of the metals in the alloy are considered to be poisonous, lead and cadmium. So safe handling requires gloves or at least washing your hands after handling and when heating not getting it any hotter than required. Heating with a torch is not a safe practice since overheating could cause fuming of toxic metals. Melting in a double boiler arrangement with water will keep the temperature below 212 degrees. Of course the material can be reused and should not be casually discarded since it is considered hazardous waste.
In my project I needed to make a couple of 60 degree elbows in ½ tube. I don't have a ½” bender and looking at a ⅜” bender I realized that in a commercial bender the radius would be too large. So I machined a pair of rollers to fit a bender I had. I started with a stainless tube but the radius could not be bent without flattening the tube so I substituted copper on the second try. My heating setup is a laboratory style hot plate and a bowl of water with a restaurant stainless creamer containing the alloy. I think the creamer is an ideal container for this material and it came that way. I got it at an estate sale where everyone thought it was lead due to the weight. But my hunch paid off and it proved to be Wood's metal. Incidentally B Woods was an American metallurgist who got the credit for creating the alloy.

Once the metal was fluid, which I measured at 120 degrees, I simply filled the piece of copper tubing I had prepared, by sealing the bottom with masking tape and standing it up in a drill press vice. That was placed in a tray to collect any spills.
When cool I tried making 4 bends. Two were successful but due the tight radius I broke the tube twice.
It’s a lot of effort for general bending but for those special bends it's another tool to use.

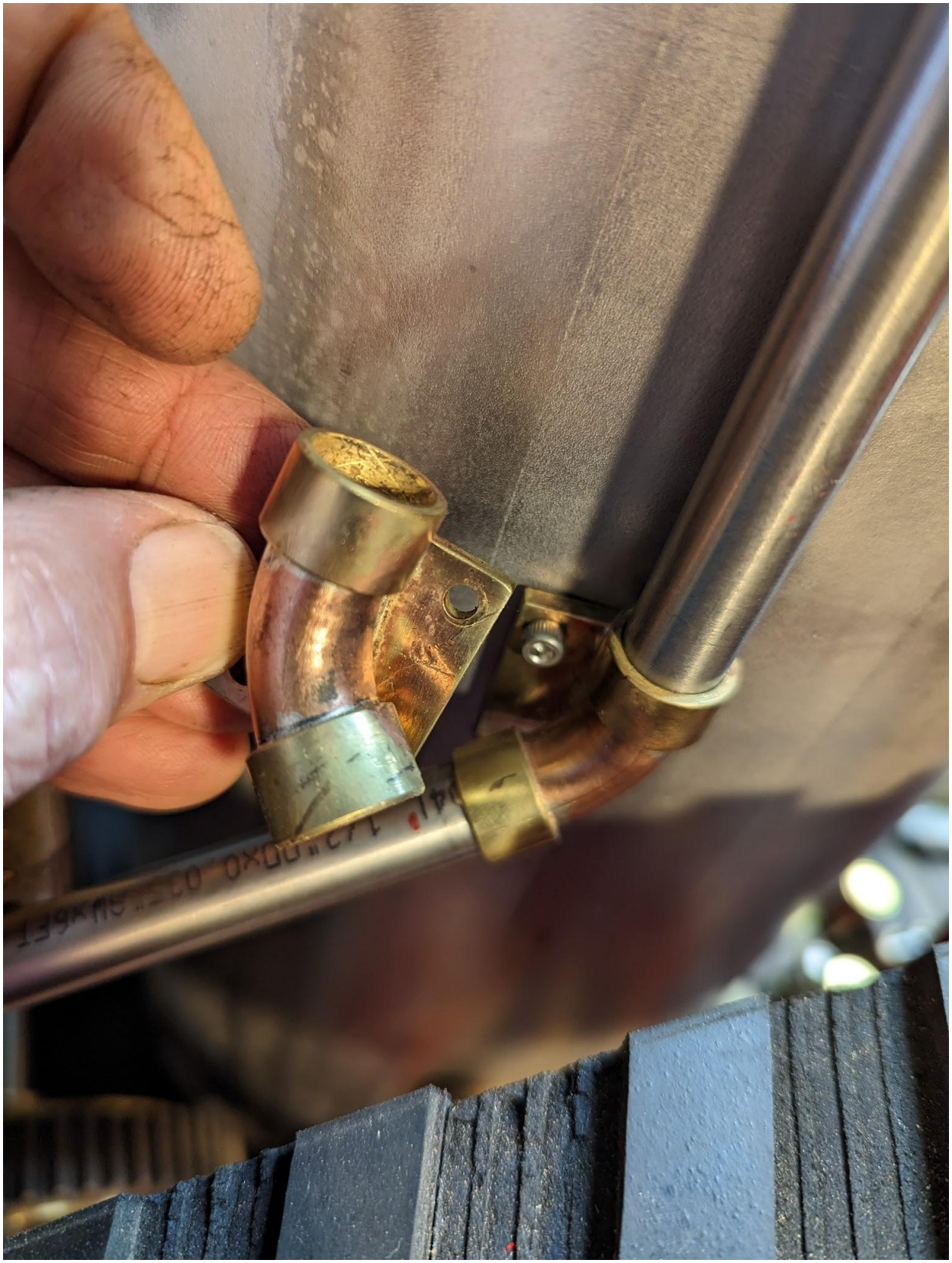


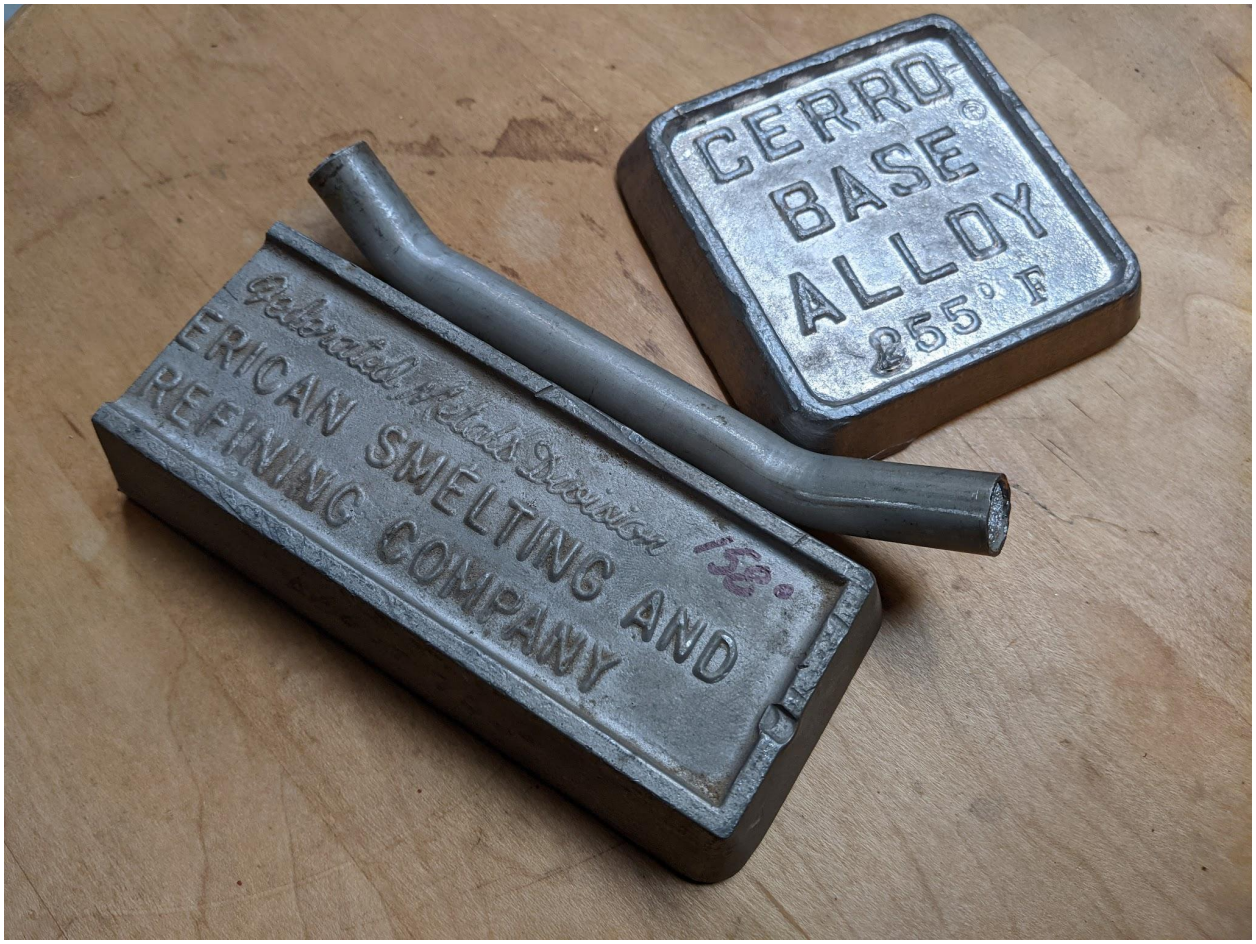
This is the setup used for the pore.



This is the bender with the two rollers and the bent parts, including the failed use of stainless steel tube. You can imagine the force necessary to shear off the tube where it broke. The dark line on the copper part is a trim line.

And here you see the finished parts, exhaust pipe bends. The sort of part that just recedes into the finished assembly, not showing the complexity of its creation. Incidentally getting the position right was a challenge too. The base plate was machined to create a seat for the fitting and then installed in the proper place. The tubes were then assembled and the fitting was super glued to the base plate. Once removed from the assembly a screw hole was drilled through from the back and a flat head screw installed after removing the glue. The parts were then silver brazed together.





Here we have the material as it comes from the maker just so you know what it looks like. The stainless tube at this point still had alloy in it. Little ingots are square or hexagonal in shape.