Steampunk – Wolf Pens Way

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A.K.A "Si90"

Steampunk as defined by the Urban Dictionary:

Steampunk is a subgenre of speculative fiction, usually set in an anachronistic Victorian or quasi-Victorian alternate history setting. It could be described by the slogan "What the past would look like if the future had happened sooner." It includes fiction with science fiction, fantasy or horror themes.

I have had a few requests and questions about the inspiration, design and production of my "Steampunk Collection" pens so I thought is was about time that I put all the details together in one place for anyone who wants it. I'll start with a bit of background information and then go onto a more detailed look at the actual build process. I am by no means an expert on anything this is just how I do it.

Stage 1: Inspiration

The first part obviously is the inspiration and ideas for the design. As it says in the title the first part of the inspiration is the "Steam" part and the second comes from the definition above - "Victorian". For me this conjures up pictures of Steam engines, pipes, valves, pistons, cogs, levers, girders, beams, gauges, industry, brass and copper. As an example of taking inspiration, I want to use the framework of an airship as the theme for a pen.

The next inspiration is the Science and Science Fiction part. Much of this comes from films and TV. These would include the original Flash Gordon TV series, Metropolis by Fritz Lang, Van Helsing, Frankenstein, Sky Captain and the World of Tomorrow, Wild Wild West, Hellboy and HG Wells and Jules Verne etc etc. This part of it lets you get away with putting things in that wouldn't normally be seen in a context of the Victorian era. Radio Valves and Nixie tubes are a perfect example of this. Far too advanced for the Victorians but just look perfect when used in a Steampunk project.

You have to look at things in a different way. Don't look at it for what it does but what it looks like. Is it an interesting shape, is it mechanical, complex, industrial. It doesn't matter whether it does anything, it should just look like it does something. I think "Steampunk" is all about the visual and the visual interest - what appears to be a modern or even complete science fiction function but produced with Victorian technology.

I am really a frustrated model maker - I have wanted to earn my living doing that since I built my first Airfix model when I was about 10. My perfect job would be working for a movie prop company so I think that really helps with ideas. I find I am more interested in the props used in films rather than the film itself. It's probably why I have sat through hundreds of REALLY bad films that most people would turn off after 5 mins just because I like the gadgets, props or the "look" of it.

I generally don't design anything on paper it's just in my head. I have designed on paper but tend to find my design becomes too elaborate which then gets me frustrated when I make it as its too difficult to replicate by my current methods of production.

Stage 2: Materials

I start with a kit and add to it. I don't have a metal lathe or mill nor the ability to use one. Hopefully that is something I may look at in the future. Most of the raw material is brass and copper rod, tube, profiles and sheet made for the Model Engineer. The 2 main companies making this are K&S Precision Metals and Albion Alloys. They both make a range of sizes and profiles. What is nice about them is that the tubes and rods are designed so that they are a perfect fit inside the next size tube up. This allows for nice joints and make it easy to vary the size of pipes for added interest. The profiles are not cheap as they are machined to shape but you don't use a lot on a pen.

You can buy a bag that contains off cuts. These are great because you get a wider selection of profiles and strip that you probably wouldn't want to get in large volumes. These are quite readily available on a well known online auction site or through online model shops.

There are also a number of companies making "detail up parts for model makers". These consist of Photo Etch parts or machined metal parts for replacing/enhancing the plastic kit parts. As an example you can buy machined tank/artillery gun barrels in a range of scales which are perfect sizes for a pen. Model boat fittings are also a good source of parts.

You can buy miniature functional nuts and bolts right down to 1mm made by a company called Scale Hardware. Again these are aimed at the "Model Engineer".

A word of warning. Anything aimed at the Model Maker is quite expensive especially in the case of nuts and bolts so I try to use those sparingly.

Plumbing fittings are also a good source of parts or just ideas. I have used a few Microbore fittings which are available in 8 and 10mm and also the olives from compression fittings.

Brass watch parts are also nice to incorporate into a design to add the mechanical/industrial look. Some of the thicker wheels are perfect for the wheel of pressure valves for instance.

Stage 3: Equipment and materials for soldering/brazing.

To join the brass parts you will be “soldering” or more correctly if using higher temperature solders “brazing” the brass. Here is some basic equipment you are going to need.

A heat source.
While it is possible to use a soldering iron on small parts the types of solder that this restricts you too is very limited. Also as I will discuss later you heat the joint NOT the solder. If you are working on a large piece of metal or joint a soldering iron just won’t get the area hot enough to melt the solder and allow it to run through the joint. I use 2 heat sources as pictured below. Both of these state a working temp up to 1300°C.

As a note. With soldering irons the wattage is not an indication of the temperature it can get too, just the speed it will get there and how fast it recovers when touched against cold metal. They all top out at about 450°C no matter whether its a 25W iron or a 100W iron.

Iroda SolderPro 120 - Butane powered soldering iron/blow torch. It does struggle a little when its very cold as it is quite a small flame so doesn’t cover a large enough area. Great for smaller joints and more intricate areas.

Standard torch bought from my local DIY shop. Great for larger areas or when its cold as the flame covers a larger area and generally has more oomph.

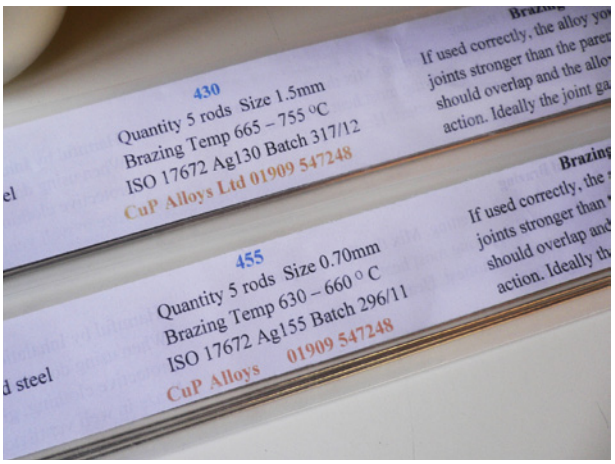
Somewhere to solder.

It should go without saying but it does need to be heat resistant. I use a small hearth (230mmx 230mm) made from Vermiculite Blocks but I suppose you could use matts aimed at the plumbing industry. The advantage with the hearth is that it gives a nice flat surface to stand things on and the sides reflect back the heat. The picture shows mine with an insulation matt in. You don't have to use it but it will stop scorching of the hearth and also helps keep the heat in the metal.

Solder and Flux.

The solder and flux need to be compatible with each other. Where you get the solder from should sell the appropriate flux. The best and strongest solder to use is Silver Solder. Effectively silver solder is just brass that has had an amount of silver added to it. The silver is used to lower the melting point to below that of the brass - the higher the silver content the lower the melting point. One of the advantages of this is that if the solder content is quite low then it will be a close match to the colour of the brass. The disadvantage is the much higher melting points than that of electronics and plumbing grade solder - way above what you can achieve with even the best soldering iron.

Flux is not universal as I mentioned, it has to be matched to the solder and materials that you are using. The role of the flux is to encourage the flow of the solder into the joint. It does this by running into the joint cleaning the jointing surfaces and removing any oxide build up from the heating process. The flux is usually a paste that is made up from flux powder mixed with water and a couple of drops of detergent.



Silver Solder temp guide

Low Temp Solder.
Melting point: 630- 660°C
Silver Content: 55%

Medium Temp Solder.
Melting Point: 650-750°C
Silver Content: 30-35%

High Temp Solder.
Melting Point: 740-780°C
Silver Content 18-24%

Pickle

When you braze your parts no matter what you do the metal will tarnish and oxidise – you have to clean this off. In some cases the flux could be corrosive to the metal over a long period. To clean this you use a pickling solution. Again where you get your solder from will usually sell an appropriate pickle. Much of these nowadays are Citric Acid. It's not as vicious as some solutions but much safer to use and dispose of. You can also buy it from a home brew supplies store in the form of Citric Acid Crystals. To make the solution **ADD THE CRYSTALS TO WATER IN SMALL AMOUNTS UNTIL THEY STOP DISSOLVING. DO NOT MAKE YOUR SOLUTION BY POURING WATER ONTO THE CRYSTALS.** The solution works best if it's warm so I use a camping stove to gently warm mine in a pan. You can buy a specific electric temperature controlled pickling bath but it isn't essential.

A WORD ON SAFETY: IT'S ACID. DON'T BOIL IT, YOU ONLY NEED TO WARM IT. DO THIS IN A WELL VENTILATED AREA.

When you have soldered your joint and it has cooled or you have quenched it in water drop the parts in the solution for 20 to 30mins which should be sufficient to clean off the residues.

Other things you will need

Something to cut and shape parts will be required. I use a Dremel tool for this. You could also get a rod and pipe bender specifically for the small sizes of rod and tube you will be using. I don't use one yet so I have restricted myself to only bending rod. For this I use a bench vice and bend by hand occasionally using drill bits as formers. Most of my bends however have just been basic tight 90° bends against the jaws of the vice.

You will need some way of holding the parts together while you solder them. If you are making a simple joint using tubes or rod and are butting them up then I have seen people use a block of wood and use nails to hold the parts in place. Obviously the wood will burn so it could contaminate your joint but it is a good way to hold the parts in place. It only allows you to heat one side so you may have to flip it over and apply heat again to ensure the joint is fully brazed.

I use a helping hand (as pictured). Wire can also be used to hold the parts together and tweezers. Crocodile clips are also useful to hold things together but also as heat sinks to put near pieces you have already brazed. They will take some of the heat away so that previously made joints don't fall apart when you make the next joint.

A nice set of needle files, wire wool and some fine grades of wet and dry for cleaning up joints, stubborn tarnished areas and any solder that has run where you don't want it.

Finally you'll need some polish to shine up the parts further after pickling and filing. I use Autosol Metal Polish initially then follow that up with Renaissance Pre-Lim Surface Cleaner and finally 2 or 3 coats of Renaissance Micro Crystalline Wax Polish.

Soldering/Brazing

I'll start first with some basic Safety rules

- **Work in well ventilated areas.**
- **Wash hands thoroughly after soldering or brazing.**
- **Use protective gloves and goggles at all times.**
- **Do not eat, smoke or drink while soldering or brazing.**
- **If you notice anything unusual - stop brazing and seek advice**

Silver soldering or brazing is a simple process capable of producing strong joints in a wide variety of material combinations. Although its a simple process it is a skilful one. It is a series of basic principles that if you stick too will produce a very successful and strong joint. Deviating from them is usually when the problems occur.

I feel I should clarify soldering and brazing. As far most are concerned if you are working below 600/610°C you are soldering, above this you are brazing. The term is dictated by the temperature you are using not the materials.

British Standards define brazing as :

"A process of joining generally applied to metals in which, during or after heating, molten filler is drawn into or retained in the space between closely adjacent surfaces of the parts to be joined, by capillary attraction"

The key to brazing is capillary action. Everything that you do, joint design, fluxing and heating should be done with the aim of promoting capillary flow of the solder into the joint.

Brazing Step 1: The joint

When you join the parts you want the solder to flow into the joint so therefore you should have a slight gap in the design of your joint. The size of the gap will depend on the solder you are using. High Silver content solder (low melting point) will tolerate the tighter gaps in the region of 0.05mm - 0.15mm as it flows most readily. Low Silver content solder (high melting point) requires gaps of 0.2mm as it flows a little less. You need to keep the gap in mind when you are holding your parts together for brazing so you may have to work this into your joint design. Don't clamp them too tight and eliminate your gap as the solder can't flow into the joint. On a pen the joints will be very small so you won't have long joints to get the solder to flow along and have to come up with fancy joints with spacers built in etc. A pen also isn't subject to much structural stress so again as long as you get flow into the joint you should be OK. To be honest unless you are using a mill and machining to create mating parts there will probably be enough gap inherently in most cases.

Number 1 rule for joints: No gap = No capillary flow = no joint

Brazing Step 2: Be Clean

The golden rule for a strong joint is that all joints are perfectly clean before brazing but you don't have to spend time making it surgically clean. Contrary to what you may think its how clean the joint is at brazing temperature not room temperature that is the more important. When you braze the heating process will be creating more oxide than you will have cleaned off. The function of the flux is to keep the joint clean by removing the oxide as it's created during heating. You should however, make sure you have removed any oil or grease from the joint with warm soapy water or solvent before brazing as this could inhibit the performance of the flux. If you do need to use an abrasive use wire wool if necessary not abrasive papers as they may leave deposits that even the heat and flux cannot remove resulting in a week joint.

Brazing Step 3: Fluxing, applying the solder and pickling.

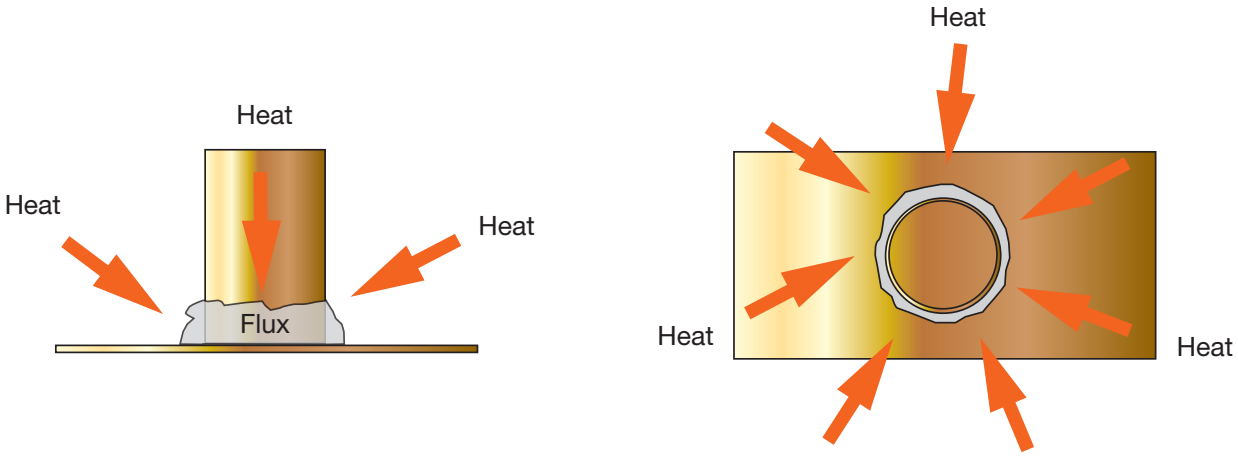
You should apply a good amount of flux around the joint. Not enough and it will be burnt off before it has had time to do it's job. You can tell if you haven't used enough flux as your solder will remain as a ball and not "wet" and flow into the joint no matter how much heat you use.

The flux will undergo a number of changes as you heat it. These can be used as indicator of when to apply the solder.

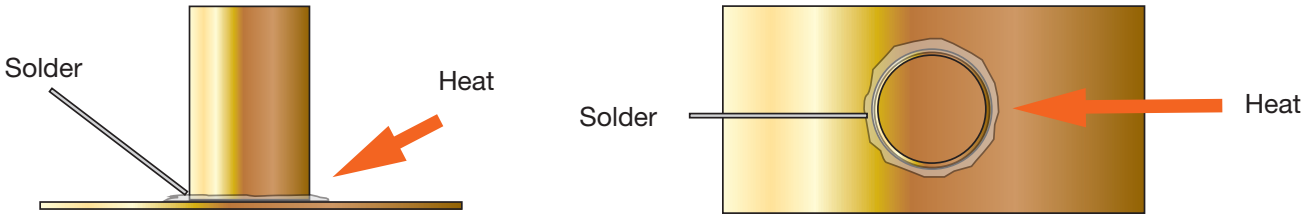
1 The water will be driven out of the flux and it will turn white
2 The flux melts and appears to sweat
3 The flux will become a clear liquid - this is its working stage.
4 The flux flows by capillary action into the joint cleaning it as it goes.

Once you have positioned your fluxed parts apply heat evenly around your joint to raise it to the melting point of the flux and solder. Once the flux has run clear and sucked into the joint continue to apply further heat to one side of the joint only. Apply the solder to the opposite side of the joint that you are heating. As you continue to heat the joint metal will get hot enough so that the solder melts when you touch it onto it. Once the solder has melted, as you continue to heat it will then be sucked to the hotter side of the joint by capillary flow filling the joint. Once you see it flow through/around the joint stop heating, further heat could weaken your joint. Solder will always run towards the heat.

THE GOLDEN RULE OF BRAZING: HEAT THE JOINT NOT THE SOLDER



Heat the joint evenly around the entire joint until the flux runs clear like water.



Once the flux runs like water, heat the joint on one side only while applying the solder to the opposite side. Continue to heat on one side only until you see the solder run around or into the joint.

Once the joint is made you can let it cool or quench it in water and then place it into your warmed pickling solution for 20 to 30 mins. If you have followed these simple steps you should have produced a nice strong and neat joint. **DO NOT PLACE THE HOT METAL IN YOUR PICKLING SOLUTION.**

Obviously if you are making a second joint close to another you run the risk of melting the solder in your first joint and it coming apart. In this case you can step solder. Make your first joint with high melting point solder and drop to a lower one for your second joint.

All that remains is to make the rest of you parts in your design, clean and file your joints if necessary, polish and assemble your parts and sit back and admire your work.

A couple of final considerations.

If you want to make your pen have an old worn look gentle application of heat in strategic areas will oxidise the brass and add the aged patina. Obviously do this before any plastic parts are used or if you are using any kit parts etc.

I have made pens that wouldn't withstand the pressure of having kit parts pushed in them. Keep this in mind when building your pen. You may have to make a jig to put them together. Sand kit couplers down to reduce the pressure required to put them in. Sand them so you can push them in by hand or to the point where you have to make them an easy fit and glue them in.

If anyone needs more information or has any questions please feel free to contact me via the IAP - user name Si90. I will be more than happy to help out if I can.