

# A Look at the Low Cost and Methods of Hydrogen Torch/Upright Spin Casting of Platinum Alloys.

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This paper will describe in moderate detail the equipment, tools and methods appropriate to casting platinum on a minimal budget and work area. This method uses hydrogen and oxygen as fuel and oxidizer. An upright centrifugal casting machine is the most efficient to use for smaller scale production. These tools amount to a relatively small investment of funds. Far more small manufacturers have the ability to equip themselves to cast platinum than one may expect.

For those of us who cast in gold, platinum casting work is reasonably familiar. We have the familiar elements of waxing, investing, an oven burnout and a hydrogen torch melt. Then an upright "Ferris wheel" centrifugal type of casting. We even enjoy the same sequence of inspections for quality control- model, mold, wax, tree, casting and prepolished castings all need careful attention before stones are set or more work is performed. The less familiar aspects derive from the high temperatures involved with platinum along with its high purity compared to gold jewelry.

The first unfamiliar procedures relate to the latest generation of platinum investments. These investments all come with specific instructions that must be adhered to in every detail. The new powders need acid in addition to water, (preferably deionized water) to make a mild acid solution. These new investments all require the use of a porous paper sprue base so that the solution can drain from the invested flask. We at Precious Metals West use newspaper for the flask base, which we seal around the base with molten wax. One must sprue as appropriate to a high temperature fast freezing metal like platinum. This means while you are new to casting platinum, keep the design simple *and as you design*, keep spruing needs in mind. The details of how each investment is prepared do vary... but all share the paper base, acid binder and a need to be mixed and vacuumed to remove air pockets. The mixed, vacuumed investment is poured into the flask that is then again subjected to vacuum. It is very important to note that during mixing, the newest investments give a *false* impression of dryness. They look too dry, almost like a cake batter that lacks adequate water. The solution and powder mix with a very odd look, slowly liquefying, and upon pouring somehow appear both liquid and rubbery. Descriptions of this odd consistency include yogurt, toothpaste and pudding. It will not truly solidify until it is in the oven. Trust the investment procedure as given by the investment manufacturers.

After the recommended burnout ramp and timing, (be sure to check the charts usually included by the investment maker) the flask

is ready to cast. Generally speaking 1500°F to 1600°F is the correct flask temperature for most platinum castings. Take careful note of that oven temperature! Be sure your existing oven will operate properly at those high temperatures, and calibrate at those temperatures. If your existing oven fails to perform, I suggest a small electric oven, available from most equipment suppliers.

The most unfamiliar aspect of platinum is its extreme casting temperature. All of us who cast gold are accustomed to working in the 1700°F-2100°F range. Platinum melts in the mid 3500°F range, depending on exactly what alloy you prefer. Here is the most dangerous part... You will need special safety goggles or a face mask to protect you from radiation produced by the molten platinum. We use goggles specifically rated for platinum use. A small amount of molten platinum usually escapes from the crucible flask/seam during casting. To protect your workers from this hazard, a safety shield must be installed around the perimeter of the swing arm/crucible assembly. Also, use casting gloves and proper protective clothing.

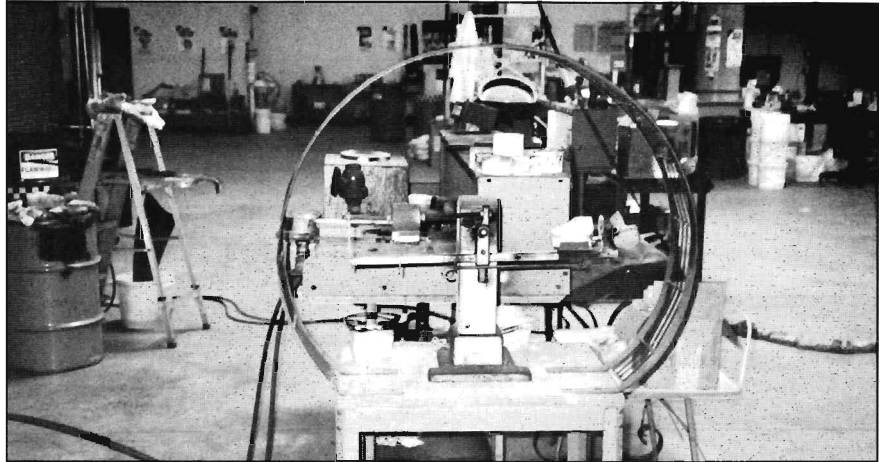
Since this paper deals with torch casting, precise flow temperature is not important to know in a numerical sense. The correct temp *must be recognized by sight*. Experience pays well.

The high heat brings up the need for a very special crucible to melt the platinum in. The most common, the WESGO crucible, is silica bound by flux. Unlike gold casting, this crucible *barely* tolerates the melt temp of platinum. If the metal is held molten too long, the crucible actually melts and can

make Pt/Si compounds that do cause casting flaws. A fast oxidizing flame from a hydrogen (the cleanest available gas) torch is the best heat source. The oxidizing flame prevents Hydrogen/Pt reactions that would otherwise cause brittleness. (show the proper ratio and chemical formula) The extra O<sub>2</sub> also boosts the heat enough to melt Pt efficiently and quickly.

The very nature of platinum is that it freezes solid very, very fast. For this reason we suggest two people be on hand to cast platinum. Both must observe all safety precautions. One will melt the Pt while the other stands ready to get the flask out of the oven and place it carefully in the casting machine. As soon as the metal is properly molten, have the second employee get the flask out of the oven and carefully place it in the cradle on the casting machine. *Be sure the flask is properly secured before casting.* With the flask secure, get the torch out of the way of the swing arm, and immediately hit the release bar. The swing arm will violently accelerate and spin at high speed forcing the molten platinum into the flask before it can solidify. Some (very little) molten platinum will usually escape during casting. If there is an unexpected problem with the flask, *all* the molten platinum can escape at great hazard and expense.

After the flask is removed, the cooling period before you hammer out the flask will be under one hour. Be sure to wear a respirator any time you work with, hammer, or quench all types of investment. After cooling, wear protective gloves, set the flask on a tray on the ground. Hammer the flask gently from the button side until the investment breaks up and the casting falls from the rest. Rinse in cold water. Remove as much in-



vestment as possible by hand with small tools.

From a safety standpoint, the worst acid we use in our trade is hydrofluoric acid. Any human flesh contact with this very dangerous acid will require medical attention right away. This acid is very good at devesting cast platinum trees. Since we refine gold at our shop, we are properly equipped for handling and disposing of acid waste. Most of you reading this need to look into alternative devesting methods which include pressurized water, bead blasting and tumbling.

When all investment is removed from the tree clip and carefully inspect your castings. Do all spruce grinding, filing or sanding at a bench set aside for platinum. Gather all platinum dust and scrap frequently and set it aside in a safe location to accumulate to a quantity large enough to refine efficiently.

A final note for those who implement this method... Every supplier worth the money will assist you in working with their product. From the equipment and tools, through the investing, and the clean up, environmental supplies and the rest. Call these folks when you have any question on the use

of their product. Key players include your platinum grain supplier, the investment manufacturer, and the equipment dealer. Key components include the casting grain, the oven, the oven controller and the investing equipment. The casting machine we suggest is a very simple mechanical device. With proper maintenance, it requires attention proportionate to its simple design.

### *Biography*

Daniel Ballard is fourth generation raised in a family of gold and platinum jewelry manufacturers. He was with the family firm "Ballard & Ballard/Arthur Ballard & Son" from 1976 until 1981. He then went to work selling gold/platinum settings and findings (for Baker/Eichmuller) until 1986, when he went to work for Precious Metals West. In his first few years with PM West, he spent the first half of each day working in the PM West Fine Gold factory. His position with PM West is National Sales Manager and he handles most tech support for PM West products. He can be reached at 1-800-999-PLAT or E-mail Daniel@Westworld.com