IMPROVED Garage Nickel Plating and Steel Polishing

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Agenda

1. Plating basics
2. Imperative of Surface Prep
3. Stripping Old Plating
4. Reverse Electrolysis for Rust Removal
5. Resurfacing to Reduce Corrosion Spots
6. Steel Polishing: Flatness v. Smoothness
7. Nickel Electroplating to Steel

Improved Plating Results

Plating with Twice the Quality and Half the Time as My Previous Process

Hand Tool Plating History

- Stanley began nickel plating tool parts in 1888, then nickel plating was the standard for plating steel tool parts until about 1955.
- Chrome largely replaced nickel plating around 1956.
- The initial standard for chrome plating was “show plate”: first a thin layer of copper, highly polished, then nickel, then chrome.
- To save money on the process and labor, most tool parts were just chrome plated directly to steel beginning in the 1980s.
- To save even more money on labor, industry then stopped polishing steel tool parts before chrome plating, and chrome plated directly onto machining marks.

Chrome Stripping and Plating is Not Worth the Hassle

- Chrome stripping and plating involves significant toxins and harsh chemicals, e.g., hexavalent chromium.
- Stripping chrome show plate: First a lye bath to strip chrome, then nickel stripper, then industrial peroxide (40%) to strip copper.
- Replating chrome show plate: You can’t electroplate copper directly to steel - you must either use a flash copper process or first plate nickel, then copper, then nickel, then chrome.
- Chrome plating involves a process of up to a dozen chemical baths and electroplating steps, depending on what you are starting with and the quality you want to achieve.

Types of Nickel Plating

- Most vintage tools worth collecting and preserving were manufactured with nickel plating between the late 1800s and 1955. So nickel plating is all you need for vintage tools.
- Three ways to nickel plate:

1. The inexpensive method using non-toxic chemicals covered in today's presentation.
1. Electroless nickel plating: See https://caswellplating.com/ for more information.
2. Expensive, more complex process on next slide.

ALTERNATE Multi-Process Professional Quality Nickel Plating

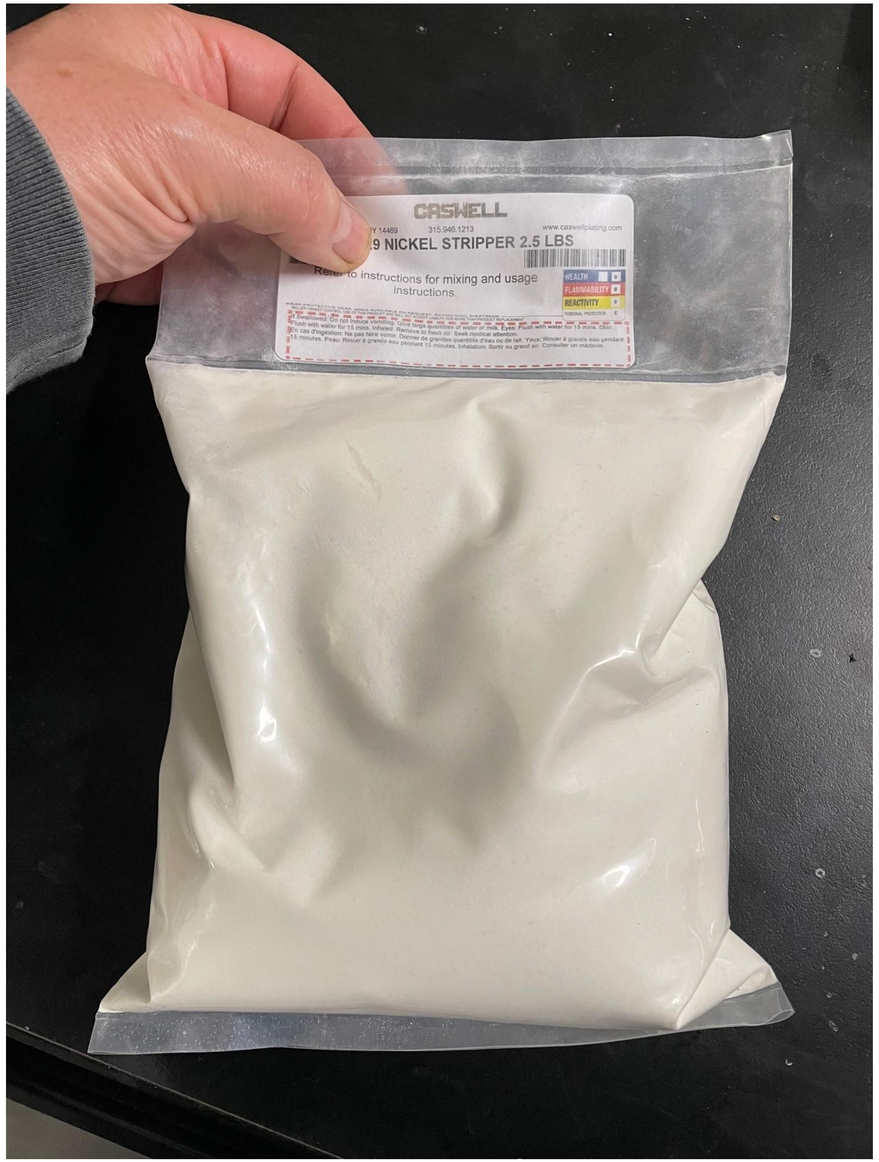
- After all resurfacing, buffing and pre-plating cleaning steps, use Caswell flash copper process to direct plate copper onto steel. Buff copper to a mirror shine.
- https://caswellplating.com/electroplating-anodizing/copper-plating-kits/flash-alkaline-copper-plating-kits.html
- Smear Solder-It Solder Paste https://amzn.to/3sY3x4p onto your part to fill scratches and corrosion marks, then melt it onto your part to fill pits and scratches using a butane torch. Buff residual solder from your part.
- Nickel plate using Caswell Bright Nickel Electroplating Kit https://caswellplating.com/nickel-electroplating-kit-1-5-gal.html

Nickel Electroplating: Cleaning Your Parts

Use an alkaline-based paint stripper and/or acetone to remove paint, glue, and oil residue, then thoroughly clean with Simple Green to avoid contaminating the stripper solution.

Nickel Electroplating: Stripping Your Parts

At $29, Caswell B9 Nickel Stripper is the only one step nickel stripping solution on the market. This amount provided will strip more than 100 lever caps. Be SURE to get the B9 formulation. https://caswellplating.com/metalx-b-9-nickel-stripper-2-5lb.html

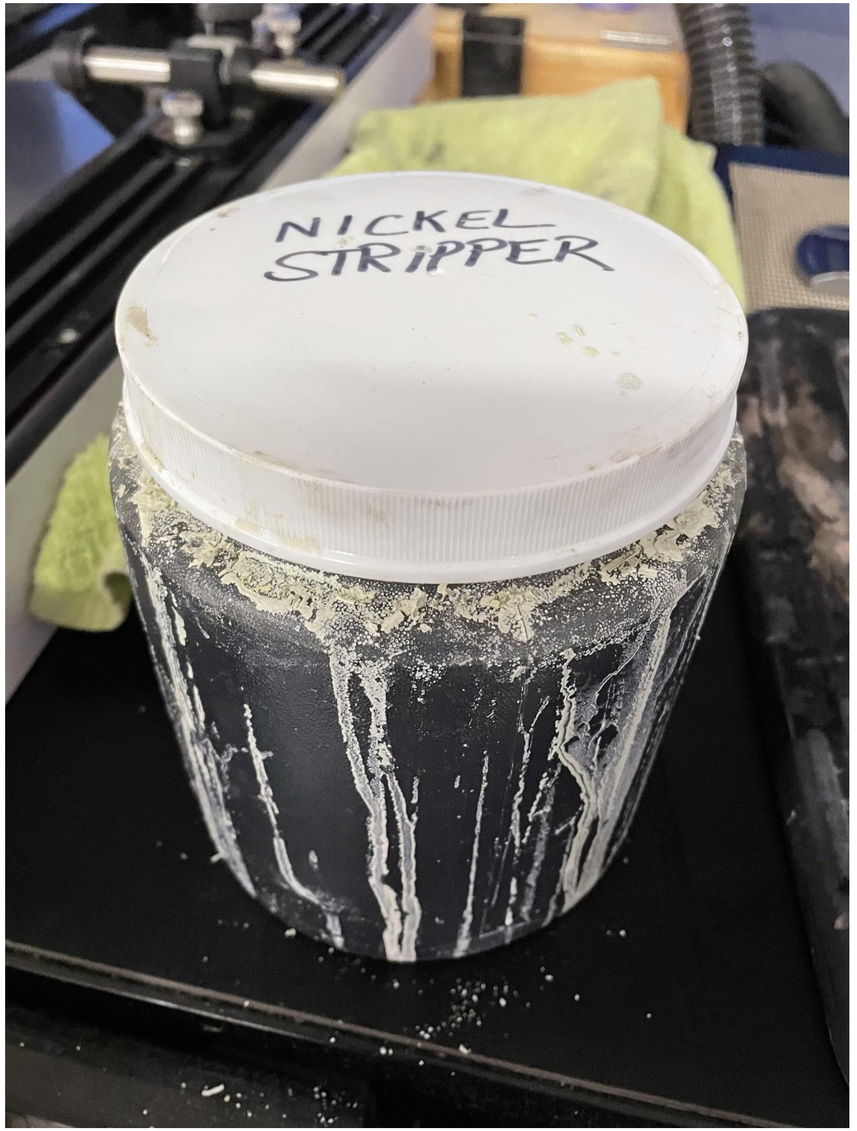


Nickel Electroplating: Stripping the Old Nickel

- The nickel stripper solution must be heated to 150 degrees F (65 C) and maintained at that temperature for the duration of the bath.

- I mix half the provided Caswell product in a half gallon microwave safe plastic container, fill almost to the brim with water, mix, then microwave the container for 10 minutes to achieve the initial temp. DO NOT SEAL THE CONTAINER WHEN MICROWAVING.

- I then immerse 3-5 lever caps in the solution and maintain the temp for about 2 hours.



Nickel Electroplating: Stripping the Old Nickel

- I place a radiant heater on high directly in front of the microwave container with solution to maintain the 150 degree F temp for the duration of my bath.
- You MUST occasionally stir the solution during the bath. I do so about every 15-20 minutes using a simple stick, and reposition the lever caps in the bath with the stick.

The Product of Nickel Stripper is Smut

- After the nickel stripper bath, let the solution cool and put it back into your paint cabinet. After my first 5 uses, I replenish with about ¼ cup of additional powder each following use. I'm still on my first package after 1 year.
- Smut is the technical name for the dense black residue that remains on your parts after the nickel stripper bath.
- Kill two birds with one stone and remove the smut AND all rust from your part at the same time with reverse electrolysis.

Reverse Electrolysis: A Chemistry Lesson

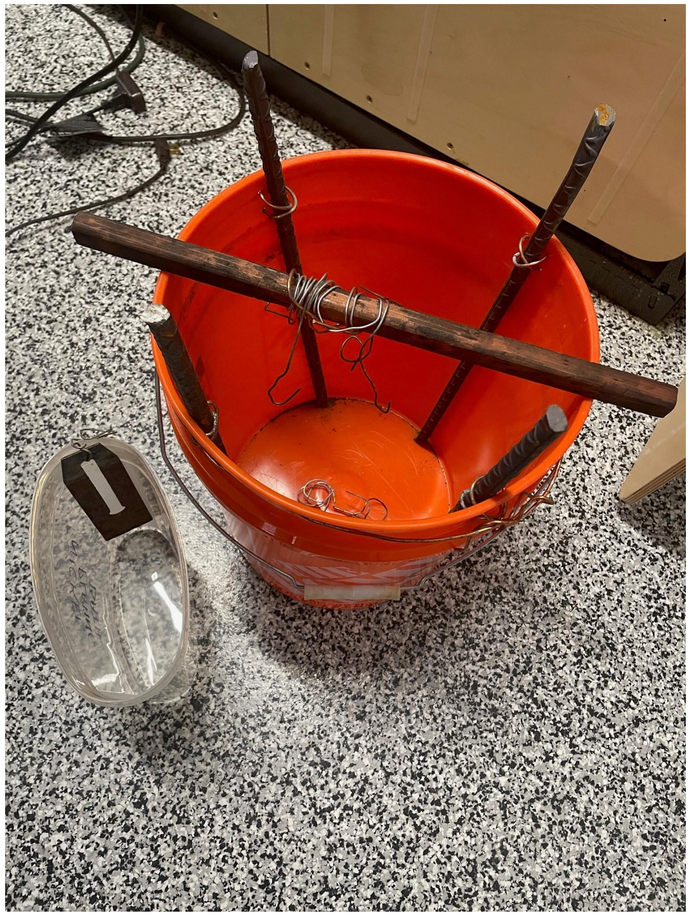
- Iron corrosion (rust) is formed by oxidation through a naturally occurring electrochemical process.
- The process to remove rust from iron involves reduction rather than oxidation so it is reverse electrolysis.
- Reduction involves the gain of electrons, which is a decrease in the oxidation state of an atom.
- In reverse electrolysis, water is oxidized at the iron anode (positive, red); which produces O2 as the anode corrodes and ions from the metal enter the electrolyte solution.

Reverse Electrolysis: A Chemistry Lesson

- At the iron cathode (negative, black), the DC power source drives the ions to the rusty iron part which accepts the ions (electrons) and produces hydrogen bubbles.
- Two types of rust: orange (Fe_2O_3) and black (Fe_3O_4).
- During reverse electrolysis, the orange rust is exfoliated into the solution, while some of the black rust is reclaimed and reduced back to metallic iron!
- Pits in the iron/steel were formed by the orange rust and cannot be restored. But surface black rust will be stabilized and hardened with new electrons to reform the iron/steel.

Reverse Electrolysis: The Bottom Line

- Reverse electrolysis is the best way to remove smut, stabilize the surface of your part, and best prepare it for plating.



Reverse Electrolysis: What You Need

- For an electrolyte solution, use ½ cup of sodium carbonate (NOT sodium bicarbonate) in about 4.5 gallons of water
- Run DC power supply current at about 1 amp for about two hours.

Sodium Carbonate

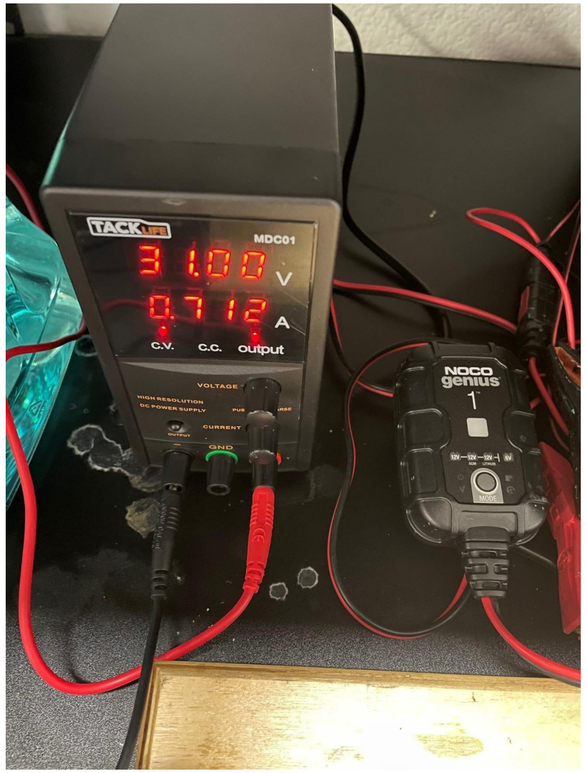
https://amzn.to/3wjNmQS

Inexpensive power supply

https://amzn.to/39vEQ7B

Better power supply for plating

https://amzn.to/2PuSLUD



Don’t Connect the Polarity Backwards!

- For both reverse electrolysis and electroplating, the red/positive/anode is ALWAYS connected to your sacrificial item.
- The black/negative/cathode is ALWAYS connected to the part you want to derust or plate.
- If you reverse the polarity, you will destroy your part.

Cleaning After Reverse Electrolysis

- Immediately after removing parts from the electrolysis bath, clean them avoid flash rusting. Get oil on your parts and clean them using a handheld brass brush or ultrafine scotch brite pad. I use CRC 3-36 solvent/oil.

Same Lever Cap, 3 Different Processes

Before Stripping

1st attempt:
Lapped Below Logo Only then Plated

2nd attempt:
Additional Lapping and Hand Sanding then Plated

3rd attempt:
Abrasion and Polish with Die Grinder, Hand Sanding then Plated

Resurfacing Lever Caps: Understanding Flat Versus Smooth

- Flatness is a scientific standard, e.g., the British Standard for flatness of a metal wood plane sole is .0015”.
- Smoothness is visual, i.e., a shiny surface appearance.
- If your goal is to achieve the best overall appearance on your cap within a reasonable prep time, you want to flatten (lap) the lower portion of your caps and make the upper portion smooth.
- Use a lapping plate to flatten lower area, then use a die grinder and light hand sanding to smooth upper/concave areas.

Same Lever Cap, About 45 Minutes Prep then Plated and Painted

Resurfacing Lever Caps: My Lapping/Sharpening Station

Resurfacing Lever Caps: Hand Lapping Lever Caps

Lapping time: 1 minute

Lapping time: 2 minutes

Lapping time: ~12 minutes

Resurfacing Lever Caps: Die Grinder and Steel Mirror Polish Starter Kit

Milwaukee M12 Right Angle Die Grinder: https://amzn.to/3tQBLYG

Pferd Mirror Finish Die Grinder Starter Set: https://amzn.to/3lxOBHz

Resurfacing Lever Caps: Die Grinder with Compound and Accessories

Milwaukee M12 Right Angle Die Grinder: https://amzn.to/3tQBLYG

Fine green polishing compound: https://amzn.to/3EumCB1

Extra fine green polishing compound: https://amzn.to/3hIjY15

24 pack buffing disks: https://amzn.to/2XBZKPt

Workpro 101 pack die grinder sanding/rust removal/buffing/polishing disks https://amzn.to/3nG4VJ3

Resurfacing Lever Caps: Using Die Grinder and Hand Sanding

- After lapping, use 180 > 240 grit sanding disks to smooth areas not flattened by lapping @ 15K RPM.
- Be careful not to run grinder over sharp edges of your part, because it will quickly chamfer or round the edges.
- You are only trying to remove .003” to .010” (width of 1-2 human hairs) in surface material in a fluid manner to reduce surface pits, corrosion, and smooth peaks and valleys.
- Move the die grinder in small circles as if you were welding, also counterclockwise in the opposite direction of the spin as if you were using a router.
- After surface grinding with the die grinder, hand sand your part in the same direction (vertically, not side to side) to create the appearance of metal grain on your part.
- Use 220 > 400 > 600 sandpaper, apply pressure as needed to totally sand out any swirl marks.
- After hand sanding, install wool pad disks on the die grinder, apply polishing compound, and apply pressure to polish surface @ 10K RPM. Repeat until you have a mirror shine with no clouding or polish swirl marks.

Cleaning After Resurfacing and Polishing 1-2-3

Cleaning After Resurfacing 1-2-3

- Electroplating will not adhere to oil, buffing compound, fingerprints, or other contamination.
- START BY PUTTING ON GLOVES. Scrub your part with Simple Green and a toothbrush or other soft brush. Dip in a tub of water.
- Dip part in acetone, scrub with a soft brush, and dip in water to prevent flash rusting.
- Finally, immerse part in Electro-Cleaner solution https://amzn.to/3wjihg4 or a lye solution for about one minute, then immediately dip in water. When removed from water, the water should “wet out” and not bead on the surface of the part.

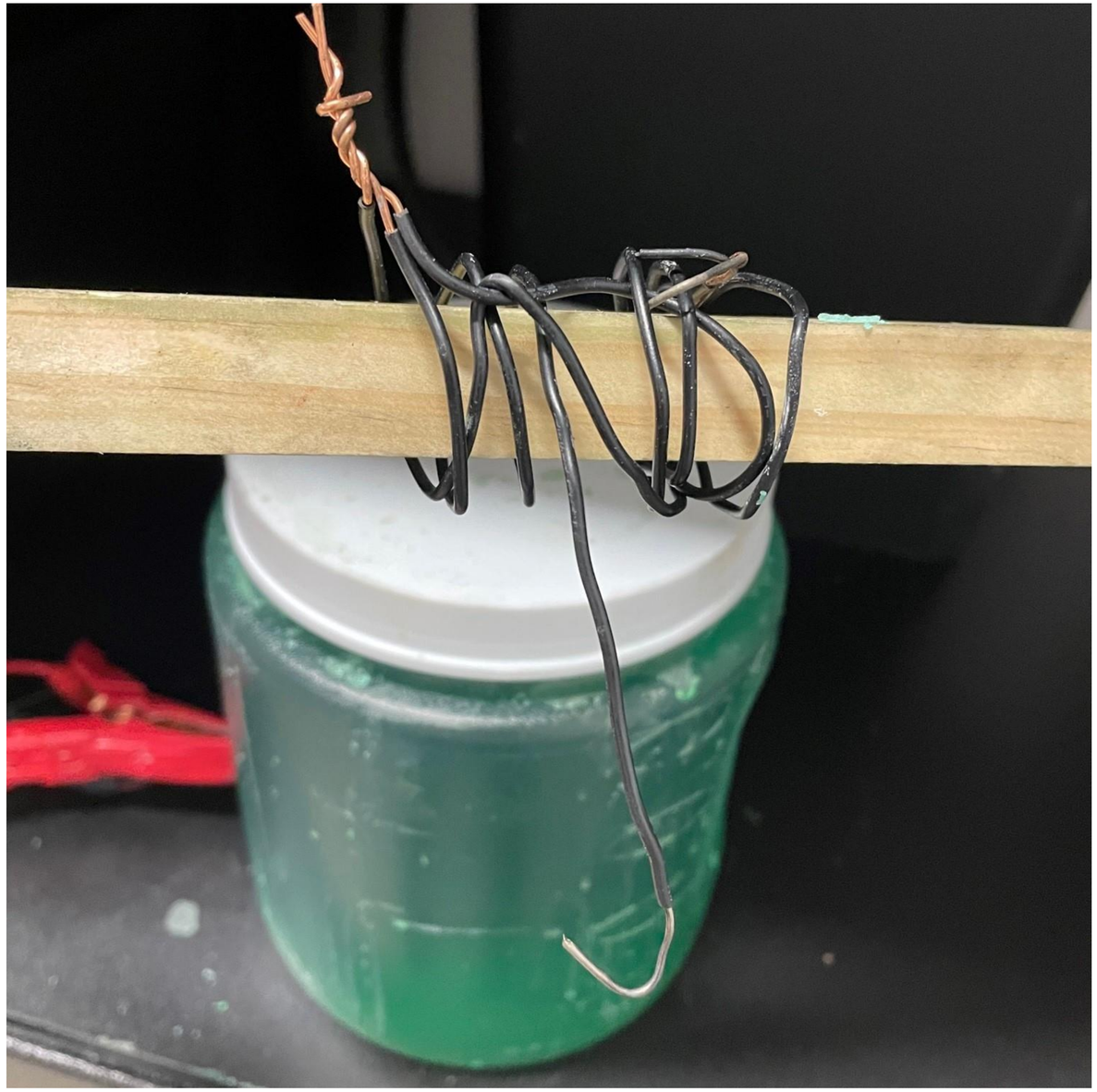
Making Your Plating Solution

- Fill a one-gallon clear plastic container near the top with vinegar. Add about a rounded tablespoon of plain table salt for an electrolyte (NaCl) (not sea salt or salts with minerals).
- Bend the edges of two nickel anodes https://amzn.to/2Odn29J so they will hang on the inside of your container in the solution.
- Connect one lead from your power supply to one nickel anode, and the other to the other one - polarity doesn't matter at this step. Set current to about 2 amps. DO NOT allow alligator clips or any copper or other metal than nickel to enter your solution or you will contaminate it.
- Let this run overnight or until the nickel anode connected to the red terminal has completely dissolved. Solution should now be bright green.

Make Your Plating Solution and Set Your Power Supply

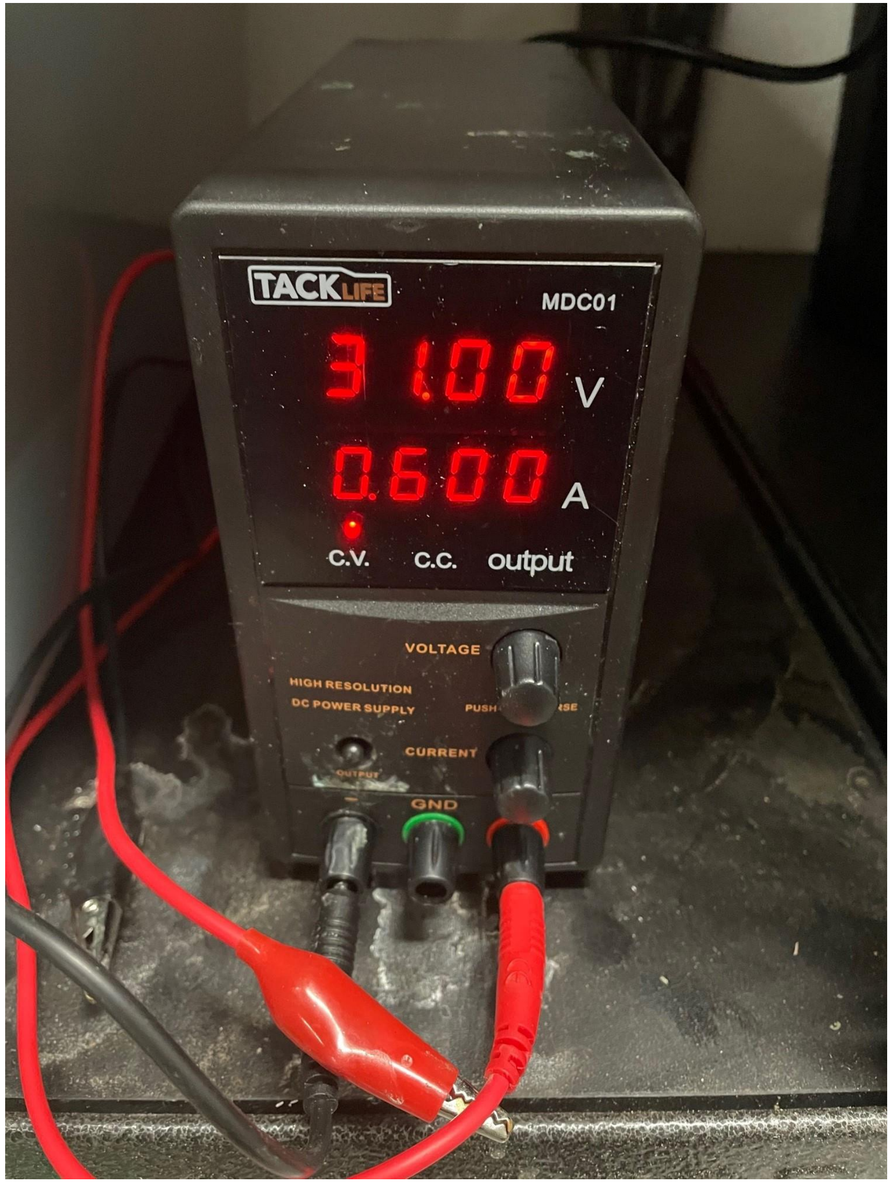
- Using two new nickel anodes, drill holes in one end of each, bend ends so they will hang in the nickel solution, then connect with copper wire so they will hang on opposite sides of your container. DO NOT allow copper wire from your anode to enter solution or you will contaminate it.
- Wrap a copper wire around a stick, expose end of wire, bend it to a hook, then use the hook to hang your part in the solution. It’s ok for the copper hook to enter the solution because it is functioning as a cathode and will become nickel plated.
- Set your DC power supply. At 70 degree ambient temps, I get best results at 400 mA. Current is what matters here, so set your amp ceiling at 600 mA and your voltage at max.

Plating



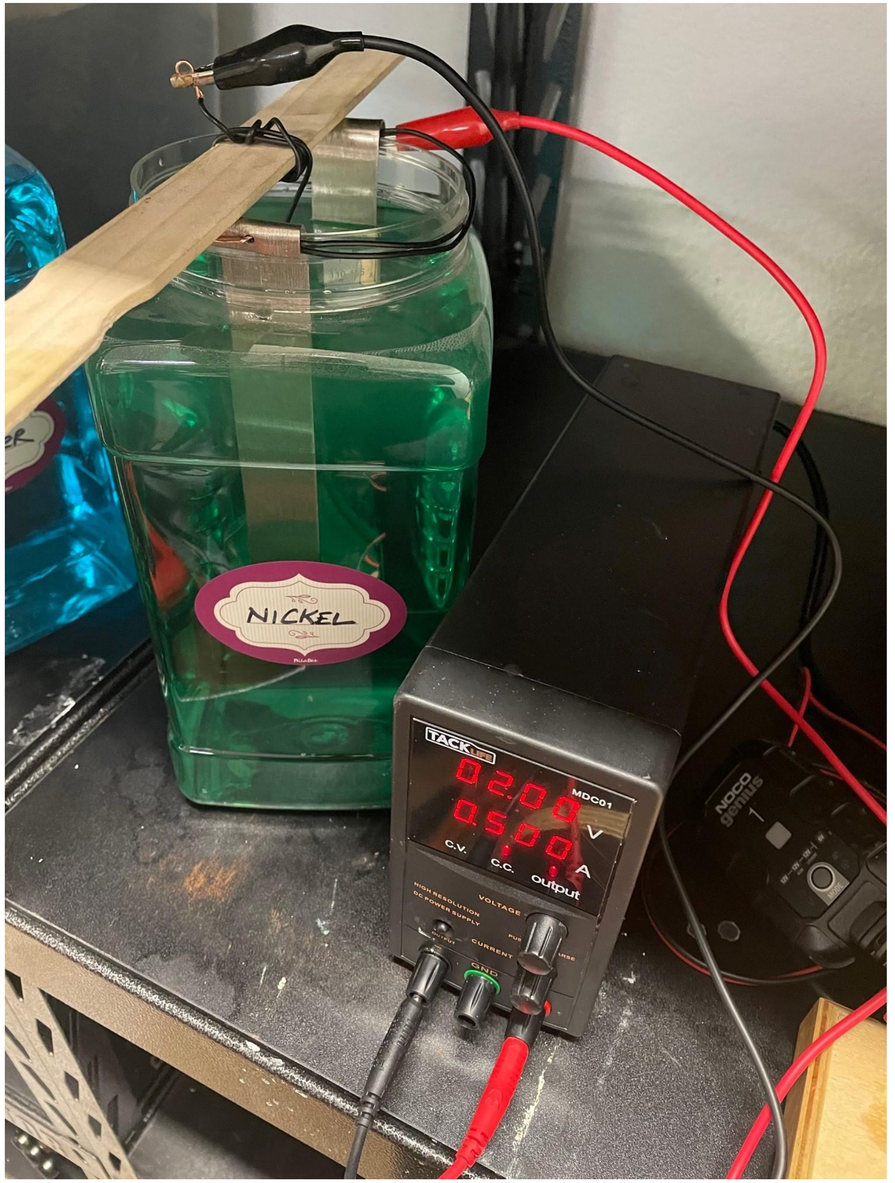
Plating


RECORD
NICKEL


TACKLIFE
MDC01
31.00 V
0.600 A
C.V.
C.C.
output
VOLTAGE
HIGH RESOLUTION
DC POWER SUPPLY
CURRENT
GND

Plating

- At 70 degrees ambient temp, I will reposition my part in the solution (wearing gloves!) at least 3 times, letting the system run about 30 minutes per position.
- If significant black streaks form on your part, your solution is contaminated; you should dispose of your solution and make new solution.
- At the end of your plating session, immerse the part in water to neutralize the vinegar solution on it.



Logo Painting After Plating

Fine Detailing After Plating

Thank you!

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