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200 S. Front St. Montezuma, IA 50171
800-741-0015 or 641-623-4000 • www.brownells.com

ELECTROLESS NICKEL PLATING INSTRUCTIONS & EQUIPMENT

by
Ralph Walker
and the Crew at Brownells, Inc.

An easily applied, beautiful, durable, attractive, long-wearing and non-rusting finish for metal gun parts has long been sought by the firearms industry. Nickel plating has been one of the favorite plated finishes, meeting all of these requirements except the first one - "easily applied" - until now. Finally, we can offer you a simple to do, easy to apply, absolutely foolproof, nickel plating system for the individual gun shop that will give you a beautiful, uniform, evenly-plated, ready-for-assembly finish of the exact thickness you want each time you use it. And, you can do it yourself in your own shop using safe-to-handle chemicals with a minimum of extra equipment.

In order to understand the real impact and importance to the gun shop of this new nickel plating system, however, we need a short history lesson on nickel plating.

Traditionally, nickel plating was applied by a process called Electroplating" which used an electric current to deposit the nickel onto the steel surface. To work, the steel part to be plated was suspended in a solution containing a high concentration of nickel along with a bar, or sheet, of pure nickel. The negative wire from a transformer was connected to the steel part (making it the cathode) and the positive wire was connected to the nickel bar (making it the anode). By carefully controlling the D.C. electrical current passed through the anode into the solution and on through the steel part, the nickel in the solution was deposited on the steel. At the same time, an equal amount of nickel was being removed from the nickel bar to replenish that which was taken out of the solution.

The electroplating system works and is still being used, however, it has some serious drawbacks. Because electricity, by its very nature, takes the path of least resistance, the edges of the steel part being plated receive the largest deposit of nickel, the flat surfaces receive a thinner plate, and recesses or crevices receive even a thinner plate - and in some instances, no plate at all. Also, the chemicals involved almost always are forms of metallic cyanide salts solutions, which, besides being deadly poisonous in the presence of any acid solution, can be shipped only by truck freight (not by UPS, Parcel Post or any Air Freight/mail method). This makes getting the supplies to the operator slow and often outrageously expensive. Finally, the plate thrown in an electroplating system is characteristically rough. Often pieces have to be pulled out, wire brushed to "reactivate" the surface and put back into the plating bath. Then, the final finish is so rough that extensive polishing has to be done to bring the gun up to the expected "bright standards of nickel plating".

Fortunately, about 1945 a method of depositing nickel on the surface of the steel was discovered that did not require electricity, but used chemical action to do the work of the anode, cathode and cyanide salts solutions. Because of intense industrial interest in the success of the process, it has been developed to the point now that almost universally perfect results can be achieved by the most fainthearted beginner as long as he mixes the solutions correctly and follows the steps exactly. In addition, this new process, called "Electroless Nickel Plating" will deposit an absolutely uniform plate thickness over the entire piece, smoothly and beautifully, using chemicals that are readily shipped by United Parcel Service. The equipment needed is minimal - a couple of plastic pans, an old sink, a heat source, a couple of Grandma's blue-rock canners and a stirring mechanism. Plus the patience - and intelligence - to read and follow the instructions, particularly the cleaning instructions, to the letter.

The efforts expended in learning this new process - and doing it on your customer's guns - is going to be one of the most rewarding experiences you can have in your shop. The pieces come out of the plating bath diamond-bright and beautiful - ready to dry off and wipe down with a jeweler's cloth and assemble. If your customer prefers a Satin Nickel Finish (requiring light sandblasting or glass beading before plating), the finish is outstanding, and has more appeal than even stainless steel because it looks so nice. But, let's get down to some hard and fast specific advantages of the Brownells Electroless Nickel Plating System...things to hang your hat on and things to sell your customer on:

1) Outstanding resistance to continuous exposure to fingerprints, petroleum distillates of all types, gun solvents, gun cleaners and all powder residues.
2) A salt spray corrosive resistance tolerance exceeding 240 continuous hours per 1-mil thick deposit.
3) Yield of nickel plate deposit is quite predictable, letting you put exactly the amount of nickel plate on the piece that you want to.

4) None of the chemicals or processes used involve the use of cyanides or any of the cyanide compounds common to all Electroplating. As a result, all the chemicals can be shipped by UPS - the fastest, cheapest and most convenient common carrier available. Also, without the use of cyanide compounds, nearly all the health hazards usually associated with Electroplating have been removed.
5) All surfaces submerged in the plating solution are equally plated with a micro-smooth nickel deposit of microscopically uniform thickness. This adds a natural low friction and lubricity which results in easier gun operation than with normal, unplated steel.
6) 0.1 tougher than hard chrome on the Taber Wear Index and although this does not seem like much, the index is a log rhythmic scale, meaning that it is truly significantly harder.
7) Expansion and contraction from heat do not result in cracks and peeling of the nickel plate as is common in other forms of plating.
8) Will pass a 180° bend test without cracking or peeling.
9) It is rated at Rc 53-56 in hardness as it comes out of the plating tank! This means the simple plating of wear surface alone will greatly extend its useful life.
10) The plated surfaces can be soldered, brazed or welded.
11) The nickel plate is non-magnetic and will not affect the magnetic or non-magnetic qualities of the surfaces it is applied to.

And, if that is not enough, because nickel plating prevents rust, you can plate bullet molds (gives smoother bullet drop out, too) or other shop tools, fixtures or jigs. And, when plating pistols, the plated bore reduces leading, making it easier to clean. (Since the plated surface is quite hard, however, best do all repair work before plating. It's almost impossible to do a throater job on a revolver after it is plated!) Likewise, because you have complete control over the thickness of the plate, you can put on as much, or as little, as you wish. If you should get the plate a little too thick, simply polish off a small amount until you get the fit you want. You can even build up undersized parts, although one-mil plate per piece should be considered maximum. Actually, *three-eighths-mil thickness is considered overall the best combination of long wear and durability for gun plating.*

Since all electroless nickel plating systems use a nickel alloy as the plating metal, different alloy solutions are required for different applications and for different base metals. The Brownells Electroless Nickel Plating System deposits an alloy consisting of 87% per nickel, 12% phosphorous and 1% copper, and has been carefully formulated to meet the requirements of firearms - including mild steel, alloy steel, cast iron, cast steel, and so on.

The solution and system of application are the result of several years of testing under all kinds of laboratory, industrial and gun shop conditions. We know you are going to be as pleased and delighted with the extraordinary results you will be able to get as we are with being able to provide such a foolproof Electroless Nickel Plating system to you.

SAFETY

Every effort possible has been taken to make the process as safe to use as possible. Common sense must be applied when using any chemical process. **READ THE WARNINGS ON THE CONTAINERS.** The plating room must be properly ventilated. An exhaust fan, similar to the ones used above a large kitchen stove is easily installed above the plating tanks. Be sure a window or door is left open for fresh air intake. The operator must wear long-sleeved clothing, a filter mask, a full face shield, a neoprene work apron and rubber gloves. In short, use the same personal protection equipment as in bluing. Use extreme caution in handling acids, plating and cleaning solutions. **DO NOT** use or store chemicals near food or in a food preparation area. Wash down all exposed surfaces with a flood of clean water.

This instruction booklet is based on our working experience, and to the best of our knowledge is true and accurate. However, since the conditions for use and operation in your shop are beyond our control, this information and these products are offered without warranty or guarantee as to use or safety.

USE EXTREME CAUTION

There is no such thing as being too safe in handling all types of chemicals!

TANKS AND SOLUTIONS

PLATING AREA - If you have a separate bluing room or area, this is the ideal place to do your plating. If not, a specific, isolated area should be selected with two factors in mind. First is safety. As you are dealing with acids and potentially hazardous chemicals, care must be taken to prevent unauthorized personnel from entering the area and being accidentally injured. **"DANGER - ACIDS"** signs in the area are a good idea. Second, the area must be as free of airborne contamination as possible. (Such as polishing dust, sanding dust, etc.)

HOT CLEANER TANK - The hot cleaner tank normally used with a bluing operation can be utilized to decrease the number of tanks you have to get. However, as cleanliness is a major factor in all plating, the best arrangement is a separate cleaning tank to be used only for plating. The common *misconception* that "the cheap way is best" holds true here, too. Only one gun requiring stripping of the poor plating, re-polishing, and re-nickeling will exceed the cost of setting up a separate hot cleaner tank for daily use in plating. The Brownell 6" x 6" x 40" Bluing Tank and Pipe Burner (specify natural or bottled gas) is fully adequate. If you don't want such a large hot cleaner tank, an excellent one can easily be made from another of the porcelain tanks (described in detail under the "Plating Tank" section), heated by an electric hot plate or a 15,000 btu/hr gas ring.

DO NOT attempt to keep the cleaner solution from plating day to plating day. In fact, since a clean surface is so vitally important to good nickel plating, we suggest you change it more often if you are doing more than 6-8 guns per day. When not in use, cover the empty, hot cleaner tank with a section of ¼" plywood over a couple of layers of 6-mil builders' plastic to keep airborne particles from contaminating the interior of the tank.

FLOWING WATER TANK - This tank can be any container large enough to hold the guns. It can be metal, rubber, plastic or ceramic. (Any time a "Flowing Water Tank" is used in these instructions, it is this same tank.) You only have to set up one Flowing Water Tank because the constantly changing water keeps it clean between steps.

The tank is set in an old sink - available at most salvage yards - and the sink equipped with a drain pipe and cold water

faucet. A section of plastic pipe or hose with several holes in one end is placed on the bottom, inside the tank. The other end is connected to the faucet. As water flows through the pipe and out the holes, clean, fresh water is brought into the bottom of the tank which pushes the old water upward over the sides of the tank into the sink and down the drain. In doing so, all residue is flushed out of the tank assuring a continuous and adequate supply of clean, fresh-flowing water.

Make sure the flowing water tank sits level in the sink so the water flows evenly over the top edge - all around the top edge. This prevents "dead spots" in the tank which could still contain chemicals from the previous wash and contaminate your plate job. Be sure to use a 'medium' or heavier water flow to keep the tank clean. This is imperative! If the parts are not thoroughly rinsed and all traces of the 909™ cleaner removed, (which are alkali) they will be dragged out into the pickling or plating baths (which are acid) and partially neutralize or "kill" them. Likewise, the acid pickling bath must also be thoroughly rinsed off to avoid carry over into the plating bath and upset the chemical balance there. Always flush the tank for two or three minutes prior to starting a plating session. Drain the tank occasionally and wash out thoroughly with common dishwashing detergent.

PICKLING TANK - This tank cannot be metal of any type, not even stainless steel! Rubber, plastic, ceramic or glass tanks must be used. A simple, inexpensive and efficient pickling tank can be purchased at most discount, grocery or hardware stores. **RUBBERMAID** makes a variety of excellent plastic containers which are highly acid resistant. We found we liked using a small, gallon-size, heavy-duty wastebasket for the pickling tank because it gave us lots of working depth in the tank for a relatively small amount of solution. For safety sake, we put the waste basket inside a medium-sized, deep-sided, heavy-duty plastic dishpan, so if we had an accident or a leak we wouldn't have acid all over the plating room. When not in use, you can either store the acid in brown, plastic, chemical jugs (our preference), or leave the pickling solution in the tank, covering it with either a piece of glass or plexiglas to keep it uncontaminated. This tank is not heated, and if emptied, must be flushed thoroughly several times with clear water to eliminate all possible chance of an accident with the acid residue.

PLATING TANKS

This tank should be an extremely fine surfaced ceramic, porcelain, pyrex, or one of the new heat-resistant plastics like high temperature polypropylene, polyethylene or gel-coated fiberglass. (Stainless steel can be used but it first must be "passified", a technique described elsewhere.) Because a heat source must be used to operate the plating solution at 195° F., the plastic and fiberglass tanks require quartz immersion heaters which are quite expensive. So, although there are several tanks that could be used, the limitations of the materials and the heat source make some of them both complex and expensive. Therefore, for the sake of these instructions, we are going to discuss only the following two tank systems: One system uses a porcelain enameled steel tank, gas heat and mechanical agitation. The other uses a pyrex glass, gallon tank and an electric Hot/Stir Plate which gives both electric heating and magnetically-coupled agitation all in the same unit. We found specific advantages unique to each system, and applications where one was superior to the other. So, we've described each in detail below so you can choose the one - or quite probably either - that will work best under your shop situation.

(A) PORCELAIN TANK GAS HEATED - MECHANICAL AGITATION

This is an extremely flexible and economical system to construct and use. With several sizes of porcelain tanks available, you can do just about any plating job big or small. The largest tank will take up to 4 handguns, while the smallest will handle 1 small one, or a number of individual, small parts. However, the porcelain tank is slightly porous which will slowly build up a light plated surface inside the tank, especially on the bottom. When this plate gets heavy, the tank must be discarded and a new one purchased. Since the price of the tank is modest and its use life fairly long, this is not major expense.

The **PORCELAIN TANK** is nothing more than a common kitchen canning boiler available at most hardware stores.

The **HEAT SOURCE** is a commercial, 15,000 btu/hr gas ring with mixing chamber and valve, (specify Bottle or Natural Gas), plus mounting pedestal. Temperature is controlled by adjusting the gas valve. An electric hot plate can be used, but when heating up the larger tanks, the time delay is a disadvantage, and most hot plates designed for the home-use market just don't have the heat output to even heat up the larger tank. The stand to hold the plating tank needs to be built around your heat source, and ideally will be about waist high (or can be short and put on a bench). Across the top of the stand, weld ¼" rods about 2" apart to support the plating tank. Remember, you probably will be using more than just one size tank, so best take into account how you are going to support the larger and/or smaller tanks over your gas flame. We found a rectangular barbecue grill and some bricks work well - as does an equilateral triangle made out of 1" angle stock using redi-rods and nuts at the corners to hold the sides together and support the stand above the gas ring. Just keep the stand sturdy and convenient to work around.

We mounted our gas ring on a 1" x 3" board about 20" long for easy centering under the plating tank, pulling out for lightening, bench cleanup and so on. Base flange takes a standard ½" pipe nipple, so you can easily raise or lower the whole gas ring assembly by changing nipple lengths. You must use a heat diffuser plate between the gas flame and the bottom of the plating tank. We found that a steel or aluminum plate about ¼" to ⅜" thick and about 2" larger than the overall diameter of the tank you are using, to be ideal. (If you do not use this diffuser plate, you stand a very good chance of overheating the plating bath directly above the flame and causing the nickel to literally "fall out" onto the bottom of the tank. If the gas ring is used, this "fall out" will frequently be in a "donut" shape, coinciding with the round shape of the gas ring directly below the tank.) When properly set up, the hottest part of the gas flame should just be touching and spreading out across the bottom of the diffuser plate it is under. (The hottest part of the flame is that section directly above the inner, "blue" cone that you can see, and is usually not readily visible.) We found we had about 1⅛" from the top of the gas ring to the bottom of the diffuser plate. You may have to adjust yours from that to compensate for altitude, gas type and/or pressure, etc. Then, set the porcelain enamel pan directly on the diffuser plate for best heat conduction.

The **MECHANICAL AGITATOR** is a small, 110 Volt 1/40 h.p., sealed, kitchen ventilator motor. A paint stirrer made to use with an electric hand drill is connected to the motor shaft with a coupling. In use, the paddles on the stirrer cause the plating solution to swirl around in the plating tank. This agitation must be a steady movement of the plating solution to assure a constant and continuous supply of fresh solution

past the metal surfaces being plated. If the swirling motion is too fast and excessive "whirlpooling" is caused, oxygen and air bubbles will be carried into the solution and will "crater" your plated surface, requiring you to strip and replate the part. Ideally, the agitation should be fast enough to create a "cone" in the center of the bath, about 1" deep once the parts are in it, but never enough to cause air and bubbles to be drawn down into the bath. You will be able to see this condition easily; there will be a string of bubbles trailing down from the cone when agitation gets excessive. The easiest way to stop the over-agitation is to move the stirrer to a different location in the tank. If this doesn't do it, then you can shorten the paddles on the stirrer itself, or use a speed control on the electric motor. We found the sealed, Stirrer Motor caused whirlpooling in the smaller tanks. Sometimes placement of the parts being plated would break it up - if not, we used the Dremel Speed Control to slow down the motor. Note, however, that insufficient agitation will cause poor plating just as much as over-agitation will; so watch this carefully and be sure to have at least the 1" cone in the center of your operating bath. We found we had to put a lightweight sheet metal shield between the motor and the heat coming up around the side of the tank in order to keep the motor from overheating and burning out. It was a simple, bent-up affair, but did save our motor. Watch for this condition.

Obviously, some form of support bracket must be used to hold the agitator. This is easily made from a section of flat ¼" x 2" common iron, 24" long. Note that the electric motor has two mounting screws on each side of the shaft. At one end of the steel or iron flat, locate the exact center about 2½" in from the end and drill a hole large enough for the motor shaft to pass through. Locate and drill the two holes for the mounting screws. (The motor shaft hole should be slightly oversize; the mounting screw holes should match the diameter of the bolts.) Install the motor temporarily, tighten the nuts and check to be sure the motor is running free. Remove the motor. At the same end of the flat stock, measure off and mark a line 6" from the end - which puts the line 3" to 3½" from the shaft hole. Heat the iron right on this line and make a 90° bend in the shape of the capital letter "L". The long leg of the support bracket is not welded to the stand. Instead, with motor, agitator paddles, etc., installed, a "C" clamp is used to attach the agitator support to the stand holding the plating tank. This allows you to reposition and adjust the agitator as desired in relation to the plating tank.

The paddles of the mechanical agitator may become plated when used in the plating solution, but it is a slow buildup. The same agitator can be used in the nickel stripping tank, which will, of course, remove any plating buildup on the paddles and shaft. (See Stripping Instructions on page 12.)

(B) PYREX TANK ELECTRIC HOT/STIR PLATE

The beauty of this system is its compactness, ease of use and setup, plus positive and immediate control over agitation rate. It also permits easy stripping of parts where the solution must be used in pyrex, ceramic or other non-metal containers.

The **PYREX TANK** is a large laboratory jar which will give long, useful life if handled with common sense and care. In use, it is filled with solution and placed in the center of the heat table. (**DO NOT** heat it empty then pour in solution - that causes thermal shock and will break it.) Turn the heat up to maximum setting, start the agitation and let the temperature of the solution come up to operating level before turning down the heat control. Pyrex cannot be used over direct gas flame, directly on "kitchen-variety" hot plates or other heat sources; the thermal shock will break it. Also, any sudden change in temperature from hot to cold or vise-versa will cause thermal shock. Once you are finished with the solution in the pyrex tank, turn off the heat and let the tank with the solution still in it remain on the Hot/Stir Plate until cooled down to room temperature.

The **ELECTRIC HOT/STIR PLATE** is simplicity itself to operate. Once the filled pyrex tank is placed in the center of the heat table, one of the small, teflon-coated stir bars is dropped into the tank and the *Stir* dial turned slowly until the drive magnet under the heat table "couples" with the stir rod and starts it turning. For more agitation, just continue turning the dial. At some point you will stir faster than the rod can move through the solution and the stir rod will "throw-out" on you. Then just back off the stir knob setting until it is slow enough to again couple with the rod and you can bring the stirring back up to best speed. (This magnetic agitation system will not work through a steel container, so unfortunately, you cannot use it with the porcelain tanks. However, if you are using a flat-bottomed 304 or 316 stainless steel tank for stripping, it works quite well. **Note:** You must never try to plate in a stainless steel tank without first passifying it per the instructions on page 10.) The heat control dial is marked with relative graduations, and should not be taken for temperature settings. The heat table itself is very heavy, aluminum casting with embedded heating elements. When heating a one-gallon solution in a pyrex jar we found we had about a one-degree rise of solution temperature per minute of heating time. However, to control the heat loss through the pyrex, we found we had to put a "jacket" of aluminum foil or fiberglass insulation around the pyrex container, and a plate glass or wood lid on top. You can easily have up to a 20% heat loss without the lid and jacket, and in some cooler plating rooms, you may never be able to bring the solution up to the proper plating temperature.

THERMOMETER - You must use an accurate thermometer with either tank/heat source system. We recommend the Brownell Bluing Thermometer or a good quality laboratory thermometer to assure exact temperature. **DO NOT** use an alcohol-filled cooking or kitchen thermometer, and most meat thermometers are simply not accurate enough. Since temperature control is critical, don't guess on the temperature of your solutions. - **USE THE THERMOMETER, AND USE IT OFTEN!**

DIP STICK - As you read further through the mixing instructions of several of the solutions, you will discover that you mix the measured amounts of chemicals and then "add water to bring to 1 gallon". This means you must predetermine the capacity of the tanks you are going to use - and you must be able to tell how much more water is needed to top them off. We found that by pouring measured gallons of water into each new tank before we used it, then measuring the depth of the solution in the center of the tank with a dip stick, and recording that depth either on the stick or in a log, we could then mix the solutions accurately with ease. Actually, we found a stainless steel rule the easiest to use, for you only have to record the number of inches per gallon in each of the different tanks and can then use that base figure to mix solutions of gallons, parts of gallons or multiple gallons, checking total volume with the rule. Sorta' like going to the gas station and ordering up "7½" of gasoline"!

WATER QUALITY

Water quality is extremely critical in plating. If the water you use in the rinse tank has an excessively high iron, mag-

nesium or metallic-ion content, the dragout from the flowing water rinse tank into the plating tank may well be sufficient to "kill" the plating solution. (The nickel is so anxious to attach itself to some metal that it is just as likely to plate the iron or magnesium molecules or other metallic ions in the solution as it is to plate the gun suspended in the tank. These plated molecules fall out of the solution and collect on the bottom like sand. In some cases, the nickel even appears to "plate" a Pyrex container because the metallic-ions in the water cause it to "fall-out" and adhere to the Pyrex.) If you have this problem, you will have serious problems plating successfully. Therefore, we insist that all plating, stripping and pickling solutions be mixed with distilled water rather than local tap or well water. This is **very** important and despite how safe and clean you think your water is, don't chance your plating solution's life on it.

Secondly, if you suspect high iron in your water, you can put the parts through a Brownells TCE Cleaner Degreaser dip just prior to going into the plating bath, after the flowing water rinse tank. This will remove the water from the metal's surface and prevent "drag-in" of the water to your plating bath. We realize this sounds like a very small matter...a little iron in the water...but, it can easily use up all the nickel in your bath. Worse, it will mix with the nickel that is plating the surface of the gun and actually be entrapped there to "rust" later, after the gun has been returned to the customer. We have had several reports of this from gun shops in areas where there is a high iron concentration in the water. Be very careful that it doesn't happen to you! Always suspect your water as the prime contaminant source for the plating solution.

NICKEL PLATING STEEL

TECHNICAL INFORMATION ON MIXING & USING THE PICKLING SOLUTION FOR NICKEL PLATING STEEL

(1) A NOTE ON ACIDS: The Hydrochloric Acid (HCL) furnished by Brownells is a 31% pure concentrate. This is equivalent to an 18° Baumé Muriatic Acid (HCL). Either acid can be used in the mixing of the pickling solutions as they are both exactly the same chemically. (In fact, our supplier may label the jugs either Hydrochloric or Muriatic; you can use either or mix them together as they are the same.) However, Hydrochloric Acid is available in concentrations as high as 37.3% with a specific gravity or 1.18 and is equivalent to 23° Baumé Muriatic Acid. This concentration is too strong; do not buy or use it, for it may result in damage to the gun.

TO MIX ONE GALLON OF PICKLING SOLUTION:

(Do these steps exactly in the sequence given!)

a) Measure the capacity of your container and mark a permanent line at the one-gallon level on the outside of the tank.

b) Pre-measure 1.5 pounds by dry weight of Activator additive C-1.

c) Measure two (2) quarts (64 fluid ounces) of distilled water and pour into the tank. (Remember, this must not be a metal tank!)

d) Add the pre-measured 1.5 pounds of Activator Additive C-1 slowly to the water in the tank, stirring with a clean plastic or nylon spoon until the C-1 is totally dissolved in the water. You will have a solution that has a "head" of suds on it just like a pan of dishwater. This is normal.

e) Very slowly add 51 fluid ounces of Brownells Hydrochloric Acid to the solution. Stir thoroughly.

f) Bring the volume of the total solution to the one gallon mark you made on the tank, by adding additional distilled water slowly. Again, stir thoroughly.

The Pickling "Activator" Solution is now ready for use. This tank is not heated but is used at room temperature. The solution may remain in the tank when not in use, but it must be covered to avoid airborne particles from contaminating it.

(2) Be sure you control the amount of time gun parts remain in the pickling solution. **DO NOT** leave a part in the solution in excess of one minute as solution will begin to etch metal. If a part is dropped into the solution, do not remove by hand - use a magnet on a wire or rod to remove the part. *It is recommended that a new solution be made up after approximately twelve (12) average size guns have been through the tank to assure correct function.*

(3) When immersed, the parts will start to bubble or "gas". This is normal and indicates the solution is functioning correctly. If no "gassing" is present, the solution is probably too weak for correct operation and should be replaced. However, if you are plating either high carbon steels or case hardened steels, our experience indicates you will have to keep these parts in the pickling solution for as much as 15 or 20 seconds before they will start to "gas" satisfactorily. You may even find on parts like Ruger cylinders, Smith & Wesson magazines and a number of .45 slides, you have to dip the part into straight acid for two or three seconds to get it started "gassing". This is an extreme method, and should not be used on any parts but those that won't gas in the normal pickling solution. Once "gassing" has started, remove the parts from the pure acid and immediately immerse in the flowing water tank. Put them into the pickling solution for the normally allotted time. You must have this uniform "gassing" of the metal surface for the nickel plating to "strike" (stick-on) properly, so watch carefully and be sure you get it.

(4) The C-1 Additives' purpose is to prevent "smut" from forming on the metal. If this occurs, use a clean, cotton swab to remove the smut. Normally, it will not occur, but if smutting persists, the solution is out of balance and must be dumped and a fresh solution made. Wash tank thoroughly in clean water each time an old solution is dumped.

TECHNICAL INFORMATION ON MIXING & USING THE HOT CLEANING BATH FOR NICKEL PLATING STEEL

(1) Determine the size tank you wish to use and the volume of solution it will conveniently hold in gallons (ie: 1 gal., 1½ gal., 2¾ gal., etc.)

TO MIX ONE GALLON HOT CLEANING SOLUTION:

a) Mix 8 oz. by weight (approximately 1 cup by volume) of Brownells Dicro-Clean 909™ per gallon of clean water.

b) Heat to 180° F. and stabilize temperature.

c) Suspend parts in the cleaning bath for 10 to 15 minutes.

If you already have a bluing tank setup, the same tank can be used, but be sure to change the solution mix to this ratio, not the milder cleaning ratio, used for cleaning prior to bluing.

TECHNICAL INFORMATION ON MIXING & USING THE PLATING SOLUTION FOR NICKEL PLATING STEEL

(1) The plating tank, agitator and measuring containers should be thoroughly washed with clean, fresh water just prior to each time the tank and accessories are used. This removes dust and other contamination that can ruin a plating solution.

(See Water Quality on page 5.) **DO NOT SKIP THIS STEP!**

(2) Always measure water and solutions. Guessing results in a solution too weak or too strong. Use one non-metallic measuring cup for the plating solution. A different one for the pickling solution, etc. Trying to use one measuring cup for all solutions will result in chemical contamination and a ruined solution. Measuring cups are inexpensive, so do not try to cut corners. Mark each with felt pen or regular fingernail polish as to its purpose.

(3) Plating solution operating temperature range is 190° (Minimum)-to-200° (Maximum) **F.** For best results try to maintain exactly **195° F.** Operating exactly at 195° F. will give you exact plating thickness control.

(4) At correct operating temperature, the plate deposit is controlled by the length of time the part is in the solution. **One Hour Will Give A Half-Mil Plate** ("mil" is .001 inch, so a half-mil plate is .0005 inch thickness). This maximum for firearms as a thicker plate will probably cause problems in reassembly. One half hour immersion in the solution will give a quarter-mil plate (.00025") which is adequate with good wear results and no problems with reassembly. However, a quarter-mil plate should be considered minimum for firearms. We consider **a three-eighths-mil plate (.000375) as optimum, which will require 45 minutes immersion time at 195° F.** The bore and chambers are plated in the process. **DO NOT PLUG THE BORES OR CHAMBERS.** If this is done, the plugs will be blown out by the heat and cause the solution to erupt and spill out of the plating tank.

(5) One gallon of plating solution at 195° F. will plate 114 square inches of surface to a thickness of one-half-mil (.0005 inches). Trying to calculate the number of square inches on a gun is almost impossible. In practical application, if your plating is too thick and causing difficulty in reassembly, simply decrease the amount of time the parts are in the plating solution as this will decrease mil plate in exact ratio. Under normal conditions, a gallon of solution will plate all surfaces on about three 1911 Auto pistols to a one-half-mil thickness, or six 1911 Autos to a quarter-mil thickness. There is a complicated process known as "titration" which is done to determine the nickel content of the partially used plating solution in order to permit you to replenish the tanks as the solution is used up. Unless correctly done, the results are a poor plating job. Forget it!! Simply follow the above "average" surface area in calculating the strength of the solution and the number of guns that can still be plated.

When in doubt, dump the solution and mix a fresh supply. Yes, some useable solution will be dumped too, but it is poor economics to partially plate a gun, then have to strip and start over because the solution became depleted halfway through the plating run. The "dumped" weak solution can be stored in dark brown, plastic, chemical storage jugs and used to plate other items such as tools, jigs, fixtures, bullet molds, etc., where thickness is not essential but rust retardation is desired.

Brownells plating solution will plate all types of steel and iron. Cast iron or cast steel are usually porous and difficult to polish to a high luster finish. As the plating will not fill the pores, most cast metals are best plated with a satin-type finish.

As you become more familiar with plating, you will find many uses other than just for firearms and many "special effects" on firearms. You will also quickly learn how much surface area can be plated for various guns in the tank.

(6) Plating bath mixture is exactly 76.5% distilled water, 20% A-1 concentrate and 3.5% B-1 concentrate. Using these percentages and remembering there are 16 fluid ounces per pint, 32 fluid ounces per quart, 128 fluid ounces per gallon, you can mix any amount of plating solution.

TO MIX ONE GALLON OF PLATING SOLUTION: (You must mix components exactly in the order given.)

a) First, measure 98 fluid ounces of distilled water and put into plating tank. Bring temperature up to 100° F. with tank heater.
b) Slowly add 25.5 fluid ounces of A-1 Concentrate, stirring thoroughly. Start mechanical agitator now.
c) Slowly add 4.5 fluid ounces of B-1 Concentrate, stirring thoroughly. As the B-1 Concentrate is added, there will be a slight foaming, which is normal.
d) When the concentrates are thoroughly dissolved and mixing is complete, stir steadily without "whirlpooling" as you bring the plating bath's temperature up to the operating level of 195° F. Check your thermometer frequently as it is easy to go past 195° F. At 195° F., allow the solution to "steady-down" for about 5 minutes, making whatever minor adjustments are required to the heat source to hold the temperature constant.

As the gun parts are lowered into the plating solution, there may be some "gassing" around the parts. This is normal and will slowly decrease during the plating cycle. **DO NOT REMOVE A PART FROM THE SOLUTION ONCE IT HAS BEEN IMMERSED**. To do so stops the plating action and if you resubmerge the part, a false plate will form on top of the first plate. **ONCE IN THE SOLUTION - PARTS REMAIN IN THE SOLUTION UNTIL PLATING TIME IS COMPLETED.**

Then, and only then, remove the parts.

(7) The gun parts should be held with common iron wire when submerged in the solution. Be sure to make the loop you hang the part on an oversized "O" shape instead of a narrow "U" shape to prevent discoloration streaks on the plated part. And, if possible, twist the free end of the loop back around the hanging part of the wire, closing the "O" to keep parts from falling off. The other end of the wire is wrapped around a 1/4" steel rod which lies across the top of the tank. Shorten or lengthen the wire as needed to assure 100% immersion of the part, keeping in mind the solution level will lower about one third because of water boil-out during each hour of heating at 195° F. **DO NOT** use galvanized, aluminum, copper, or brass wire as these can contaminate the bath. The wire will be nickel plated with the part, of course, but can still be used several times. Silver-soldered sights or soft-soldered parts will not present a problem in the bath.

Parts should be suspended so they do not touch tank walls or each other. This is not due to any danger of them becoming fused together by the solution, but remember, the solution is being agitated and the spacing is needed to prevent parts from banging into each other and spoiling the polishing job.

(8) If you have a long plating run and are doing several "batches", you can "top-off" the tank with distilled water between the batches, then bring up to temperature and put in the next batch. **DON'T ADD WATER TO THE PLATING TANK WHILE PARTS ARE IN THE PLATING SOLUTION.** You most assuredly will ruin the plating job in the process and have to strip and replate. The usual result is black smut deposits.

(9) When finished plating, do not store the solution in the plating tank. Allow it to cool to normal room temperature then add enough fresh distilled water to the bath to "top-off" the tank to the total volume you originally started with. (Use the "dip stick" discussed earlier.) Be accurate in this step for you only want to replace the water lost by evaporation during the heating cycle; you don't want to change the chemical make-up of the solution. Pour the plating solution into the brown, plastic, chemical jugs and mark the amount of time and area the solution has plated on one of the stick-on labels, and put it on the jug. **Plating solutions must not be stored below 50° F. Ideal storage is between 60°-to-90° F.**

Next time you are ready to plate, all you have to do is flush out the plating tank with clean water to be sure it is contaminant free, (see Note on Water Quality - page 5), pour in the solution from the storage jugs, check the level with the dip stick and bring the temperature back up to 195° F. Always wash the plating tank thoroughly with clean water each time it is used and store in a dust-free place.

PLATING OPERATION STEPS
FOR NICKEL PLATING STEEL

Before we begin actually plating, it is important for you to understand that the thickness of the plating you are going to apply is determined by thread variables: (1) the temperature of the plating bath; (2) the length of time the part is left in the tank; and (3) the number of guns that have been put through that particular solution and, therefore, the amount of free nickel left in it. If you vary any one of these three, you will affect the amount of plating deposited on the gun.

Obviously, the temperature is the easiest factor to control under all conditions. So, watch it closely, and do not vary from the 195° F. required.

Unfortunately, the other two factors are not as easy to control. As the solution is used, nickel is removed from it. Therefore, you will deposit a thicker coat of plating in a brand new bath than in one that has already had guns run through it, providing time-in-bath and temperature are constant. It is nearly impossible to determine exactly how much nickel has been removed during each plating cycle, so there is no way to determine the time-correction factor to use, as the nickel in the bath is depleted. For instance, 2 guns through a five-gallon bath have very little effect on the total nickel available; whereas 1 gun through a one-gallon bath may deplete it nearly one-fourth. We found that if we considered 45 minutes of time, 195° F. temperature and ⅜" mil thickness as optimum at "mid-life" of the plating bath; took the parts out a few minutes sooner on a brand new bath and left them in a few minutes longer as the bath depleted, satisfactory results were always obtained. It is an extremely subjective situation; there just are no hard and fast rules.

A word of caution is in order. **DO NOT** go to extremes in adding time for each gun you plate. We had a customer who added 15 minutes per gun and at the end of four guns in a one gallon bath had a plating time of nearly two hours. The fourth gun was nearly destroyed because the nickel was by then all gone from the bath, and he was simply cooking the steel in the residual high acid solution for those 2 hours. Just a matter of 2 to 5 minutes shy on the early guns and 2 to 5 minutes added on the later guns is all you should consider.

Twelve steps are required to properly plate a gun. These are outlined below and in the Flow Chart. **DO NOT** take any shortcuts. Do each in turn, as given, for the time specified. Then go on to the next step. Layout of the plating room is completely optional, but do try to set up your tanks so a logical progression from tank can be done handily.

(1) POLISHING - Polish and prepare metal exactly as for bluing. Plating will not hide or fill scratches or pitting. A High Gloss Nickel Finish requires metal preparation equal to Master Grade bluing preparation. A Satin Nickel Finish can be achieved by using glass beading, very fine sand blasting, or a coarse, wire, scratch wheel with light pressure on the gun. (See Glass Beading details under "Special Notes" section.)

(2) PRE-CLEAN - This step is absolutely necessary and must not be eliminated. Use TCE Cleaner Degreaser and saturated cotton swabs to thoroughly clean all surface areas including holes, crevices, etc. This removes any old grease and accumulated crud, silicone oils and other gun oils plus polishing residue, especially that left by wax or grease-base polishing compounds. **DO NOT** use petroleum base solutions like gas, kerosene, mineral spirits, or gun cleaners as these may leave a residue once the carrier has evaporated. If at all possible, thoroughly blow all parts clean with a medium to high pressure air gun to remove loosened gunk.

(3) FLOWING WATER RINSE - Submerge parts in the flowing water tank for about ten (10) seconds. This helps float away any loose particles of foreign matter loosened by the pre-clean step.

(4) PICKLING TANK- Submerge part for three (3) seconds. The parts will start to "gas". This further removes any foreign contamination.

(5) FLOWING WATER TANK - Submerge parts in tank for three (3) seconds and agitate to flush pickling solution from surface of metal.

(6) HOT CLEANER BATH - Submerge parts in tank for 10 to 15 minutes with operating temperature at 180° F. Agitate occasionally to ensure good surface cleaning.

(7) FLOWING WATER TANK - Submerge for five (5) seconds and agitate to flush cleaning solution from surface of metal.

(8) PICKLING TANK - Submerge for five (5)seconds to "activate" the surface of metal for plating. Parts will start to "gas" indicating surface is activated. This step, in addition to cleaning, will make the nickel "strike" the metal surface quickly assuring a good initial bonding to the surface. If gassing does not occur, refer to #3 under Mixing and Using the Pickling Solution, page 5.

(9) FLOWING WATER TANK - Submerge for three (3) seconds and agitate to flush pickling solution from surface of metal.

(10) NICKEL PLATE TANK - Turn on the heat source and agitation system, bring the plating solution to optimum operating temperature of 195° F. and stabilize. Be sure agitation is started when the heat is first turned on to prevent hot spots in the tank which can cause numerous problems. Next, determine thickness of plate you wish to apply. ***For optimum results we***

consider ⅛-mil plate best, which will require 45 minutes of submersion in the plating solution. Submerge parts to be plated into plating solution, making sure they do not touch each other or sides of tank. Be sure agitation is thorough, and that severe whirlpooling does not develop. Solution must be maintained between 190° and 200° F., with 195° F., optimum. **ONCE THE PIECES ARE IN THE PLATING SOLUTION DO NOT REMOVE THEM UNTIL THE DESIRED LENGTH OF TIME IS UP. IF YOU DO - EVEN FOR AN INSTANT - YOU WILL RUIN THE PLATING JOB AND HAVE TO START OVER!** When the predetermined time has elapsed to plate the thickness desired, remove the parts from the plating solution.

(11) FLOWING WATER TANK - Submerge for a minimum of two (2) minutes and agitate to flush nickel solution from metal surface. There is no maximum time limit in this tank as the nickel plating process has been completed. Remove from the tank and allow parts to dry normally or use compressed air for faster drying.

(12) INSPECTION - Check all parts and components carefully to assure an even plate of all desired surfaces prior to assembly of the gun. (If a part or component is not nickel plated as desired, it **CANNOT** be put back into the nickel tank. The part must be stripped of all nickel and reprocessed from bare metal or the parts can be processed with Brownells Nickel-On-Nickel system.) Wipe all parts clean and dry with a soft cloth to remove water spotting or lingering wet areas in holes, etc. If a high gloss finish is desired, you can buff the parts lightly on a loose muslin wheel (6 inch diameter wheel 1725 RPM) to bring up the luster or, we had incredible success with the Professional Nickel Final Polishing Cloth. If you wish to use polish on the wheel, use ONLY No. 555™ White Polish and very light pressure, as any form of polishing will remove metal, and you will be removing the nickel plate you just put on. Simichrome can also be used to increase the luster of a high gloss finish. Reassemble gun.

SPECIAL NOTES

The complete plating procedure consists of two overall phases, both equally important. First is a preparation of the metal to enter the plating solution and second, the actual plating of the metal. Any attempt at short cuts in the procedure usually results in a poor plating job, wasted time and material. At first the process will seem lengthy, especially the cleaning steps prior to putting the piece into the plating tank. However, with a little practice you can complete the plating process in about the same amount of time required for a good blue job.

The Preparation Phase is a step-by-step sequence in getting the metal absolutely clean of all foreign residue and down to the bare metal. When metal is stripped of all protective coating, it absorbs oxygen and oxidizes very quickly when in the open air. Oxidation on the metal surface prevents good initial bonding of nickel to metal. Therefore, the time between each step should be as short as possible. Work quickly, but at a steady pace between each step.

Timing in the tanks in seconds does not require a stop watch. If you say the word, "one thousand and one" it takes one second. Hence "one thousand and one - one thousand and two -one thousand and three" will take three seconds. This is an old trick, but effective.

Equally important is the flushing step between each tank. It prevents the carrying or "drag-out" of chemicals from one tank to another tank with resulting chemical contamination of the next tank.

If you can blue guns, you can plate guns. It is only a matter of familiarization and practical experience. The major difference is that plating requires extreme measures to assure parts are clean prior to entering the plating solution.

As with all types of metal finishes, it is best to make a test run by using scrap parts until you become familiar with the process instead of attempting your first plating job on a new gun!

The most common cause of a poor plating job can be directly traced to lack of cleaning or contamination of solutions.

It is possible to plate one or two parts for two (2) hours in a brand new bath and give them a one-mil plate buildup if desired. This can occasionally be done to tighten up loose-fitting screws, pins, and other slightly worn parts. Plating past this one-mil thickness is not practical. Be sure to remember that every surface will receive the same amount of plate and increase by the same thickness. So, while you may tighten up the threads of a screw, you may also keep the head from fitting flush, or fitting the counterbore at all.

Agitation of the plating solution is critical, for too great an agitation will result in excessive "whirlpooling" which draws air into the solution and will "crater" your plated surface, requiring you to strip and replate the part because the poor plating cannot be saved. Too little agitation results in "pebbling" of the plated surface (little humps and random bumps). This is more easily remedied, for the part need only be polished carefully with 555 White Polish on a loose Muslin wheel to remove the "pebbles". Be sure to review the section on the Mechanical Agitator, page 4.

It has been reported in various magazines that you can heat nickel plating and make it harder. This is true, and half an hour's heating in an oven at 300° F. will definitely give you a harder surface. However, it will also turn this nickel a dark, mottled blue-black color that is uneven and very unappealing in appearance. In fact, any time during the plating cycle when the part is heated over 200° F. in the bath or afterwards, you will tend to destroy the nickel color and turn it to a burnt, motorcycle-muffler color. Avoid overheating the parts that you are plating at all times.

DO NOT MIX AND ADD MORE FRESH PLATING SOLUTION TO A PARTIALLY USED BATCH. This is a tempting idea, but don't do it, for you then lose track of the plating capacity of the total solution.

Solution heatup in the pyrex tanks can be greatly speeded-up by making a "tank jacket" from fiberglass furnace duct insulating panels. Cut to fit like an open-ended box, hold corners with duct tape. Make lid from pyrex glass sheet or hi-temp plastic, and be sure to use lids on enamel tanks also, as will cut evaporation.

Electroless Nickel Plating will not adhere to stainless steel without a pre-treatment with "Woods Nickel Strike". This is the industrial generic name for putting a piece through a light electroplating nickel plate first before putting it in the electroless nickel solution. This works because electroplated nickel

sticks to stainless steel and electroless nickel will "strike" and stick to electroplated nickel. Lots of bother to do, adds all the drawbacks of electroplating, and frankly, we don't feel it's worth it.

Because of the acids used, parts not directly under the surface of the plating bath will rust badly - worse than in the bluing room. The small amount of water that condenses on hanger rods and falls back into the plating bath is of no consequence. But, do take precautions by keeping all easily rustable equipment and items out of the plating room.

If you are working on a rusty gun that you want to put through a Rust & Bluing Remover Solution or Steel White™, you must do so before you polish the gun. Rust & Bluing Remover contains phosphoric acid which acts as a "passifier" to steel, and will prevent it from plating. Polishing will remove this passified surface, but you must polish thoroughly and completely. Then the Pre-cleaning, Pickling and Cleaning steps in the plating sequence should properly "activate" the steel surface. If you notice that the part does not "gas" in the pickling tank immediately, you may have to leave it in for a *few more seconds or use Full Strength Acid Plunge* (See page 5 - #3 under "Pickling Solution").

Because the real beauty of nickel plating in all its forms - diamond bright, deep satin, light satin, and so on - are nearly impossible to explain to a customer, we suggest you do up sample gun pieces and keep handy to show a prospective plating customer. You've never seen eyes light up till you've told them what their gun can look like - and then bring out the sample to show them!

If your tank has a bad case of "fall out" in which all of the nickel simply falls to the bottom of the tank like bird shot, or the tank foams and fusses, turns color and all the nickel will do is stick to the sides of the tank or fall to the bottom, or for whatever reason the tank stops plating after only one gun, you probably can trace the problem directly to one of the following causes:

(1) At some point the tank was overheated dramatically, over 200° F., precipitating the nickel out.

(2) You did not use a heat diffuser between the direct/flame/heat source and the bottom of your plating tank. The result was an overheated layer of solution at the bottom of the tank which caused the nickel to fall out and collect at the bottom of the tank, typically in a "donut" of nickel.

(3) You did not use distilled water to mix the original solutions or you did not carefully check your rinse water for iron, magnesium or metallic ion content. These were dragged into the plating tank in minute, but sufficient, quantities for the nickel to plate them (and fall to the bottom of the tank) instead of plating the gun suspended in the tank.

(4) The container you are using to plate in has a thin enamel coat, or has been used for enough plating baths that the pin holes typical of enamel ware have plated through to the steel underneath. These spots will continue to plate until all the nickel is pulled out of the solution. The best cure is to replace the faulty/burned out tank with a new one.

THE "STAINLESS STEEL" LOOK SANDBLASTING AND GLASS BEADING

The extremely desirable and popular "stainless steel" look for nickel plating is achieved by the way the gun's surface is prepared prior to plating. It is not something you do in the plating solution. Usually, the soft, satin look is created by glass beading the gun with very small glass beads. The harder, frosted look is done with coarser beading, and the "bright", frosted look with individual grit reflections is done with sandblasting. When glass beading or sandblasting, the gun's surface must be absolutely clean and down to bare metal **BEFORE** blasting. Both processes have a "preening" effect that forces not only old bluing but also oils, silicones, and other contaminants into the pores of the metal where they act as a barrier to the plating and keep it from adhering properly; (beading is worse in this respect than sandblasting, however, both are guilty). To prevent impacting contaminants into the metal, **BEFORE BEADING/BLASTING, YOU MUST: 1)** Remove any old bluing by polishing, or removing with Brownells Rust and Blue Remover; **2)** Degrease the gun thoroughly with TCE followed by; **3)** Hot cleaning with Dicro-Clean 909™. Only then should you glass bead or sandblast the gun.

With both sandblasting and glass beading, you might want to consider the decorative use of these finishes in contrast with bright-finished or even blued surfaces. For instance, sandblast the entire cylinder, then polish just the outside, back up to bright leaving the flutes sandblasted.

When sandblasting, you must use clean quartz/silica sand. You must not recycle the sand because any rust or dirt that you cut off the steel will recycle with the sand and be "blasted" into the surface of the metal where it will act as a contaminant and either give you "rusty" plating or plating that does not adhere properly.

Particular care must be taken with glass beading (and to a lesser extent, sandblasting) as the particles shatter on impact with the steel, which causes the "peening" effect, but also disperses through the air, a fine mist of broken glass particles which can easily be inhaled to do very serious damage to your lungs. Both processes must always be done inside a closed cabinet with a filtered exhaust system.

STAINLESS STEEL PLATING TANKS

We talked earlier about not using stainless steel for plating tanks. It can be done, however, the tank must first be "passified" so the nickel plating solution will not stick to it and will not immediately deplete itself totally by plating the tank it is in. The process is easy, but it is absolutely not guaranteed by us or anybody else to be satisfactory for you. The problem is that the pacification of the stainless steel tank may "wear off" at any point and when that happens, the solution will immediately plate all of its available nickel onto the tank. If you wish to pacify a stainless steel tank, however, here is the procedure.

(1) Wash out the stainless steel container thoroughly and treat it with the following nitric acid solution. The solution can be used either hot or cold, the only difference being that the hot acid solution will pacify the tank in a shorter period of time.

a) For room temperature: use one gallon of industrial grade, non-fuming nitric acid to one gallon of distilled water. Completely immerse the stainless steel container (or fill it absolutely brim full) and allow it to sit undisturbed for two hours.

(2) Pour the nitric acid solution into a dark plastic container of either polyethylene or polypropylene and set it

away in a cool, dark place until you need to repassify the container again. The container will stay passified for an undetermined length of time...in other words you may well lose the passivity at any time during use. It may last 3 or 4 batches or more - or less!

(3) To test the passivity of the stainless steel tank, mix the following solution:

a) Combine four grams of copper sulphate (C_uSO_4) to ten grams of sulphuric acid (H_2SO_4) and 90cc of distilled water. Mix thoroughly and bottle in plastic or glass. Apply a small amount of this testing solution to the already-passified stainless steel surface. If you get a light, pink-colored, copper plate on the surface of the stainless steel, it is not passive. And, you must repassify it with the nitric acid solution. If, after testing, no color shows on the stainless steel surface, then it is presumed to be passive and you should be able to plate in it safely. (Be sure to have the colors checked by somebody with true color perception to avoid the problems caused by color blindness!)

(4) This solution can be saved and should be used to test the tank each time you are intending to use it. Likewise, the nitric acid solution can be reused to pacify the stainless steel tanks until the nitric acid solution itself turns blue. Then, it is no longer capable of passifying the stainless steel and should be disposed of safely.

TROUBLE SHOOTING CHART
FOR NICKEL PLATING STEEL

In the Trouble Shooting Chart when you are advised to "strip and replate", it does not mean run the part through the stripper and then directly back into the plating tank. It means take the part through the stripping sequence, then through the entire 12 steps of the plating sequence. If you skip a step and put a dirty part back into the plating tank, it will not plate correctly that time either. **You cannot ever skip any step of any sequence.**

MALFUNCTION

Probable Cause	Remedy

NEW BATH DOES NOT PLATE

1. Improper makeup.	Bring bath into specs if can determine mistake. If not, discard bath.
2. Incorrect bath volume.	Adjust bath if can do so correctly. If not, discard.
3. Temperature too low.	Check Thermometer; heat source. Must operate between 190° - 200° F. with 195° F. optimum.

POOR SURFACE ACTIVATION

1. Acid too old or too weak.	If so, remake.
2. Oil contamination in tanks.	Find source, clean up, then remake all baths.
3. Poor rinsing between cleaning steps.	Increase agitation or water flow.
4. No nickel strike on stainless steel or hardened steels.	See special note on "Wood's Nickel Strike" and Full Strength Acid Plunge.

"SMUT" FORMS ON SURFACE AFTER PICKLING

1. Result of over-activation of surfaces by pickling solution.	Wipe off parts with cloth and re-pickle for shorter time and/or reduce strength of pickling solution.

"SMUT" FORMS DURING PLATING

1. Adding water to tank during plating sequence.	Add water between plating sequences.

CONTAMINATIONS

1. Check for galvanized, aluminum, copper or brass in tanks, racks, hanging wires and stir rods. Check for leaded steel, heavily soldered or brazed parts.	Discard contaminating metals and parts. Remake bath.
2. Residual acid left from stripping.	Generally will have to discard bath.
3. Containers, mixing cups, stir rods, etc., mixed between plate bath, cleaning bath and pickling bath.	Generally have to discard solutions. Always use separate mixing/measuring cups and label for whichever bath is used.

RAPID DEPLETES OF A-1, B-1

1. Poor chemical reaction: result of storage below 50° F.	Return to solution as described below. Ideal storage is 60°-90° F.

WORKING LIFE DEPLETES TOO SOON

1. Plating solutions stored in tanks, open containers, and not light-proof containers.	ALWAYS STORE in dark brown chemical jugs when not actually in use to preserve working life.

SURFACE ROUGH WITH SCRATCHES

1. Probably not polished to fine enough grit before plating.	Plating will not hide anything!

"PEBBLEY" SURFACE

1. Plating solution agitation too slow.	Increase speed to make one inch "cone" in center of bath, but do not allow bubbles in solution. Surface can be cleaned up with 555 White Polish on loose muslin wheel and very light pressure.

"CRATERED" SURFACE

1. Plating solution agitation too slow.	Slow down agitator with speed control. Part must be stripped and replated. Will not polish out.

"SANDY" SURFACE

1. Took part out of plating bath and put back in during plating cycle.	**DO NOT** Remove Parts Once Put Into Plating Tank. You will get a "false plate" which must be stripped and replated if careful polishing does not remove.
2. Agitation too slow, or too many items in tank which interfere with agitation.	Increase speed to make one inch "cone" in center of bath, but do not allow bubbles in solution. Surface can be cleaned up with 555 White Polish on loose muslin wheel and very light pressure.

DISCOLORATION ON SURFACE

1. Shaded "gray"streaks caused by parts touching, hanging loops too tight, too large a part in too small a tank.	Use large tank; run more than one batch. Use "O" shaped hanging loops.
2) Add water during time part is in plating tank.	Water to "top-off" volume can be done only when no parts are in plating tank; then temperature must be restabilized to 195° F.

SMEARS, STREAKING

1). Surface not clean.	Remember, Clean - Clean - Clean and Clean again. Strip and replate.

PLATING CAME OFF

1. Surface not clean.	Strip, clean and plate. See "Special Notes" for comments on cleaning prior to sandblasting and glass beading.

2. Tried to plate Stainless Steel or hardened steels.	See special note on "Wood's Nickel Strike" and Full Strength Acid Plunge.
3. You took it out of the plating bath to look at it and put it back in for some more plating.	You cannot do this for it will "false plate" and may come off. Strip and replate.

PLATING TOO THIN

1. Tried to plate with depleted solution.	Check mil-usage record on storage jug. Make new solution then strip and replate.
2. Check surface area-to-volume of plating bath ratio. 1 gallon does only 114 square inches ½-mil thick.	May require larger container and more solution volume.

PLATING TOO THICK

1. Too long in plating bath.	Reduce time in plating bath. 1 hour gives ½-mil; 45 minutes gives ⅛-mil; ½ hour gives ¼-mil . Generally thick plating can be polished off with 555 White on loose muslin wheel, adjusting pressure and checking it often. Be sure not to cut through plating.

CASE HARDENED/CAST STEEL PLATES UNEVENLY

1. Many case hardened surfaces do not activate as well as unhardened steels.	Leave in pickle tank longer than normal until good gassing occurs. See note on Full Strength Acid Plunge.
2. High silicone content of some cast steels may inhibit plating.	Pre-clean to the point of "over-kill" with TCE Cleaner Degreaser to remove silicone.
3. Cast parts will usually not polish well enough for "Bright" Nickel Plating.	Suggest sandblasting cast surfaces before plating for a deluxe, "Satin" Nickel Finish.

CHEMICAL STORAGE: If these solutions become colder than 50° F. during transportation or storage, the solution will separate. DO NOT attempt to use the SEPARATED SOLUTION. IT WILL NOT WORK PROPERLY. To return the chemicals to solution: Dump the entire contents of the jug, including the crystals and sludge, into a container with a clean, non-metal surface. Heat to 150° F. and stir with a clean, non-metal rod until all crystals and sludge are re-dissolved and the solution is clear.

STRIPPING NICKEL FROM GUNS

There are essentially four ways to take nickel off a gun. You can polish it off, but for the sake of these instructions, we will assume you do not wish to do that for whatever reason.

Secondly, there is a process in the electroplating field that removes nickel plating by making the gun the anode, and a piece of stainless steel the cathode, so the electrical current transfers the nickel from the gun into the special "stripping solution". Brownells offers this product as Super-Strip™.

Thirdly, you can use pure nitric acid. As long as the nitric acid is pure, it will strip nickel from iron or steel without attacking the base metal. This works fine until the humidity in the air changes the purity of the acid, and then it literally dissolves a gun in a very few minutes - plating and all. Besides, nitric acid is very dangerous to handle, nearly impossible to ship via any common carrier, and is expensive to use relative to the amount of nickel actually removed. Finally, under certain conditions, nitrous oxide is formed which can damage lungs, and result in permanent injury to the operator.

The fourth is a hot bath stripping system in which the parts are immersed in a heated plating solution until the nickel is removed from the base material (or substrate). In order to meet more of the needs of the gunsmithing industry, we have chosen 2 different stripping solutions which provide, between them, full range stripping of all types of electroless and electro nickel plated steel, brass and other copper bearing alloys without damage to the base metal. The differences between, and advantages of, the individual solutions are important to understand though, before you decide which you wish to use in your plating operation. You may well decide, as we did, that you will best be served if you set up for both baths.

#1082™ STRIPPER - This new stripper was added to our line because it is a more versatile stripper and will remove all electroless nickel plating (ours and everyone else's) plus most electroplated nickel plating from ferrous steel and its alloys, brass, and other copper bearing alloys. Removal rate is .5 mil per 1.33 hours. Operating temperature is 170°-175° F. The solution will remove 3 mil ft/gal total, requiring replenishment every 1 mil/ft of nickel removed. The solution will operate in any stainless steel, normal steel, pyrex, ceramic, polypropylene, or quartz container. It cannot be used to remove plating on aluminum, but can be used on both steel or copper alloys without attacking either base metal. When you have to remove electroplating, or a brand of electroless nickel other than Brownells Electroless Nickel Plating, we recommend you use the #1082 Stripper on all steel and ferrous alloys plus brass and copper alloys. The #1082 Stripper generally does a better job of removing most original, factory nickel plating that comes into the shop. However, it is quite a bit slower, a typical .45 frame will strip clean in about 3 to 4 hours.

Both systems are safe and will not etch steel. They have excellent stability and a long, active solution life. Because of the easy replenishment, solution life can be further extended which will reduce the operating costs. None of the stripping components contain cyanide, so they can be shipped easily by UPS. Each system operates at a relatively low stripping rate which gives you complete control. However, neither system is designed to strip nickel plating from aluminum, aluminum alloys or maganese alloys. **DO NOT** put these metals into the stripping solutions because the base metal will be severely damaged.

As with the plating procedure, the gun should be disassembled and heavy emphasis placed on cleaning. This thorough cleaning prior to beginning the stripping sequence removes all gunk, gun oils and so on - and must be done to allow the stripping operation to work efficiently.

BROWNELLS #1082 NICKEL PLATING STRIPPER

STRIPPING TANKS

Three tanks are required for the #1082 stripping operation - the acid cleaning tank, the stripping tank, and the hot cleaner tank. The acid cleaning tank and the stripping tank cannot be the same ones used in the plating sequence - they must be different to avoid crossover contamination. To avoid any problems, they should be marked **"For Stripping Only"**, and preferably kept in a different storage area. Because similar chemicals and solutions are involved, the same, strict, personal safety precautions must be followed as specified in the plating section.

(1) #1082 STRIPPING TANK - The tank can be mild steel, stainless steel (any grade), ceramic, pyrex, quartz or other suitable materials that will withstand the 170°-175° F. operating temperature. The pyrex tank like the one you use for nickel plating is very convenient for stripping. If you were stripping from a large surface such as a long barreled revolver or a barreled rifle action, you may wish to use either the porcelain

tanks or one of the long gun (6 x 6 x 40") regular or stainless steel bluing tanks.

(2) #1082 ACID CLEANING TANK - The same acid cleaning solution is used with Stripper 1082 as with 778™ and the solution is again 50% Brownells Hydrochloric Acid and 50% distilled water. The tank must be covered when not in use, and must be marked **"Stripping Only"** to prevent any mixup with the Plating Pickling Tank.

TO MIX ONE GALLON OF ACID SOLUTION: (Do these steps exactly in the sequence given!)

a) Measure 2 quarts (64 fluid ounces) of distilled water and pour into the tank.

b) Measure 2 quarts (64 fluid ounces) of Brownells Hydrochloric Acid and pour slowly into the distilled water already in the tank. Remember, *always add the Acid to the water.* Never do it any other way.

(3) HOT CLEANING TANK - All guns and parts to be stripped must be clean and free of oil, dirt, etc. If you are stripping a gun that just came into the shop you **MUST DO THIS STEP**. If you are stripping a gun to remove plating that did not take correctly and (1) the gun is coming straight from your plating tanks and (2) has not been handled/oiled/polished and (3) the surface is still clean, this step can be eliminated.

As described in the plating section, the Hot Cleaning Tank can be the same one used with either the Nickel Plating setup or your Bluing operation. Remember...cleanliness is still a major factor, so don't take any chances with crossover contamination. If only one gun is to be stripped, a small, round, porcelain tank on the gas ring or the pyrex tank on the Hot/Stir Plate can be used.

TO MIX ONE GALLON HOT CLEANING SOLUTION:

a) Mix 8 oz. by weight (approximately 1 cup by volume) of Brownells Dicro-Clean 909 per gallon of clean water.

b) Heat to 180° F. and stabilize temperature.

c) Suspend parts in the cleaning bath for 10-15 minutes.

TECHNICAL INFORMATION ON MIXING & USING THE #1082 STRIPPING SOLUTION

TO MIX ONE GALLON STRIPPING SOLUTION: (Do these steps exactly in the sequence given!)

a) Wash the Stripping Tank with clean water to remove any residue or possible contaminants.

b) Pre-measure 1 gallon of water in your tank, and make note of its depth on your dipstick - or in your dipstick log. Dump and dry the tank.

c) Measure 90 fluid ounces of distilled water (hot or cold) and pour into the Stripping Tank. Start agitation and heating.

d) Measure one half pound of 1082-R and, very slowly, add to the water in the tank, allowing the agitation to dissolve the powder. (**Note:** The slow rate of adding the 1082-R to the agitating bath will dissolve the powder much faster than if the entire measured amount is just dumped into the tank.) It often takes three to five minutes before the powder is dissolved and the bath changes to a clear, amber color.

e) Measure 26 fluid ounces of Concentrate 1082 and, very slowly, add to the Stripping Tank.

f) Add sufficient distilled water to bring the total solution volume up to one gallon as measured by the dipstick.

g) Bring the solution up to the operating temperature of 170°-175° F. Higher temperatures shorten bath life. Check the thermometer several times to be sure the heat setting is holding the temperature constant. When it is, the Stripping Solution is ready to use.

During normal use the stripping solution will darken, and after 2-3 hours of use will be considerably darker than what it started out to be. This is expected and occurs as you strip the nickel plating off the parts.

Parts are suspended on iron wire, just as in the plating process. **DO NOT** use other kinds of wire. Be sure to make large, closed "O" loops as you did in plating.

Once the parts are submerged in the stripping solution, they should not be removed for any extended period of time to avoid contamination. However, the parts can be taken out of the tank for a very brief period of time for inspection (to see how the stripping is progressing) and returned directly back into the stripping tank. If absolutely necessary, we found we could remove the parts with no apparent damage for longer periods of time, but they then have to be run through the Flowing Water Tank, the Acid Cleaning Tank, re-rinsed in the Flowing Water Tank and then put back in the Stripping Tank. Although, it is better if the parts are not left out of the Stripping Tank that long, once actual stripping has begun.

As water is evaporated out of the Stripping Tank, it should be replenished. Use the dipstick method, or make a mark on the side of the pyrex tank. DO NOT allow parts to stick above the solution level as the fumes from the stripping solution cause very rapid rusting and pitting - which does not happen to parts that are left fully submerged.

The rate of stripping will vary greatly, depending upon the type and thickness of the plate that is being removed, and even on how good the "strike" was when the plating was put on. Most parts will fully strip between 3 or 4 hours. If parts are not stripped in 4 hours, check the parts to see if there is evidence that some stripping has occurred. If the plating has changed color and shows signs of being removed, continue for a while longer. If there seems to be no change in the surface, the solution is too weak and needs to be replenished.

Agitation of the solution is important, and is done at the same rate as for plating. If the solution is not agitated, stripping will be much slower because the stripping solution remaining close to the metal becomes super-saturated with removed nickel and slows down in removing more. Fresh solution must flow by the metal surfaces at all times, distributing the dissolved nickel throughout the full gallon of stripping solution. The surface finish will have an effect on stripping time, too. For instance, a .45 Automatic Slide with polished sides and glass-beaded top will have sides stripped first, and the top stripped last.

One gallon of fresh stripping solution will remove the nickel plating from about 2-3 Colt .45 Autos. After this, the solution normally must be replenished.

TO REPLENISH THE #1082 STRIPPING SOLUTION:

a) Be sure no guns are in the Stripping Tank.

b) Be sure agitation system is working, solution is agitating thoroughly, and the temperature is 170°-175° F.

c) Add 4 ounces by dry weight of 1082-R to the stripping solution.

d) Continue agitation until all the 1082-R is dissolved.

e) Add 2.5 ounces of Brownells Ammonium Hydroxide to the stripping solution.

f) Continue agitation until the Ammonium Hydroxide is thoroughly mixed and the solution is up to proper working temperature.

This replenishment will normally allow stripping approximately the same amount of nickel as did the original, fresh solution. However, after four (4) replenishments of the stripping solution with 1082-R, the solution will become super-saturated with dissolved nickel and will fail to strip any more. Dump the solution, wash the tank thoroughly with clean water and mix up a fresh solution.

After stripping is completed, turn off the heat. If using a pyrex container, leave the solution in the tank and allow both to cool to normal room temperature while still sitting on the Hot/Stir Plate. If you set it on a cold bench or countertop, you will cause thermal shock and break the tank. Once cooled, do not store the stripping solution in the Stripping Tank. Pour it into a clean, brown plastic, chemical jug. Be sure to mark the jug **"Stripper"** and put on the label how many times the solution has been replenished. To reuse, simply pour back into the thoroughly clean Stripping Tank; bring up to heat with agitation to correct operating temperature and begin the cycle.

Stripping is a slow process and of all the sequences involved with nickel plating, the most worrisome, for very shortly after you put the plated piece into the stripping solution the piece turns a dark gray color and gets worse, and more mottled. Finally - at what we thought was a nerve-wrackingly slow rate, the crud disappeared and the clean, bright steel was underneath all that motley stuff. Surely would recommend you don't hover over the stripping tank expecting instant removal. Doesn't work that fast because if it did, you'd stand a good chance of damaging the steel. Working as slowly as it does, it won't pit or etch the steel. And, you may not have to do even much more than touch-up polishing if you are stripping and replating a piece that is in good shape.

#1082
STRIPPING OPERATIONAL STEPS

(1) PRE-CLEAN - Use trichloroethane on cotton swabs and brushes to remove as much foreign matter, powder residue, gun oils, etc., as possible. **DO NOT** use a petroleum base cleaner such as gas, kerosene, mineral spirits, or gun cleaners; they will leave a residue on the part.

(2) FLOWING WATER - (Use same tank as used for plating process.) Submerge parts for ten (10) seconds and agitate to float away loosened residue.

(3) HOT CLEANER BATH* - Submerge parts in tank for 10 to 15 minutes with operating temperature at 180° F. Agitate occasionally to ensure good surface cleaning.

(4) FLOWING WATER TANK* - Submerge parts in tank for five (5) seconds and agitate to flush cleaning solution from surface of metal.

(5) ACID CLEANING TANK - Submerge parts for three (3) seconds and agitate. This further cleans parts and removes foreign residue, especially oil.

(6) FLOWING WATER - Submerge parts for five (5) seconds to flush acid cleaner from surface of metal.

(7) NICKEL STRIPPING TANK - Submerge parts in Stripping Tank until all nickel is removed from the bright steel or brass base metal. The stripping solution must operate at 170°-175° F. Water lost by evaporation should be replaced during the stripping cycle in order to maintain the original volume of solution. Parts will have to be removed from the Stripping Tank to be thoroughly checked to see that they are completely clean of the nickel plating (note earlier comments on how to do this).

(8) FLOWING WATER TANK - Submerge parts for two (2) minutes to flush away all of the stripping solution. Allow stripped parts to air dry normally, or use compressed air to speed drying. The gun can now be polished or put back through the plating cycle. If you are not going to polish or plate immediately, be sure to oil gun surfaces with Water Displacing Oil, Nyoil, HOLD™, Brownells No. 2™ or some other basic rust preventive which does not contain any of the exotic penetrants which could contaminate future bluing or plating of the gun.

* These steps required only when stripping dirty guns or guns just coming into your shop.

SUPER STRIP FOR STEEL - The Super-Strip process actually dissolves the old plating and leaves the base metal surfaces 100% free of any trace of old plating. The surface can then be replated either by the electro or electroless process, or reblued.

CAUTION:

You cannot strip **Stainless Steel** pieces (nickel and/or chromium content which makes Stainless Steel rust resistant is dissolved with Super-Strip); or pieces made from **High Carbon Steel** or are **Case Hardened Steel** (the carbon content is also dissolved by Super-Strip); or pieces made from **Zinc Alloys** (like many low-priced handguns or their components, because the zinc is dissolved). All **Lead, Tin** or **Silverbearing Solders** and **Alloys** will be attacked by Super-Strip once the plating covering them is dissolved. Watch these parts carefully! Take them out of the Super-Strip as soon as all plating is removed and rinse immediately to prevent erosion damage to solder joints.

OTHER CAUTIONS:

1) For **MILD STEEL PARTS ONLY.** Will etch or destroy high carbon, case hardened or alloyed-steel parts. (ie: most hammers/triggers.)

2) POWER SOURCE: 6 to 9 Volt D.C. with minimum continuous output of 90 to 100 Amps per square foot of metal being stripped. (Any other voltage or amperage will damage parts.)

3) CHECK PARTS EVERY 5-TO-10 MINUTES. Do not leave unattended.

4) MOST EFFICIENT OPERATING TEMP: 65°-80° F. Max. temp: 100° F. Above 100° F. causes pitting or etching.

5) DO NOT OVERLOAD TANK. Overloading increases time-to-strip, and probability of heating-up of solution which causes pitting.

6) REMOVE SLUDGE FROM TANK. See Page 16, Step 7 of instructions on Mixing, Using & Storage of Super-Strip. Sludge raises temperature; slows down stripping; contributes to pitting.

Basically, Super-Strip is the reverse of electro plating, that is, electricity is used to remove plating rather than to put it on. In operation, the gun or part to be stripped becomes the anode and attaches to the positive terminal. An iron bar or steel plate becomes the cathode and is attached to the negative terminal. Both parts are immersed in the Super-Strip solution and a DC current is applied.

As the current flows from positive to negative the solution is activated; it both strips and breaks down the plating that is to be removed. The plating comes off in the form of minute particles and enters the solution but is not deposited upon the iron or steel cathode. Instead, the plating particles settle to the bottom of the solution as sludge and the solution continues working until all of the plating is totally removed from the surface of the base metal.

TANKS AND POWER SUPPLY

STRIPPING TANK - Virtually any container - glass, plastic, iron or steel can be used. Do not use stainless steel, galvanized steel or chrome, cadmium or zinc-bearing metal tanks as they will be attacked by the solution. The inside surface of the tank should not be painted as some paints will contaminate the solution.

The least expensive container is a plastic waste basket or similar plastic container. If a steel or iron bluing tank is used, the tank itself can be the cathode or negative terminal of the DC current. The only recommendation is that the tank should be of a shape and material that is easily cleaned after use (see additional info under "Special Notes", page 3).

CLEANING TANKS - A Hot Cleaning Tank for a Dicro-Clean 909 cleaning bath; a Cold Cleaning Tank for a TCE Cleaner Degreaser cleaning bath are required, and are discussed later in these instructions. Also, a Flowing Water Tank is required, and can easily be made from a shallow plastic dishpan placed level in an old sink to permit uniform overflow over all sides, with fresh water brought into the tank from a hose placed in the bottom. If you are using the Brownells Electroless Nickel Plating System, you can use the same Flowing Water Tank, however, be sure to rinse thoroughly before and after use to avoid contaminating future plating projects.

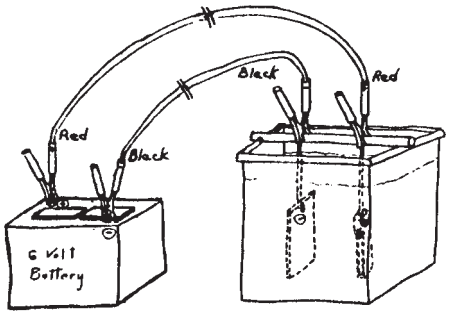
ELECTRICAL SOURCE - A heavy-duty, 6 volt, 90-100 amp battery is recommended; however, any 6-9 volt DC electrical source that can supply a minimum continuous output of 90-100 amps per square foot of metal to be stripped is acceptable.

The simplest and least expensive choice is a 6 volt, 100 amp automobile or tractor battery.

Under normal use you will be able to run 3 or 4 batches of gun parts through the stripping cycle before the battery will need recharging. A standard battery charger, or a trickle charger, can be used to bring the battery back up to full power. Be sure to follow the directions provided with the charger when recharging the battery.

ELECTRICAL CONNECTIONS - Any good copper wire (not aluminum) will transfer the current from the battery to the part to be stripped, and to the cathode. As the diameter of the wire limits the amperage, a simple solution is to use a good set of heavy duty, flexible, copper wire "jumper cables".

The battery, trickle charger and jumper cables can be purchased at most auto parts supply houses, Western Autos, Coast-to-Coasts, or similar store.



We have included a drawing of a typical tank setup, using a plastic waste basket for the stripping tank. To support the pieces in the solution, we placed a wood dowel across the tank (either ½" or 5/8" is fine). Since the stripping solution will dissolve copper wire (used in the jumper cables), the work must be hung from iron or steel wire hooks We made hooks from 5/32" drill rod to avoid restricting the amount of current flow through the rods to the part. (Wire coat hangers can be used; just clean thoroughly to bare metal. However, we found they cut amperage, so went to the larger diameter drill rod.) Fashion the hooks to support the work as required, and make the top end to fit snugly over the dowel you are using. You will need two sets of hooks - one for the part to be stripped, and the other to hang the iron or steel cathode that will be used. Clamp the jumper cable across both the dowel and the hook for a firm, non-slip connection.

The cathode can be any piece of iron or steel, but it MUST have a clean, bare surface, and it must have a surface area equal to - or greater than - the entire surface area of the workpiece; i.e. front, rear, ends, outside, inside, etc.

AGITATION - An occasional stirring of the solution will assist in stripping, but constant stirring should not be done as it does not permit the stripped plating particles to settle to the bottom of the tank where they "get out of the way" of the action between the chemicals and the surface being stripped. The stirring paddle can be a nylon spoon or an unpainted, bare wood scrap.

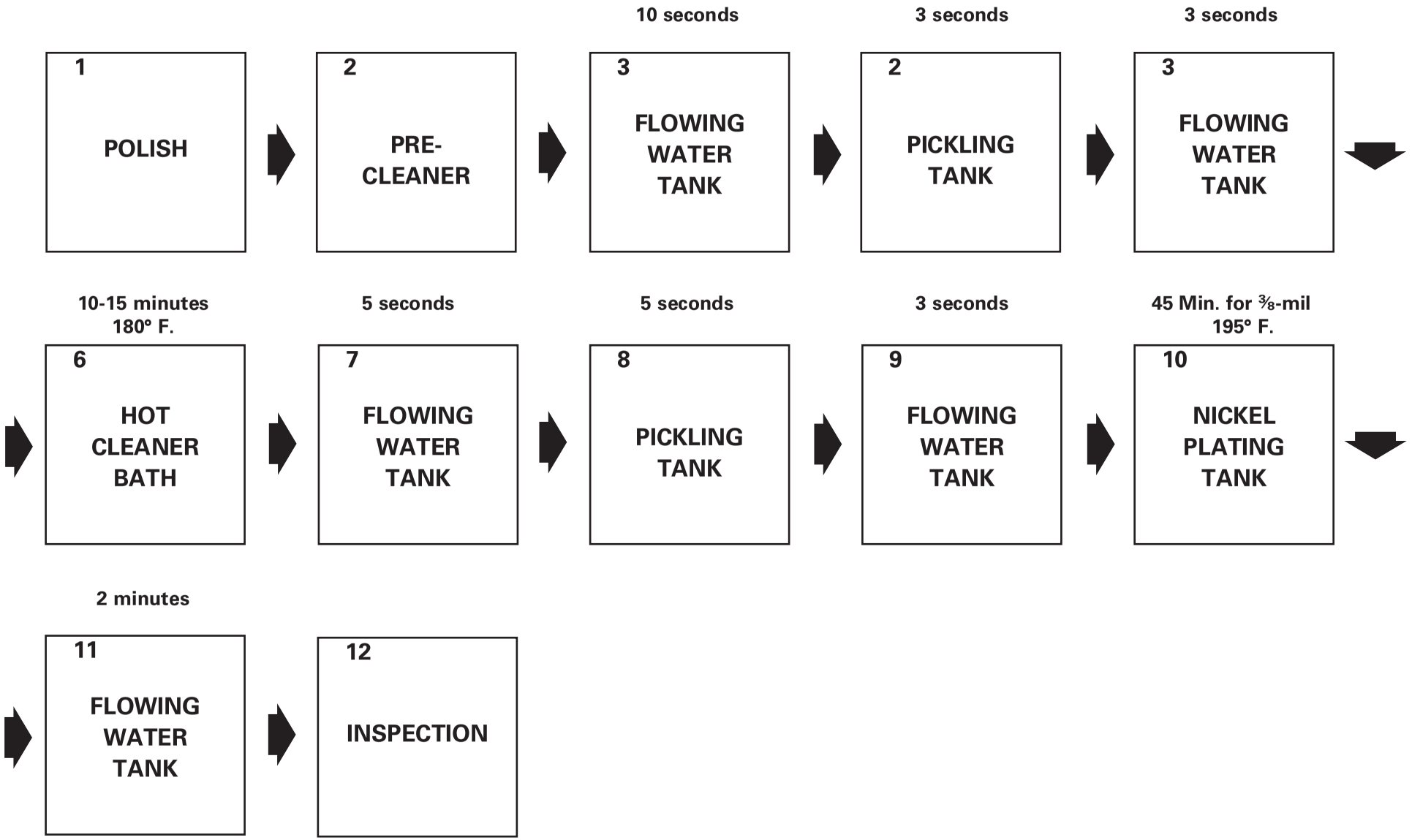
STORAGE - as the stripping solution may be reused until depleted, the Super-Strip solution must be stored in airtight jugs. (See details for removing sludge on Page 16, Step 7 of instructions on Mixing, Using & Storage before storing.) Milk or soft drink plastic jugs, lab jugs, or glass jugs are all ideal.

SAFETY

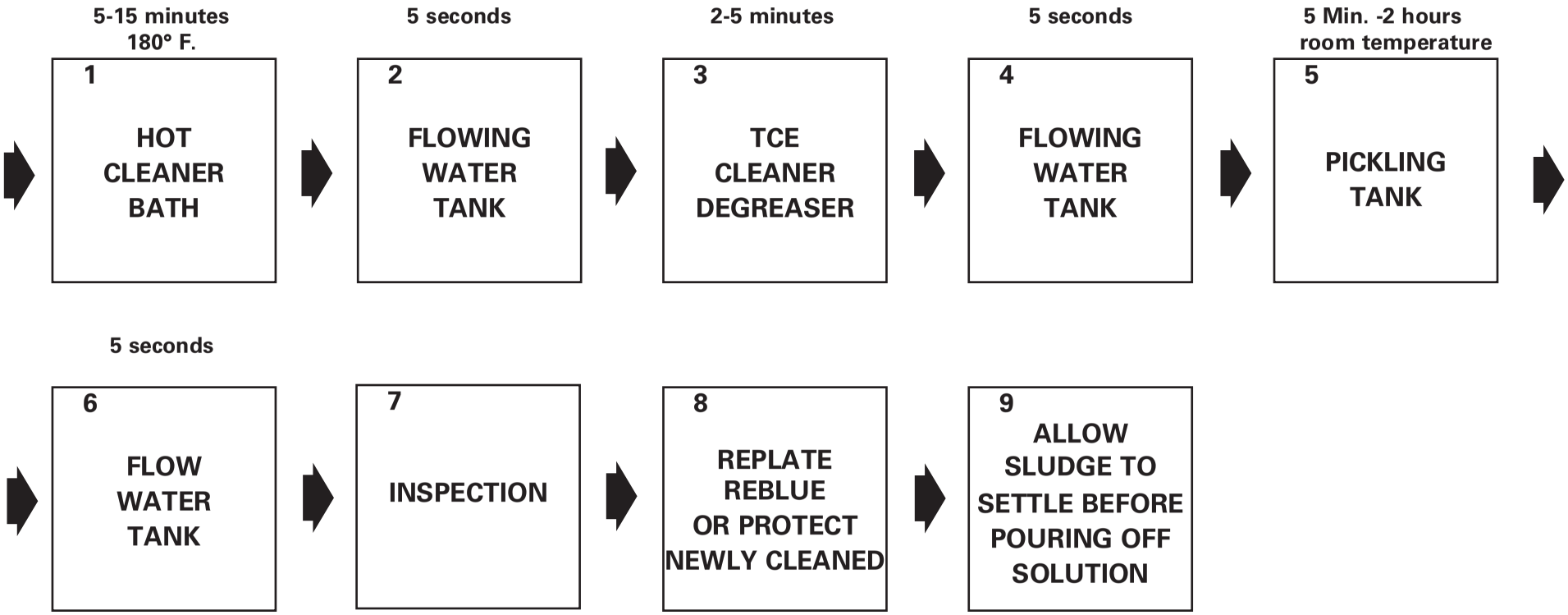
Every effort possible has been taken to make this process as safe as possible. Common sense must be applied when using any chemical process. READ THE WARNINGS ON THE CONTAINER. An exhaust fan is essential and must be used to draw the fumes away from the work area. **Note:** A small amount of free hydrogen is released in the process of using Super-Strip and should not be inhaled. Be sure, too, to use the exhaust fan when mixing Super-Strip as it is a dry powder and you do not want to breathe in any dust while mixing. Always have a door or window partially open for fresh air intake.

As in plating or bluing, the operator must wear long-sleeved clothing, a filter mask, a full face shield, a neoprene work apron and neoprene gloves.

ELECTROLESS NICKEL PLATING STEPS
NICKEL-ON-NICKEL

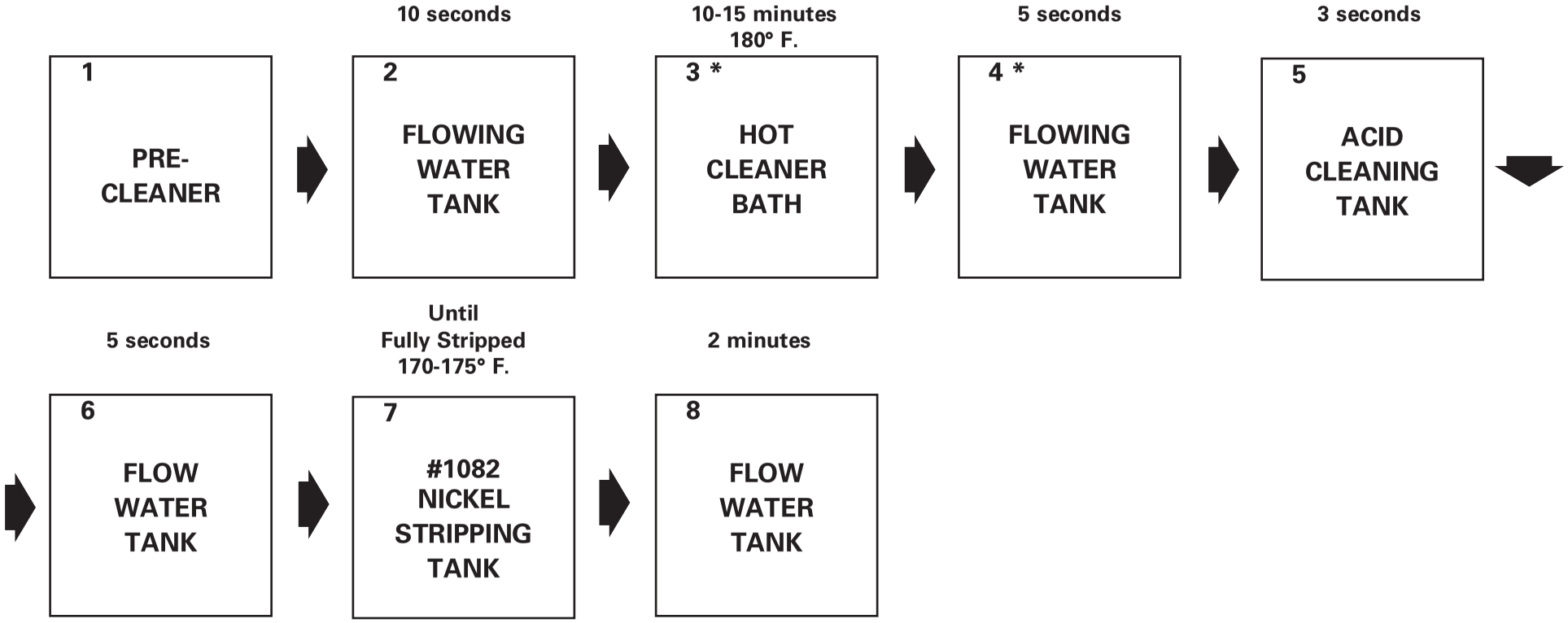


SUPER-STRIP For STEEL



NICKEL STRIPPING STEPS

NO. 1082 UNIVERSAL ELECTROLYTIC & ELECTROLESS NICKEL PLATING STRIPPER



* Steps 3 & 4 required only when stripping factory new guns or used guns that have come into your shop. Not needed if stripping guns directly from faulty plating job that have not been oiled or handled.

PROCEDURES FOR USING SUPER-STRIP

TECHNICAL INFORMATION ON MIXING & USING HOT CLEANING BATH FOR SUPER-STRIP

(1) Determine the size tank you wish to use and the volume of solution it will conveniently hold in gallons.

TO MIX ONE GALLON HOT CLEANING SOLUTION:

a) Mix 8 oz. by weight (approximately 1 cup volume) of Brownells Dicro-Clean 909 per gallon of clean water.

b) Heat to 190° F. and stabilize temperature.

c) Suspend part in the cleaning bath for 10-15 minutes.

If you already have a nickel plating setup, the same tank and cleaner can be used. However, be sure the cleaner is in good condition and the tank is clean. The same hot cleaner tank from your bluing setup can also be used but you must change the solution mix to this ratio, not the milder cleaning ratio used for cleaning prior to the bluing.

TECHNICAL INFORMATION ON TCE CLEANER DEGREASER

(1) Determine that the tank you wish to use is large enough to conveniently hold the parts. This tank should be metal (such as stainless steel or black iron) porcelain, fiberglass or pyrex. Do not use plastic or galvanized steel. The TCE is used full strength at room temperature in a well-ventilated room.

The TCE can be the same solution that is used as a precleaner in nickel plating, but it must be clean since it is used here as the final cleaning step.

Do not use petroleum base solutions like gasoline, kerosene, mineral spirits, or gun cleaners as these may leave a residue which can prevent the Super-Strip from working properly.

TECHNICAL INFORMATION ON MIXING, USING, & STORAGE OF SUPER-STRIP ON STEEL PARTS

(1) The Super-Strip tank, stirring paddle and any measuring containers should be thoroughly washed with clean, fresh water prior to each use. This removes dust and any other contamination that can ruin the solution. DO NOT SKIP THIS STEP!

(2) Always precisely measure the water and weigh out the powder. Guessing results in a solution too weak or too strong. Keep measuring containers separate from others to avoid any possible contamination.

(3) Super-Strip operates at room temperature (65°-80° F.). It must never go over 100° F. during operation for it will cause pitting of the base metal. If the solution is too cold because of your shop temperature, set your stripping tank in a larger container of hot water to bring the solution within the 65°-80° F. range. If the solution is too hot, set the tank in a container of ice water to drop the solution into the required operating range. Monitor both the warming and cooling of your bath carefully with a clean laboratory or reliable candy thermometer (glass - not stainless steel: be careful of breakage!) to avoid overshooting temperature correction!

(4) Within the correct temperature operating range (65°-80° F.), Super-Strip will completely strip a part in an average of 20 minutes to 1 hour. When the solution is new, the time will be faster than when it has been used several times. Depending on the type of plating being removed and its thickness, the actual stripping time may be as short as 5 minutes or as long as 2-3 hours. Super-Strip will continue working on the parts' base metal and a severely etched surface (or worse) will result. **DO NOT** leave any part in the solution for a long period of time without checking it every 5-15 minutes. However, the base metal will not be affected until the nickel is removed. If the parts are a standard gun steel or a mild steel with a low carbon content, then it is not necessary to time the parts nor be concerned about area of coverage. These parts could be left in the solution for a long period of time with no effect on the base metal. The only disadvantage is that the battery will run down and need to be recharged.

If the type of steel in the base metal is not known or if time is essential, simply remove the part from the Super-Strip periodically (about every 5 minutes) and examine. Be sure to inspect the part thoroughly not only to ensure that every speck of plating (inside and out) is removed, but also that no sign of etching of any exposed base metal has begun. If not, return the part to the solution for additional time (as required) to completely strip the plating. It is a good idea to break the electrical connection during inspection to prevent possible electrical shock. This can be accomplished easily by removing either one of the connections from the battery itself.

Should the base metal show any sign of etching, the stripping process should be stopped immediately and the part thoroughly rinsed in the flowing water tank. If additional stripping is required, then you will need to use Brownells No. 1082 Stripper (for any nickel plated parts including electro-plated nickel parts). **DO NOT** put any part back in the Super-Strip solution if it shows any sign of etching as it can be completely destroyed by the Super-Strip solution.

(5) One gallon of Super-Strip solution at room temperature will strip about six .45 Colt Automatic pistols. Of course, this is only an average as the type of plating and the method of original application of the plating will vary with the actual number of guns that can be done.

(6) The Super-Strip mixture is exactly four (4) pounds of Super-Strip powder added to one gallon of room temperature water. Using this ratio, any amount of solution can be mixed.

TO MIX ONE GALLON OF SUPER-STRIP SOLUTION:

Follow the directions exactly in the order given.

a) First, measure 1 gallon (128 oz.) of clean, fresh water into the stripping tank.

b) **Slowly** add 4 lbs. of Super-Strip, stirring constantly.

c) When the powder is dissolved and mixing is complete, the solution will be bright blue-purple color. (Changing the concentration by increasing the quantity of Super-Strip will not increase performance, or shorten stripping time. However, a weaker solution, such as 3 lbs. of Super-Strip per gallon of water, will decrease efficiency and lengthen stripping time.)

Note: Because you add 4 pounds of powder to one gallon of water you'll end up with more than 1 gallon of mixed solution, so have a sufficient number of containers on hand to hold it all. As this is a rough estimate, figure 1⅓ gallons for each 1 gallon of water and 4 lbs. of powder that are mixed.

(7) When finished stripping, cover the Super-Strip solution and let it set for several hours so the sludge will settle to the bottom of the tank. Then, carefully pour the clear part of the Super-Strip mixture into clean gallon containers and put the lids on tightly.

The color of the once-used solution will vary from bright blue to a very light blue, to an almost white translucent color. This is normal and the solution will still be effective. Discard the sludge remaining in the stripping tank for it is actually stripped plating particles and will decrease the efficiency of the Super-Strip solution and must not be left in the tank. Clean the tank with soap and water and rinse thoroughly. The system is now ready for the next job.

(8) The shelf life of dry, unmixed Super-Strip is well in excess of one year. It must be kept in a sealed container in a relatively moisture-free atmosphere. If moisture gets into the container, Super-Strip will solidify into a cake; just break up the chunks and dissolve them. The stripping solution will still work.

RECHARGING SUPER-STRIP

Brownells Super-Strip can be recharged **once**. This will provide your existing solution with the capacity to strip an additional 2 to 3 complete .45 Colt Automatics before the solution **must** be discarded. When recharging, you must keep in mind that when you mixed the original solution, you began with 1-gallon of water plus 4 lbs. of powder which yielded a solution of about 1⅓ gallons. When recharging, you must recharge the entire solution originally mixed and for the sake of these instructions, we will call this "1-gallon +" as the measurements are based on adding a weighted amount of powder to the original solution as it was mixed. If you are using more than 1 gallon of stripping solution in your tank, be sure to multiply the number of "original batches" you mixed by the amount of weighted powder per 1 gallon + required to recharge.

TO RECHARGE ONE GALLON OF SUPER-STRIP

Follow the directions exactly in the order given.

a) Pour the 1 gallon + of Super-Strip mixture back into the stripping tank. (You must remove the sludge before recharging - See Page 3, Step 7 of instructions on Mixing, Using & Storage.)

b) **Slowly** add 1 pound of Super-Strip powder to the existing 1 gallon + of Super-Strip, stirring constantly.

c) Once the new powder is thoroughly dissolved and mixing is complete, the recharged Super-Strip solution is ready for use.

d) Recharging will work only **once;** additional attempts at recharging **WILL NOT WORK**. Simply discard the old solution and mix a new batch. Make sure tank is thoroughly cleaned and all traces of old plating sludge are removed.

STRIPPING OPERATION STEPS
FOR STEEL PARTS

Review Warnings in Box at Top of Page 1

It is important to remember that in all forms of metal finishing or stripping, the cleaning steps are of utmost importance. They should not be eliminated for any reason. Any foreign material left on the old plated surface will always, with no exceptions, decrease the efficiency of the system. Disassemble the gun completely. Make sure all pins, springs and internal parts are removed. Separate the parts to be stripped from those that will not require stripping.

(1) HOT CLEANER BATH - Submerge the part in the tank for 10-15 minutes with operating temperature at 180° F. Agitate occasionally to ensure good surface cleaning.

(2) FLOWING WATER TANK - Submerge the part for five (5) seconds and agitate to flush cleaning solution from the surface of the part.

(3) TCE - Submerge the part in TCE to thoroughly clean the part. This will remove any possible remaining dirt or oils, especially some of the newer synthetic lubricants. Scrub the parts with a clean, stiff brush and use cotton swabs to thoroughly clean all surfaces including holes, crevices, etc. An ultrasonic cleaner, if available, is very helpful and eliminates the hand scrubbing. Two minutes in the ultrasonic cleaner should be sufficient to clean most parts. Of course, if the parts are extra dry, leave them in the tank until clean. Once clean, take the parts out of the TCE and set on a clean paper or shop cloth to dry.

(4) FLOWING WATER TANK - Submerge the part for five (5) seconds and agitate to flush dust or foreign matter from the newly cleaned surfaces.

(5) STRIPPING TANK - Connect the black end of the battery jumper cable to the negative terminal on the battery. Using a piece of $\frac{5}{32}$" drill rod (or similar), connect the other end of the black cable to the steel plate, or iron bar that is to be the cathode. Submerge the part in the tank and, using the nylon or wooden spoon, check to be sure the part and plate are not touching each other. (**Note:** A new solution has a deep blue color so you will not be able to see if they are touching.) Connect the other end of the red cable to the positive terminal on the battery. This completes the circuit and you should see a slight bit of gassing around the part that's being stripped. Be sure both the anode (the part to be stripped) and the cathode (the steel plate or iron bar) are fully submerged in the solution. Remember, the total surface area of the cathode must be equal to, or greater than, the anode or part that is to be stripped.

Once the part has been in the solution for a minimum of 5 minutes it can be removed for inspection. First, remove the positive (red) connection from the battery. Allow a minimum of 5 minutes between inspections. (See Page 2, Step 4 for warnings.) When the part is completely stripped, remove it from the stripping solution.

(6) FLOWING WATER TANK - Submerge the part for 30 seconds and agitate to flush all stripping solution from the part. Remove the part from the tank and allow to dry, or use compressed air for faster drying.

(7) INSPECTION - Check the part over carefully to be sure all surfaces and recesses have been fully stripped. The part can now be replated, or blued. If either process is to be done within the next few hours no further steps are necessary. However, if refinishing is to be done at a later date, use Brownells Rust Preventive No. 2™ to protect the newly cleaned and stripped surfaces. Remember, rust can form very quickly on these bare and superclean surfaces.

SPECIAL NOTES

The time it takes to completely strip a part varies and depends not only on the type of plating, thickness, etc., but also on the electrical connections and how well the battery is charged.

Throughout these instructions we have talked repeatedly about doing a "part" (singular). However, nothing prevents you from stripping several parts (plural) at a time, except the size of the iron bar or steel plate used as the cathode, (the surface must be equal to or larger than the surface of the part(s) being stripped); the electrical requirement or 90-100 amps continuous output, minimum, per square foot of surface of the item(s) being stripped. With ingenuity, you can make a hanging system that will support several part(s) in the bath, all with good electrical connections, and all stripping properly.

If the Super-Strip solution is being saved for later use, it must be allowed to set for several hours so the sludge will settle to the bottom. Then carefully pour the clear part of the Super-Strip solution into clean, gallon containers and put the lids on tightly. If you skipped this step before storing the solution, **DO NOT** try to separate the solution and the sludge after they have been stored. Some of the chemicals vital to the stripping process can settle out during storage, and would be lost from the solution. 1) Pour the entire solution, sludge and all, into your tank and mix thoroughly. 2) Be sure the solution is within the 65°-80° F. operating range. If not, adjust as outlined above. 3) Mix thoroughly again. When everything is completely back in suspension, proceed as outlined on Page 3, Step 7 of instructions on Mixing, Using and Storage. The solution should work for you on your next stripping job. If it doesn't, it will have to be replaced.

When an iron tank is used to hold the Super-Strip solution, the tank itself can be used as the cathode. Be sure the tank is clean and that there is a place for a good, solid electrical connection for the jumper-cable. Also, check to see that the wire and the connection from the battery is insulated from, and not in contact with, the positive terminal wire or the part that is being stripped. The wire or drill rod holding the part must be insulated from the side of the tank, and the part, when submerged in the solution, cannot touch any part of the tank. The easiest way to do this is to slide a section of old garden hose or other plastic/rubber tubing over the shank of the hook (being sure not to interfere with the metal-to-metal contact of the hook and the part being stripped).

The solution will work best when the cathode (steel plate or iron bar) and the anode (part to be stripped) are at minimum distance from each other, but any contact of the two will stop activity and result in a short circuit. Always check to be sure the cathode, anode, and all connecting wires are not touching.

The parts that are being stripped will appear to bubble or "gas" after a minute or more in the stripping solution. The amount of "gassing" will vary depending on the type of plating and the proximity of the anode to the cathode. The bubbling that causes the gassing is actually free hydrogen that is being released and is part of the stripping action. Caution: Do **not** breathe the free hydrogen that is released. Use adequate ventilation.

REMOVING COPPER UNDERCOAT

Some nickel plated guns are copper flashed prior to plating and, while you can still use Brownells Super-Strip, an extra step is required. As the nickel, and then the copper flashing, is stripped from the part, the copper forms copper sulfate. This appears as a black film over the metal surface and is readily seen when the part is removed from the stripping solution.

The copper sulfate film can be easily removed from the base metal by immersing the part in a solution of 50% water and 50% Hydrochloric (Muriatic) Acid. No current is used in this step. Simply hang the part in the acid bath. (Note: Hydrochloric Acid must be at least 31% pure concentrate; the Muriatic Acid equivalent is 18° Baumé. Either acid can be used as they are both exactly the same chemically: HCI. Do not use "swimming pool" acid; it is far too weak.) To mix the Acid Bath, measure equal quantities of distilled water (in one container) and Hydrochloric Acid (in separate plastic or glass container). Pour the water into the tank **first**. (An ideal tank is a plastic waste basket the same size as the one used for the stripping tank.) Add the equal amount of Acid to the water. (Never add water to acid; serious and harmful chemical eruptions may occur.)

Suspend the part in the acid solution, using the same hook as used in the stripping tank. Once the part has been in the acid solution for 10-15 minutes, remove it and brush or wipe the copper sulfate from the surface. Repeat the acid immersion procedure until the black film is completely removed. After the film has been completely removed, rinse the part for 10-15 seconds in the flowing water tank.

It is absolutely necessary to apply a coating of protective oil such as Brownells Rust Preventive No. 2 after parts are treated with the 50% acid solution as they will come out of the rinse tank super-clean and can begin rusting within minutes. Do not leave the parts in the acid solution any longer than is necessary as it can pit the surface if left in for a prolonged period. The 50% Hydrochloric Acid solution can be stored indefinitely if placed in a plastic or glass container with a tight seal.

TROUBLE SHOOTING CHART
SUPER-STRIP FOR STEEL

MALFUNCTION

Probable Cause	Remedy
SOLUTION DOES NOT STRIP	
1. New Mixed Solution.	Wait 2-3 minutes, there is a normal delay before activating begins with fresh mixed solution.
2. Poor Electrical Connection.	Check all contacts to be sure electrical current can flow from battery to parts and back properly.
3. Battery Is Dead.	Battery should be recharged to full strength, daily, after each use. Use a hydrometer if in question.
3. Depleted Solution.	4 to 6 handguns can be stripped before solution is depleted and needs to be recharged. Solution can be recharged only **once**.
SOLUTION STRIPS SLOWLY	
1. Partially Used Solution.	Allow more time. Also depends on type of plate: chrome or heavy layer of electro-nickel will take longer.
2. Parts Not Properly Cleaned.	Find source, clean up, then remake all baths.
3. Poor Rinsing Between Cleaning.	Both hot cleaner bath and TCE cleaner steps are required to get part totally clean and degreased before stripping.
4. Weak Battery.	Recharge battery to full strength for minimum stripping time.
ETCHING & PITTING OF METAL	
1. Improper Amperage.	Amperage must be 90 to 100 amps minimum continuous output per sq. ft. of metal being stripped. Lower amperage will only cause solution to heat up; not strip. Use correct power source.
2. Sludge Left In Tank.	Caused temp. to rise rapidly in tank; interferes with current flow preventing stripping. Remove per instructions for "Storage", Step 7, page 3. Operating temp. is 65-80° F. Control by chilling bath. Correct improper power source; remove sludge. Do not overload tank with parts. If temp. reaches 100° F. remove parts until temp. lowers to 65-80° F.
3. Metals Other Than Mild Steel.	Any other metal can be damaged or destroyed. Carefully review "CAUTION", page 1 for metals that cannot be stripped without damaging them.

IMPORTANT

Read and understand these instructions and all the labels on the Electroless Nickel Plating chemicals, supplies and equipment. If there is any question about the use of any of these products, please contact the Product Safety Department, Brownells, Inc., 200 South Front St. Montezuma, Iowa 50171 (515-623-5401) immediately.

NICKEL PLATING "SHOPPING LIST"

We have many requests for a list of all the items needed to set up a complete nickel plating operation. Unfortunately, we have trouble with this because we don't know what equipment or supplies you might already have in your shop. However, we did put the three following lists together that incorporate all the supplies and equipment that you need to get setup. In addition, you must have personal safety equipment including chemical face shield, rubber apron, rubber gloves and a breather mask.

The first list includes the items needed for the basic nickel plating setup. The second list includes the items required if you plan to use either natural or LP gas as your heat source. The third list is of those items you will need if you wish to use the electric Hot/Stir Plate as your heating and stirring system. (**Note:** A 1 gallon pyrex container is not all that big, and you will be limited to doing small parts, or one .45 frame and slide or a single 2" barreled revolver at a time in the tank. Much larger batches can be done, of course, in one of the gas-heated porcelain enamel tanks.)

BASIC ELECTROLESS NICKEL SUPPLY LIST

1) Heavy Duty Rubbermaid Wastebasket
2) Heavy Duty Rubbermaid Dishpan
3) Nylon or Polypropylene Funnel
4) Nylon or Pyrex Measuring Cup Set
5) Nylon Spoon
6) Electroless Nickel Plating Chemicals, A1
7) Electroless Nickel Plating Chemicals, B1
8) Electroless Nickel Plating Chemicals, C1
9) Hydrochloric Acid, 32% (same as Muriatic Acid, 18° Baumé)
10) Distilled water (available bottled locally)
11) TCE Cleaner Degreaser
12) Dicro-Clean 909™ (8 lb. box)
13) Bluing Thermometer
14) Electroless Nickel Stripper Kit (Check instructions to determine Stripper Kit wanted)
15) Brown Laboratory Jugs (carton of 4)
16) Black Iron Wire
17) 12" Stainless Steel Ruler
18) Professional Nickel Final Polishing Cloth

TANKS AND BURNERS FOR GAS HEAT SOURCE

1) Porcelain Enamel Tan (choose size to fit largest job expected).
2) Heat Source for Plating Tank
3) Tank for Hot Cleaner
4) Heat Source for Hot Cleaner Tank
5) Electric Stirrer/Agitator Motor
6) Electronic Variable Speed Controller
7) Solution Mixer/Connector Set
8) Aluminum foil to make Heat Shield for Motor

TANKS AND HEATERS FOR ELECTRIC HOT/STIR PLATE SYSTEM

1) Series #1000 Hot/Stir Plate
2) Pyrex Gallon Jar (2 required: 1 for Hot Cleaner and 1 for Plating Solution)
3) Hot Cleaner Tank (Pyrex on Hot Plate; or Porcelain Enamel Tank or Gas/Electric Heat)
4) Heat Source (for Hot Cleaner Tank)

GETTING A LARGER TANK

In response to the many requests we have received for a plating tank of sufficient size to Electroless Nickel Plate both shotgun and rifle barreled actions, we have developed a 40" long, 6" wide, 9" deep Fiberglass Tank, **#082-110-694**. There are also custom manufacturers who can build a polypropylene tank for you and we have listed them below. An alternate choice for heating is a Quartz immersion heater and suppliers of those heaters are also listed below. The price for this equipment can be quite high. The list of possible sources for High Temperature Polypropylene Tanks and Quartz immersion heaters is as follows: (Please note, there are many other sources available but these are just a few that we found listed in the current Thomas Register.)

TANKS

JECO Plastics Products
P.O. Box 26-T
Plainfield, IN 46168
317-839-4943

Aetna Plastics Corp.
17th St. & Clair Ave.
Cleveland, OH 44114
800-321-7004

M.E. Baker
25 Wheeler St.
Cambridge MA 02138
800-963-2269

United Utensils Co.
2 Yennicock Ave.
Port Washington, NY 11050
800-645-1248

QUARTZ HEATERS

Proheco Manufacturing Co.
3198 Factory Dr.
Pomona CA 91768
909-686-0687

Arklay S. Richards Co., Inc.
Newton Highlands, MA 02161
617-964-3746

Glo-Quartz Electric Heater Co., Inc.
7084 Maple St.
Mentor, OH 44060
404-255-9701