

USEFUL INFORMATION.

Marine Glue. Dissolve 4 parts of India rubber in 34 parts of coal tar naphtha—aiding the solution with heat and agitation; add to it 64 parts of powdered shellac, which must be heated in the mixture, till the whole is dissolved. While the mixture is hot it is poured upon metal plates in sheets like leather. When required for use, it is heated in a pot, till soft, and then applied with a brush to the surfaces to be joined. Two pieces of wood joined with this glue can scarcely be sundered.

Dextrine. Dry potato-starch heated from 300 to 600 degrees Fahrenheit until it becomes brown, soluble in cold water, and ceases to turn blue with iodine. Used by calico printers and others, instead of gum arabic.

A Liquid Glue that Keeps for Years. Dissolve 2 pounds good glue in 2 and one-ninth pints hot water, add gradually 7 ounces nitric acid, and mix well.

An excellent liquid glue is also made by dissolving glue in nitric ether, this fluid will only dissolve a certain amount of glue, consequently the solution cannot be made too thick. The glue solution obtained has about the consistency of syrup.

Prepared Liquid Glue. Take of best white glue 16 ounces, white lead, dry, 4 ounces, rain water 2 pints, alcohol 4 ounces. With constant stirring dissolve the glue and lead in the water by means of a water-bath.

Add the alcohol, and continue the heat for a few minutes. Lastly pour into bottles while it is hot.

Liquid Glues. Dissolve 33 parts of best glue on the steam bath in a porcelain vessel, in 36 parts of water. Then add gradually, stirring constantly, 3 parts of aqua fortis, or as much as is sufficient to prevent the glue from hardening when cool. Or dissolve one part of powdered alum in 120 of water, add 120 parts of glue, 10 of acetic acid and 40 of alcohol, and digest.

Aluminum Solder. This consists of 28 pounds of block tin, three and one-half pounds of lead, seven-pounds of spelter, and 14 pounds of phosphor-tin. The phosphor-tin should contain 10 per cent of phosphorus. Clean off all the dirt and grease from the surface of the metal with benzine, apply the solder with a copper bit, and when the molten solder covers the metal, scratch through the solder with a wire scratch brush.

Sweating Aluminum to Other Metals. First coat the aluminum surface to be soldered with a layer of zinc. On top of the zinc is melted a layer of an alloy of one part aluminum to two and one-half parts of zinc. The surfaces are placed together and heated until the alloy between them is liquefied.

Soldering Fluid. Take of scrap zinc or pure spelter about $\frac{1}{4}$ pound, and immerse in a half-pint of muriatic acid. If the scraps completely dissolve add more until the acid ceases to bubble and a small piece of metal remains. Let this stand for a day and then carefully pour off the clear liquid, or filter it through a cone of blotting paper. Add a teaspoonful of sal-ammoniac, and when thoroughly dissolved, the solution is ready for use. Depending on the materials to be soldered, the quantity of sal-ammoniac can be reduced. Its presence

makes soldering very easy, but, unless the parts are well heated so as to evaporate the salt, the joints may rust.

Mixture for Silvering. Dissolve 2 ounces of silver with 3 grains of corrosive sublimate, add tartaric acid 4 pounds, salt 8 quarts.

To Separate Silver from Copper. Mix sulphuric acid 1 part, nitric acid 1 part, water 1 part, boil the metal in the mixture till it is dissolved, and throw in a little salt to cause the silver to precipitate.

Solvent for Gold. Mix equal quantities of nitric and muriatic acids.

Composition used in Welding Cast Steel. Borax 10, sal ammoniac 1 part. Grind or pound them roughly together, then fuse in a metal pot over a clear fire, taking care to continue the heat until all scum has disappeared from the surface. When the liquid appears clear, the composition is ready to be poured out to cool and concrete, afterwards, being ground to a fine powder, it is ready for use. To use this composition, the steel to be welded is raised to a heat which may be expressed as a bright-yellow. It is then dipped among the welding powder, and again placed in the fire until it attains the same degree of heat as before. It is then ready to be placed under the hammer.

Cast Iron Cement. Clean borings, or turnings, of cast iron 16, sal ammoniac 2, flour of sulphur 1 part. Mix them well together in a mortar and keep them dry. When required for use, take of the mixture 1, clean borings 20 parts. Mix thoroughly and add a sufficient quantity of water. A little grindstone dust added improves the cement.

Durable Bronze for Tin and Tin Alloys. After carefully cleansing the article from dirt and grease, coat it lightly with a solution of 1 part of sulphate of copper (blue vitriol), and 1 part of copperas, in 20 parts of water, and after drying, with a solution of 1 part of verdigris in 4 of vinegar. After again drying, impart lustre to the article by rubbing with a soft brush dipped at first into jewelers' rouge, and frequently breathing upon it. The places in relief are then rubbed with a piece of soft leather moistened with solution of wax in turpentine, and finally rubbed with a dry leather.

Etching on Iron or Steel. Take one-half ounce of nitric acid and one ounce of muriatic acid. Mix, shake well together, and it is ready for use. Cover the place you wish to mark with melted beeswax, when cold write the inscription plainly in the wax clear to the metal with a sharp instrument, then apply the mixed acids with a feather, carefully filling each letter. Let it remain from one to ten minutes, according to the appearance desired. Then throw on water, which stops the etching process and removes the wax.

Soldering Solution. An excellent method of preparing resin for soldering bright tin is given as follows: Take one and one-half pounds of olive oil and one and one-half pounds of tallow and 12 ounces of pulverized resin. Mix these ingredients and let them boil up. When this mixture has become cool, add one and three-eighths pints of water saturated with pulverized sal ammoniac, stirring constantly.

Softening Cast Iron. To soften iron for drilling, heat to a cherry-red, having it lie level in the fire. Then with tongs, put on a piece of brimstone, a little less in

size than the hole is to be. This softens the iron entirely through. Let it lie in the fire until cooled, when it is ready to drill.

To Tin Copper and Brass. Boil 3 pounds of cream of tartar, 4 pounds of granulated tin or tin shavings, and 2 gallons of water. After boiling for a sufficient time, place the articles to be tinned in the mixture, and the boiling being continued, the tin is precipitated in its metallic form.

To Tin Iron Sauce-pans. If the sauce-pan is an old one, it must be put on the fire and allowed to get nearly red hot, which will get rid of all the grease. Then make a pickle of the following proportions: Sulphuric acid one-quarter pound, muriatic acid 2 ounces, water 1 pint. If the sauce-pan can be filled, so much the better, if not, keep the pickle flowing over it for five minutes, then rinse off with water, scour well with sand or coke dust, and rinse thoroughly with water. If the pan is clean, it will be of a uniform gray color, but if there are any red or black spots, it must be pickled and scoured again until thoroughly clean. Have ready chloride of zinc, or muriatic acid, in which sheet zinc has been dissolved, some powdered sal ammoniac, about 18 inches of iron rod about one-quarter or three-eighths inch thick, one end flattened out and bent up a little, and filed clean, and some bar tin. Dip a wisp of tow in the chloride of zinc, then into the powdered sal ammoniac, taking up a good quantity, and rub well all over the inside. This must be done directly after the scouring, for, if allowed to stand, it will oxidize. Now put the pan over the fire until it is hot enough to melt tin, and then brush the end of a bar of tin over the heated part until melted. Rub the tin well over the

surface with the flattened end of the iron rod. Care should be had not to heat too large a surface at once, nor to let it get too hot, which may be known by the tin getting discolored, when some dry sal ammoniac must be thrown in. Having gone all over it, wipe lightly with a wisp of tow, made just warm enough to prevent the tin from sticking to it. When cold, scour well with sand and tow, rinsing with plenty of water.

Cold Tinning. Block tin dissolved in muriatic acid with a little mercury forms a very good amalgam for cold tinning, or 1 part of tin, 2 of zinc, and 6 of mercury. Mix the tin and mercury together until they form a soft paste. Clean the metal to be tinned, taking care to free it from greasiness. Then rub it with a piece of cloth moistened with muriatic acid and immediately apply a little of the amalgam to the surface, rubbing it with the same rag. The amalgam will adhere to the surface and thoroughly tin it. Cast-iron, wrought-iron, steel and copper may be tinned in this manner. Those who find it difficult to make soft solder adhere to iron with sal ammoniac, will find no difficulty if they first tin the surfaces in this manner, and then proceed as with ordinary tin plate.

To Tin Small Articles. Place them in warm water, with a little sulphuric acid added to it, which will clean them. Then powder some sal ammoniac, and mix it in the water, stirring vigorously until all is dissolved. After washing the articles in clean water, place them in the solution for a few minutes and then place them near the fire to dry. Procure a pan resembling a frying pan in shape, the bottom of which must be full of small holes. The pot for melting the

tin must be large enough to admit the pan for holding the articles. Cover the bottom of the pan with the articles to be tinned, and after sprinkling a little powdered sal ammoniac over the surface of the molten tin to clear it from dross, dip the pan containing the articles into it, after all smoke has disappeared, lift it out and shake well over the pot, sprinkling a little sal ammoniac over the goods to prevent them from having too thick a coat, and then cool them quickly in cold water to keep them bright.

Galvanizing Brass and Copper. Copper and brass may be coated with metallic zinc in the following way: Finely divided zinc, in a non-metallic vessel, is covered with a concentrated solution of sal ammoniac, this is heated to boiling, and the articles of copper or brass, properly cleansed, are introduced. A few minutes then suffice to produce a firm and brilliant coating. The requisite fineness of the zinc is produced by pouring the melted metal into a mortar and tritulating it until it solidifies.

Cheap and Quick Method of Coloring Metals. Metals may be colored quickly and cheaply by forming on their surface a coating of a thin film of a sulphide. In 5 minutes brass articles may be coated with any color varying from gold to copper red, then to carmine, dark red, and from light aniline blue to a blue white, like sulphide of lead, and at last a reddish white according to the thickness of the coat, which depends on the length of time the metal remains in the solution used. The colors possess a very good lustre, and if the articles to be colored have been previously thoroughly cleansed by means of acid and alkalies, they adhere so

firmly that they may be operated upon by the polishing steel.

To prepare the solution dissolve $1\frac{1}{2}$ ounces of hyposulphite of soda in 1 pint of water, and add $1\frac{1}{2}$ ounces of acetate of lead, dissolved in half a pint of water. When this clear solution is heated to from 190 to 210 degrees Fahrenheit, it decomposes slowly and precipitates sulphide of lead in brown flakes. If metal be now present, a part of the sulphide of lead is deposited thereon, and according to the thickness of the deposited sulphide of lead, the above-mentioned colors are produced. To produce an even coloring, the articles must be evenly heated. Iron treated with this solution takes a steel-blue color, zinc a brown color, in the case of copper objects, the first gold color does not appear.

If, instead of the acetate of lead, an equal weight of sulphuric acid is added to the hyposulphite of soda, and the process carried on as before, the brass is covered with a very beautiful red, which is followed by a green, and changes finally to a splendid brown with green and red iris glitter. This last is a very durable coating. Very beautiful marble designs can be produced by using a lead solution, thickened with gum tragacanth, on brass which has been heated to 210 degrees Fahrenheit, and is afterwards treated by the usual solution of sulphide of lead. The solution may be used several times.

Cleaning Tinware. Ordinary tinware is made of sheet-iron, coated with tin. Acids should never be employed to clean such articles, because they attack the metal and remove it from the iron. Rub the articles to be cleaned first with rotten stone and sweet oil, then

finish with whiting and a piece of soft leather. Articles made of solid tin should be cleaned in the same manner. In a dry atmosphere planished tin will remain bright for a long period, but it soon becomes tarnished in moist air.

Suggestions how to Solder. Clean the parts thoroughly from all rust, grease or scale, then wet with prepared acid. Hold the soldering copper on each part until the article is well tinned and the solder has flowed to all parts.

Watch-Makers' Oil that Will Never Corrode or Thicken. Take a bottle about half full of good olive oil and put in thin strips of sheet lead, expose it to the sun for a month, then pour off the clear oil. The above is a very cheap way of making a first-class oil for any light machinery.

Varnish for Copper. To protect copper from oxidation a varnish may be employed which is composed of carbon disulphide 1 part, benzine 1 part, turpentine oil 1 part, wood alcohol 2 parts and hard copal 1 part. It is well to apply several coats of it to the copper.

Glue for Iron. Put an equal amount by weight of finely powdered rosin in glue and it will adhere firmly to iron or other metal surfaces.

Soldering or Tinning Acid. Muriatic acid 1 pound, put into it all the zinc it will dissolve and 1 ounce of sal ammoniac, add as much clear water as you have acid, it is then ready for use.

Plaster of Paris. Common plaster that farmers use to put on land and plaster of Paris are the same thing, except plaster of Paris is common plaster calcined. Many times it is difficult to get calcined plaster, and when it is procured it is badly adulterated with lime

and unfit for many uses. To calcine plaster, or in other words, to make common plaster so it will harden, you have but to take the plaster and put it in an iron kettle and place it over a slow fire, put no water in it. In a few moments it will begin to boil and will continue to do so until every particle of moisture is evaporated out of it. When it has stopped boiling take it off, and when cold it is ready for use. Plaster treated in this way will harden much quicker and harder than any which can be bought ready prepared.

Hardening Small Articles. To harden small tools or articles that are apt to warp in hardening, heat very carefully, and insert in a raw potato, then draw the temper as usual.

Bluing Brass. Dissolve one ounce of antimony chloride in twenty ounces of water and add three ounces of pure hydrochloric acid. Place the warmed brass article into this solution until it has turned blue. Then wash it and dry in saw-dust.

Drilling Glass. Take an old three-cornered file, one that is worn out will do, break it off and sharpen to a point like a drill and place in a carpenter's brace. Have the glass fastened on a good solid table so there will be no danger of its breaking. Wet the glass at the point where the hole is to be made with the following solution:

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| Ammonia | 6½ drachms |
| Ether | 3½ drachms |
| Turpentine | 1 ounce |

Keep the drill wet with the above solution and bore the hole part way from each side of the glass.

Another solution is to dissolve a piece of gum camphor the size of a walnut in one ounce of turpentine.

Another method is to use a steel drill hardened, but not drawn. Saturate spirits of turpentine with camphor and wet the drill. The drill should be ground with a long point and plenty of clearance. Run the drill fast and with a light feed. In this manner glass can be drilled with small holes, up to 3-16 inch in diameter nearly as rapidly as cast steel.

Cement for Pipe Joints. Mix 10 parts iron filings and 3 parts chloride of lime to a paste by means of water. Apply to the joint and clamp up. It will be solid in 12 hours.

Removing Stains. To remove Ink Stains, wash with pure fresh water, and apply oxalic acid. If this changes the stain to a red color, apply ammonia. To remove Iron Rust from White Fabrics, saturate the spots with lemon juice and salt and expose to the sun.

Resharpening Files. Well-worn files are first carefully cleaned with hot water and soda, they are then placed in connection with the positive pole of a battery, in a bath composed of 40 parts of sulphuric acid and 1,000 of water. The negative is formed of a copper spiral surrounding the files, but not touching them, the coil terminates in a wire which rises towards the surface. When the files have been in the bath 10 minutes, they are taken out, washed and dried, when the whole of the hollows will be found to have been attacked in a very sensible manner, but should the effect not be sufficient, they are replaced in the bath for the same period as before. Sometimes two operations are necessary, but seldom more. The files thus treated are to all appearances like new ones, and are said to be good for 60 hours' work. Twelve medium Bunsen cells are used for the battery.

To Repair Broken Belting. Broken belting can be reunited by the use of chrome glue. With a lap of 4 or 5 inches, the reunited part is apparently as firm as any part of the band, though it is well to take the precaution to tack down the ends of the lapped pieces with a few stitches of stout thread. The chrome glue is prepared as follows: Take 100 parts glue, soaked 12 hours in water, then pour off the remaining water, melt the glue, add 2 per cent of glycerine and 3 per cent of red chromate of potash, melting them with the glue. This mixture, thinned by warming, is applied to the lapped ends after having been roughened with a rasp, and then placed between two hard wood strips in a vice and well pressed. Leave the lapped ends for 24 hours in the vice to become thoroughly dried.

Weight of Castings. If you have a pattern made of soft pine, put together without nails, an iron casting made from it will weigh sixteen pounds to every pound of the pattern. If the casting is of brass, it will weigh eighteen pounds to every pound of the pattern.

Ordering Taps and Dies. In ordering Taps and Dies, be sure and give the kind, exact size and thread wanted. Always remember you are writing to a person who knows nothing of what is wanted, therefore make the order plain and explicit. Never order a special Tap or Die if it can be avoided, as such will cost at least double that of regular sizes and threads.

Tapping Nuts. Always use good lard oil in cutting threads with a die or tapping out nuts. Poor cheap oil will soon ruin both die and tap.

Grindstones. Grindstones to grind tools should be run at a speed of about 800 feet per minute at its periphery, a 30-inch stone should be run about 100 revo-

lutions per minute. When used to grind carpenters' tools a speed of 600 feet at its periphery, a 30-inch stone should therefore be run at 75 revolutions per minute.

White Metal for Bearings. White metal for bearings consists of 48 pounds of tin, 4 pounds of copper, and 1 pound of antimony. The copper and tin are melted first, and then the antimony is added.

Marine Glue. One part of pure india rubber dissolved in naphtha. When melted add two parts of shellac. Melt until thoroughly mixed.

To Soften Cast Iron. Heat the whole piece to a bright glow and gradually cool under a covering of fine coal dust. Small objects should be packed in quantities, in a crucible in a furnace or open fire, under materials which when heated to a glow give out carbon to the iron. They should be heated gradually, and kept at a bright heat for an hour and allowed to cool slowly. The substances recommended to be added are cast-iron turnings, sodium carbonate or raw sugar. If only raw sugar is used, the quantity should not be too small. By this process it is said that cast-iron may be made so soft that it can almost be cut with a pocket-knife.

To Harden Files. To harden files dip the file in red-hot lead, handle up. This gives a uniform heat and prevents warping. Run the file endwise back and forth in a pan of salt water. Set the file in a vise and straighten it while still warm.

Leather Belts. A leather belt is more economical in the end than a rubber one. When buying a leather belt it should be tested by doubling it up with the hair side out. If it should crack, reject it as it cannot re-

alize the whole amount of power it should transmit. If it shows a spongy appearance it should be condemned at once, for it must be pliable as well as firm. The grain or hair side should be free from wrinkles and the belt should be of uniform thickness throughout its length. It should be tested for quality by immersing a small strip in strong vinegar. If the leather has been properly tanned and is of good quality, it will remain in vinegar for weeks without alteration, excepting it will grow darker in color. If the leather has not been properly tanned the fiber will swell and the leather will become softened, turning it into a jelly-like mass.

To Cement Rubber to Leather. Roughen both surfaces with a sharp piece of glass, apply on both a diluted solution of gutta percha in carbon bisulphide, and let the solution soak into the material. Then press upon each surface a skin of gutta percha about one-hundredth of an inch in thickness, between a pair of rolls. Unite the two surfaces in a press that should be warm but not hot. In case a press cannot be used, dissolve 30 parts of rubber in 140 parts of carbon bisulphide, the vessel being placed on a water bath of a temperature of 86 degrees Fahrenheit. Melt ten parts of rubber with fifteen parts of rosin and add 35 parts of oil of turpentine. When the rubber has been completely dissolved, the two liquids may be mixed. The resulting cement must be kept well corked.

Drilling Holes in Glass. Holes of any size desired may be drilled in glass by the following method: Get a small 3-cornered file and grind the points from one corner and the bias from the other and set the file in a brace, such as is used in boring wood. Lay the glass

in which the holes are to be bored on a smooth surface covered with a blanket and begin to bore a hole. When a slight impression is made on the glass, place a disk of putty around it and fill with turpentine to prevent too great heating by friction. Continue boring the hole, which will be as smooth as one drilled in wood with an auger. Do not press too hard on the brace while drilling.

To Polish Brass. Smooth the brass with a fine file and run it with smooth fine grain stone, or with charcoal and water. When quite smooth and free from scratches, polish with pumice stone and oil, spirits of turpentine, or alcohol.

How to Make a Soft Alloy. A soft alloy which will adhere tenaciously to metal, glass or porcelain, and can also be used as a solder for articles which cannot bear a high degree of heat, is made as follows:

Obtain copper-dust by precipitating copper from the sulphate by means of metallic zinc. Place from 20 to 36 parts of the copper-dust, according to the hardness desired, in a porcelain-lined mortar, and mix well with some sulphuric acid of a specific gravity of 1.85. Add to this paste 70 parts of mercury, stirring constantly, and when thoroughly mixed, rinse the amalgam in warm water to remove the acid. Let cool from 10 to 12 hours, after which time it will be hard enough to scratch tin.

When ready to use it, heat to 707 degrees Fahrenheit and knead in an iron mortar till plastic. It can then be spread on any surface, and when it has cooled and hardened will adhere most tenaciously.

Paint for Iron. Dissolve $\frac{1}{2}$ pound of asphaltum and $\frac{1}{2}$ pound of pounded resin in 2 pounds of tar oil.

Mix hot in an iron kettle, but do not allow it to come in contact with the fire. It may be used as soon as cold, and is good both for outdoor wood and iron-work.

Recipe for Heat-Proof Paint. A good cylinder and exhaust pipe paint is made as follows:

Two pounds of black oxide of manganese, 3 pounds of graphite and 9 pounds of Fuller's earth, thoroughly mixed. Add a compound of 10 parts of sodium silicate, 1 part of glucose and 4 parts of water, until the consistency is such that it can be applied with a brush.

Rust Joint Composition. This is a cement made of sal ammoniac 1 pound, sulphur $\frac{1}{2}$ pound, cast-iron turnings 100 pounds. The whole should be thoroughly mixed and moistened with a little water. If the joint is required to set very quick, add $\frac{1}{4}$ pound more sal ammoniac. Care should be taken not to use too much sal ammoniac, or the mixture will become rotten.

Removing Rust from Iron. Iron may be quickly and easily cleaned by dipping in or washing with nitric acid one part, muriatic acid one part and water twelve parts. After using wash with clean water.

Making Pipe Joints. Never screw pipe together for either steam, water or gas without putting white or red lead on the joints.

Many times in taking pipe apart the joints are stuck so hard that it is impossible to unscrew the pipe; heat the coupling (not the pipe) by holding a hot iron on it, or hammer the coupling with a light hammer, either one will expand the coupling and break the joint so it can be easily unscrewed.

Annealing Cast Iron. To anneal cast iron, heat it in a slow charcoal fire to a dull red heat; then cover it

over about two inches with fine charcoal, then cover all with ashes. Let it lay until cold. Hard cast iron can be softened enough in this way to be filed or drilled. This process will be exceedingly useful to iron founders, as by this means there will be a great saving of expense in making new patterns.

To make a casting of precisely the same size of a broken casting without the original patterns: Put the pieces of broken casting together and mould them, and cast from this mould. Then anneal it as above described, it will expand to the original size of the pattern, and there remain in that expanded state.

Preventing Iron or Steel from Rusting. The best treatment for polished iron or steel, which has a habit of growing gray and lustreless, is to wash it very clean with a stiff brush and ammonia soapsuds, rinse well and dry by heat if possible, then oil plentifully with sweet oil and dust thickly with powdered quick lime. Let the lime stay on two days, then brush it off with a clean stiff brush. Polish with a softer brush, and rub with cloths until the lustre comes out. By leaving the lime on, iron and steel may be kept from rust almost indefinitely.

Loosening Rusted Screws. One of the simplest and readiest ways of loosening a rusted screw is to apply heat to the head of the screw. A small bar or rod of iron, flat at the end, if reddened in the fire and applied for two or three minutes to the head of a rusty screw, will, as soon as it heats the screw, render its withdrawal as easy with the screwdriver as if it were only a recently inserted screw. This is not particularly novel, but it is worth knowing.