

Secrets of Craft and Nature in Renaissance France

BnF Ms. Fr. 640 - English Translation

List of names

Mestre Nico*[illegible]* **Costé**,^[c_001r_01] in the Rue de la Heaumerie,^[c_001r_02] at the sign of St Claude / Mirrors.

Mestre Jehan Cousin,^[c_001r_03] who resides in the Faubourg Saint-Germain,^[c_001r_76] knows of the MASTER.

Mestre Jehan Garnier,^[c_001r_80] in the Rue des Escrivains by St Jacques de la Boucherie,^[c_001r_77] CURRIER. Try pastel woad flowers.

List

The HARVESTER that leaves some ears is not blamed.^[c_001r_04]

Sacra Eleusinæ *deæ*^[c_001r_05] propalare nefas.^[c_001r_07]

Trumpets, see the book of funerals.^[c_001r_08]

List of books and authors

Vuolfangus Lazius^[c_001r_09]

Petrus Appianus,^[c_001r_10] *mathematicus*

Ingolstadiensis, Comment. urb. rom.^[c_001r_11]

Hieronimo Ruscelli^[c_001r_12]

Hermolaus Barbarus^[c_001r_13]

Angelius Bargæus,^[c_001r_35] *De aucupio et venatione*^[c_001r_14]

Nicolaus Damascenus^[c_001r_15]

Caresariensis,^[c_001r_34] *De rebus Persarum*^[c_001r_16]

Isidorus^[c_001r_17]

Osorius^[c_001r_18]

Eupolemus,^[c_001r_19] *HISTORICUS gentilis*

qui de rebus Davidis & Salomonis

scripsit^[c_001r_20]

monsieur^[c_001r_69]

- *Cathalogue des villes*^[c_001r_21]

Calendrier des BERGIERS^[c_001r_22]

Grammaire italiene^[c_001r_23]

Arithmetique^[c_001r_24] of **Savonne**^[c_001r_65]

Instruction pour le fait des finances^[c_001r_25]

Questions aeigmatiques^[c_001r_26]

Des præceptes d'agriculture^[c_001r_27]

+ *Le secret des finances à Lyon*^[c_001r_28]

Synesius^[c_001r_29]

Olaus Magnus^[c_001r_30]

+ **Mestre Bernard Palissi**,^[c_001r_31] *INVENTOR OF RUSTIC FIGULINES to the KING*

and the *QUEEN MOTHER*^[c_001r_32]

Alexander Aphrodisæus^[c_001r_40]

Polydorus Vergilius^[c_001r_41]

Appianus^[c_001r_42]

Athenæus^[c_001r_43]

Pausanias^[c_001r_33]

Statius^[c_001r_36] *Thebaidos*^[c_001r_44]

Servius,^[c_001r_45] *in Aeneidem*^[c_001r_37]

Macrobius^[c_001r_46]

Aulus Gellius^[c_166r_18]
Alexander ab Alexandria^[c_001r_81]
Festus^[c_001r_47]
Nonius^[c_001r_48]
Magius,^[c_001r_78] *Miscellanea*^[c_001r_49]
Pollux,^[c_001r_79] *Onomasticon*^[c_001r_50]
Higinus^[c_001r_51]
Berosus^[c_001r_52]
Suetonius^[c_001r_68]
Valerius Maximus^[c_166r_19]
Cornelius Tacitus^[c_001r_66]
Xenophon^[c_001r_72]
Seneca^[c_001r_73]
Dionisius Halicarnassensis^[c_001r_53]
Sabellicus^[c_001r_54]
cum permultis
aliis^[c_001r_67] **Julius Capitolinus**^[c_001r_55]
Budæus^[c_001r_56]
Spartianus^[c_001r_57]
Blondus^[c_001r_58]
Volaterranus^[c_001r_59]
Herodotus^[c_001r_71]
Paulus Manutius^[c_001r_60]
Strabo^[c_001r_74]
Julius Firmicus^[c_001r_61]
Quintus Curtius^[c_001r_62]
Dion^[c_001r_63]
Cornelius Nepos^[c_001r_75]
Flavius Vopiscus^[c_001r_64]

List of books

^[c_001r_70] *Aquatilium animalium historiæ*, **Hypolito**
Salviano^[c_001r_06] *Typhernate authore, Romæ 1554*^[c_001r_38]

Les Annales de Normandie^[c_001r_39]

For loosening the belly

Prunes of Saint Antonin, & if you like, you want put among them leaves of mallow & gilliflower, adding in sugar & if one wants, a little cinnamon for the stomach.

Or else, marshmallow root in a chicken broth. The fresh kind is more mollifying.

Beating syrup of sweet jujubes with water & taking it *in the morning* loosens the belly.

Books to recover

The chronicles of Sigebert^[c_002r_01]

Ruffinus^[c_002r_02]

Irenius^[c_002r_03] in *Exegesi*^[c_002r_04]

Paule Emile^[c_002r_05]

Paule Jove^[c_002r_06]

Polydorus^[c_001r_41]

Bergomensis^[c_002r_08]

Philippe de Commynes^[c_002r_09]

Against pains

Turpentine oil, oil of Jacob, and salt extracted from cabbage ash.

List of books

Practica, cioè nova inventione di contegiare,^[c_002v_03] stampata in Brescia per **Vincenzo Sabio**.^[c_002v_01]

[c_002v_07]Emeralds of Brissac

I have taken minium 26 ʒ, crystal[c_002v_04] *[illegible]* and ground on marble 12 ʒ, verdet 3 | 3 |. Incorporate all together, put in a crucible[c_002v_05] covered with another, well luted, that has a hole in the top. Fusion 7 hours without blowing. The mass was of a beautiful green.

I have taken minium 12 ʒ, crystal 6 ʒ, verdet 2 grains. Soft fusion vi hours, refired 24 hours. The mass was green, yellow & red.

| Sapphire

Pebbles or crystal 8 ʒ, minium 16 ʒ, BLACKSMITH'S salt 4 ʒ, sparkling coryal 4 grains. Fusion 6[c_002v_06] hours.

Counterfeit coral^[c_003r_02]

+

One needs to first make the branches of **wood** or take a bizarre **thorn branch**, then melt a lb of the most beautiful **clear pitch resin** and put in one ounce of **subtly ground vermilion** with **walnut oil**, and if you add in a little **Venice laque platte**,^[c_039v_02] the color will be more vivid, and stir everything in the **resin** melted over a **charcoal** fire and not of flame, for fear that it catches fire. Next dip in your branches while turning, & if any filaments should remain on it, turn the branch over the heat of the **charcoal**.

Colophony is nothing other than recooked **rosin**. To do it well, take a **leaded pot** & melt the **resin**, & boil it over the **brazier** a good **hour**, & until it appears not to be thick, but clear & liquid like **water**, & easily runs & flows from the tip of a **stick** with which you grind it, & test it. Then pour it through a **coarse canvas** or a **very light tammy cloth**, such that when pouring it falls into the strongest **vinegar** that you can find, for the **vinegar** gives it strength & prevents it from being so fragile. Reiterate this two or three times & it will be beautiful & well purified. For counterfeiting your **coral**, you can mix a quarter part of **mastic** into your **purified rosin** to render it more firm and more beautiful, & if you were to take a single tear of **mastic**, it would be all the better, but it would be too long.

Sulfur & **vermilion** makes the same effect.

The **coral** made of **gules red enamel** endures the **file** and polishing.

It is made like **cement** that is stronger mixed with **pestled than of glass** rather than with **brick**. Thus, here one mixes well **pestled gules red enamel**, which is red in body, with the **vermilion**. Thus with all colors of **enamels**.

Varnish for panels

Take a lb of Venice turpentine & heat it in a pot until it simmers, and put in half a lb of the turpentine oil of the whitest you can find, and stir it together well on a charcoal fire and take it off immediately. And *elle* it is done. But if it seems too thick to you, add in a little more oil. Similarly if it is too clear, you can thicken it by putting in a little turpentine. Thus you will give it whatever body you want. It could be made well without fire, but, when heated, it is more desiccative. It is appropriate for panel paintings and other painted things without corrupting the colors or yellowing. And it dries both in the shade and in the sun, and *overnight*, and *during the winter* as well as *in the summer*. It is commonly sold 15 sous a lb.

A little more turpentine than turpentine oil is needed in order to give body to the varnish, which needs to be applied with the finger in order to spread it thinner and less thick, for when it is thick, it turns yellow and sticks. One does not varnish to make paintings shine, for it just takes the light out of them.

Thick varnish for planks

There is a varnish that takes a long time to dry & drips more than two months after it has been applied to the planks. But this one does not drip like that of *times past*, which was made of linseed oil, garlic boiled in it to extinguish it & rid it of grease, & with wheat. And this one yellowed & rendered greenish the blue color of paintings. This one is made like the other one except that one puts coarse common turpentine

But it is used to heighten colors which have soaked in and to keep them from dust. Mastic varnish does not resist rain, whereas that of oil and rosin does.

instead of **fine turpentine**. And you can put into two lb of ~~ten~~ **common turpentine** one lb of **fine turpentine oil** & do everything as with the other one. This one will cost you no more than five or six **sous** per lb & is sold for 40 **sous** per lb.

[Figure: fig_p003v_1]

This vessel is for making large quantities of **turpentine oil**, that is to say a bucket an hour, and no matter which **turpentine it may be, whether fine or crude**. One needs to give, as you know, a little fire at the beginning and always keep **cold water** in the cooler on the top. The lb is sold at xii **sous**, & at the bottom of the vessel remains the **colophony**, or *pix græca*.^[c_003v_01] In this vessel, **eau-de-vie** is also made well, and there is no need to distill it again. You do not need a **oven** for this **copper** vessel, but only **charcoal** around it if it has a flat bottom, but if it is round, you will place it on a **trivet**.

It is better to heat the **varnish** a little bit, rather than to put it out **in the sun**, because this makes the panel *warp*.

Some say it is not good to distil in this **copper** vessel because it makes things green. However, when **tinned**, it is good.

For varnishing

Turpentine varnish does not need any **glue** because it is fatty & viscous & it is not absorbed in the **wood** like that of **spike lavender** & **sandarac**. Also, that of **spike lavender** does not require any **glue** on **iron** & similar things that do not absorb. But on **wood** & on colors which have do not have **gum** or **distemper glue**, it is necessary to lay one coat of the said **hide glue** & to let it dry & to varnish.

Varnish of spike lavender oil

One needs to heat **spike lavender oil** & as it begins to simmer, put in **powdered sandarac gum** so that it soon melts. And over a **charcoal** fire stir continuously until the **sandarac** is well melted, which you will know by taking a little of the said **varnish** on a **plate**, and if it is fatty when you handle it with a **finger**, it is ready. And for one lb of **spike lavender oil**, you will put five ounces of **pulverized sandarac**, although some only put in four ounces, but this is neither so good nor so fatty. This one is promptly dry. **FRAME MAKERS**, to avoid the trouble of polishing their **ebony**, varnish it with this, as do **GUITAR MAKERS**. This is not as appropriate for panels as that of **fine turpentine**, though it is good for the moldings of panels. One did not use to varnish the landscape of a panel when **linseed varnish** was in use, because it yellowed the landscape. But with that of **turpentine**, one varnishes everywhere. You can put in **pulverized mastic** extracted in tears or otherwise, & it will be more desiccative, in place of **sandarac**.

If you want to varnish on **plaster** or a wall, first put on your very hot **hide glue**, because if were cold it would not penetrate the wall, & when you would put your **varnish** on, it would come off.

Varnish of spike lavender oil is not as appropriate for colors as that of **turpentine**, for **spike lavender oil** ~~makes them die~~ eats the colors since it is too penetrating.

For removing **varnish** from an old panel that is yellowish & varnishing it anew

Take **white soap** & **sieved ashes**, & soak both in **water**. And with a **sponge**, take the said **ashes** & **soap** & rub the panel with them. And as you see that the old **varnish** is removed, throw a bucket of **water** against the panel to clean it. Next put it for a **quarter of an hour** **in the sun** to make it dry and to revive the colors. Next, once the panel is dry, you can spread your **turpentine varnish** on it.

Make sure the colors do not come off.

Black varnish for sword guard, bands for trunks, &c

Take **linseed oil** or more cheaply, **walnut oil**, and rid it of grease with **garlic** & **onions** + **hog's fennel**, some also add **bread crusts**, which you will boil in it for a good quarter of an hour. Next, put in one lb of the **oil** thus boiled the size of a **walnut** of **black pitch** & a double **handful** of **grains of wheat**, without removing the **garlic** & **onions**, and let it boil together for a good quarter of an hour. And when the **pitch** is well melted & when the **oil** has body, you can remove it from the fire. Then, to varnish, place your **iron** over a low **charcoal** fire & apply your **varnish** with a feather or a brush. And when you see that it no longer **smokes**, it is done and your **varnish** is dry.

For excellent **black varnish**, add two or three paternoster beads of **jet** among the rest.

Some consider **walnut oil** better.

If there is a lot of **varnish**, it needs to boil for at least **half a day**, for it is better the more it boils. It is dangerous if it catches fire, if it goes over the top, and is hard to extinguish. Make this therefore in a **courtyard** or an **open space**.

In five or six lb of **oil**, one must put one lb of **galipot**, which costs 4 **sous**, & some **peeled garlic cloves**. This **varnish** in and of itself is not black, but it blackens over the fire.

See below, around the 3rd part of this book, after **sands**, in the chapter on **FURBISHERS**.^[c_004v_01]

Black varnish without fire, without disassembling the harnesses^[c_004v_03] or removing the bands from trunks

Take **varnish of spike lavender oil** & mix in **soot black** or **lampblack**, & without fire it will mix in by itself. Varnish with a brush & it will soon be dry. **Turpentine varnish** will be quite good, but it does not dry as soon.

Varnish of IRON ENGRAVERS^[c_004v_02]

Take linseed oil or walnut oil & in place of black pitch, you will put in a little pitch resin, & it needs to be cooked in the fashion of black varnish on fire. And for applying it, heat your iron & give it only one layer of varnish, & when it no longer smokes, it is dry. Next engrave with a steel point whatever you want. Next take salt & verdigris & mix as much of one as of the other in quite strong vinegar & leave it for xx4 hours before using it, & all will be tempered. Next spread some of this liquor or sauce on the engraved object with a sponge

or linen & leave it thus for xx4 hours & it will be engraved.^[c_004v_02] But if you should want to engrave promptly, varnish all your work & boil it in the said liquor, & it will promptly engrave.

Steel mirrors

X^[c_084v_02] They are called of steel because in times past they were commonly made of steel polished with emery putty. But more easily, various kinds are made with *cuivre franc*, which is rosette & tin, because it is cast in a mold & made round, concave, convex & however one likes, to represent various forms.

So take half rosette copper & half soft tin, that is to say fine, which has not yet been used. Put them in a crucible, & first melt the copper well. And once it is well melted, put in the tin and mix together. Then cast in the mold, of white stone with no eyelets, & anoint the mold with oil, & let it be moderately warm. Then, having molded your mirror, you can polish it in this way.

Set one of these in plaster in order that it holds firmly, & then put the other one over it with thin sand in between, & rub one against the other, whether it be concave or flat, & thus you will polish two at once. And if you want to polish them on both sides, you only need to switch them, that is to say put the one that was polishing into the plaster & the one that was in the plaster to polish. After having polished them with the arene you can smooth them with Venice tripoli, which should not be sandy, & next with putty. You polish with arene using water, but polishing with tripoli & putty is done dry. Once polished, you can set it.

Concave mirrors

The concave mirror composed in the aforesaid form produces an endless number of pretty conceits which seem magic. If someone wants to see oneself from behind, it is necessary to place the **concave mirror** on the ground on its foot, & let it be at a slant; next, look at it from one pace away. But if you look at it close up, it will represent you the right way up but with your **face** quite large & the **hairs of your beard** as thick as

string & will represent a **nipple** as large as a plate, and **women** can see the **secret places** that they do not want to show to **SURGEONS**. It casts the representation out of itself, and if you *touch* ~~the place~~ the eye of the representation with your **finger**, another **finger** will come against yours.

You will make a light *at night* for someone quite far away, if you place the **concave mirror** behind a **candle** placed on the **window**. You will be able to read and write quite far from the **candle** if you place it behind the **candle** & place & turn the concavity toward you. If you put the **mirror** at the end of a **table** & a **candle** on it, it will represent two lights on the **table** for you. To see what is happening on a **street**, shutter the **window**, whereby the more of it you can shut the better it will be. Make a hole at the lower one, as wide as your **little finger**, perfectly round, from one side to the other. Then place a **sheet of paper** on the **window** & let the middle of the **sheet** be over the hole. Pierce the **sheet** in the same place as the hole & the same size. After, place the concave face of the **mirror** toward the hole, & it will represent to you all those who pass by in the **street** on the **sheet of paper**. Similarly with the **pierced door of a closed room**. You can make wavy ones & triangular ones, in the fashion that **Ptolemy**^[c_005v_01] describes, & **Archimedes**.^[c_005v_02] The concave one also sets fire to **straw** from quite far away, and lights a **candle** with the **sun**. Also, it heats through the reverberation of fire.

For bronzing in yellow and white

Take **looking-glass tin** and melt it. On half a lb of this, put half an ounce of **quicksilver**, and remove it all at once from the fire & grind it, and it will be like **ash**. **Grind** Wash it quite well in **clean water**. Next, grind it on **marble** & temper it with **water of ret hide glue**. Next, apply to your **wooden** candlesticks & any other work you like, & burnish with the **tooth**. You can grind **pin filings** & apply them with the said **glue**.

For laying down and seating **burnished gold** and giving red or green or blue

Ceruse & lead white is not appropriate for polished white nor for burnishing because it is fatty, but it is quite good for **or mat** which is made with oil, mixing it with yellow ocher & mine ~~pe~~ & tempering all of it with oil. And this **or mat** thus applied keeps in the rain like gilded lead work & similar things. Therefore for **burnished gold** take good chalk, quite white, well ground, & tempered with distemper glue, & make four layers of it, one after the other, on the wood. And once the last is dry, rub it with *prele*, which is a plant otherwise called horsetail, to render it well polished. Next take fine *boli armeni*^[c_006r_01] & sanguine, as much of one as of the other, also lamb tallow the size of a bean or a pea depending on the quantity of bole, and a little willow charcoal, or as much as the tallow, & half a walnut shell full of half-burned saffron. Some put in a little candy sugar. Grind all together with water, & apply it without gum or glue, & let it dry, & rub the place that you want to gild with a piece of white cloth to better smooth it, & when the rubbed place is a little shiny, it is a sign that the gold will be carried well. Having rubbed, wash with a clean paintbrush soaked in clear water the place that you want to gild & immediately apply the gold, which you will burnish once dry. And if you want to lay in rouge clair & glaze with it *de*, grind Venice laque platte^[c_039v_02] on marble with walnut or linseed oil. Once ground, mix turpentine or spike lavender varnish & apply on the gold with the paintbrush. Brazilwood & laque ronde^[c_006r_02] die. For green, temper verdigris with walnut or linseed oil & grind it, next mix in turpentine varnish and not spike lavender varnish, which is not suitable for verdigris. If you want to glaze with azure, it needs to be set on burnished silver and take *azur d'esmail*, &, without grinding, temper it with turpentine varnish & apply it.

For ga each cages^[c_006v_01]

You can embellish them with enamel cannules of various colors by covering the latten or iron wire with the said cannules. These you will break neatly to the length that you want if you slightly notch with a cutting file the place to be broken, and they will not break at any other place. You can bend them with a wood model over a chafing-dish or else by the heat of the lamp. It can also be drawn as long as you want in a small furnace made like a reverberatory furnace but which is pierced on both sides. And when the large cannule is red, they seize the hot end using small pincers with a long beak, such that one prong of the beak of the small pincers enters inside the end of the cannule, & thus it is lengthened without becoming stopped, & the other end of the cannule is held with the hand, because it is not hot. When the cannule is stretched enough, the one who works seated, having his furnace the size of a carnation pot before him, breaks it off & continues. This is for making cannules for capes, which are cut, as said, with a file. GLASS BUTTON MAKERS also avail themselves of the said furnace.

[Figure: fig_p006v_1]

Under the door is a grate that supports the lit charcoal, & the ash is emptied by turning the furnace upside down.

For stampings^[c_006v_03] to embellish and encrust or cover the edges of mirrors, the tops of chests, or the friezes of bed valances

Engrave^[c_004v_02] with aquafortis on iron or copper whatever you have pounced and drawn there, next clean it up with a burin or chisel. Then pour soft tin which has not been used onto polished marble & with a wooden board, flatten it quite thin. Or else cast it in tablet form like lead, or put it through a roller press. Next lay your tin plate over the engraved thing, & over the tin plate put a piece of felt and strike on top with a hammer. Then gild it in this way.

For gilding with gold color and tinsel

Once you have gilded colored, make your stamping either in tin, as is said,^[c_007r_01] or in iron *dest* or copper. You ought not to put a layer of glue there as on wood, but take only fatty oil, which is made in seven or eight days in the sun with walnut oil and lead white & with, stirring it often, or cooking it on the fire if one is in haste. Then, with the oil thus made fatty, grind a little lead white, massicot & *mine de plomb*^[c_007r_04] *[illegible]*, at discretion, as much of one as of the other. Minium gives color to the gold. Next, with this, you make a layer of it evenly on your stamping, taking care not to fill the hollows. And once it is almost dry, lay the gold leaf on it with cotton. Such gold will hold up in the rain on houses & elsewhere. And if you have gilded with tinsel, color it with smoke of partridge^[c_007r_05] or of yellow or red cloth, & it will be beautiful like fine gold. You can cover trunks, mirrors, valences & bedposts with colored velvet or satin, then apply the gilded stampings on top with strong glue.

For coloring stamped trunks

The stamping of sheets of copper or latten is made on engraved & carved service tree^[c_007r_02] wood, if one wants to spend less. And next, the stamped object is colored with the aforesaid colors of lake, verdet, *azur d'esmail*, & tempered in turpentine varnish. But in the place you want to azure, lay down *fer blanc*, which is more appropriate for an azure background.

Doublets^[c_007r_06]

Good dragon's blood soaked in eau-de-vie carries its mastic or glue in itself, as do sap green & saffron.

Fish glue or isinglass and mouth glue

It is made from codfish skin, boiled rather than being salted. JOINERS glue their masterpieces with it and GUITAR MAKER[ILLEGIBLE] use it for delicate works. It wants to be strongly beaten, then soaked gently in barely boiling water.

Mouth glue is made of parchment scrapings and one uses it without fire, for glueing paper or similar things, wetting it with the mouth.

One beats it and soaks it in ~~in eau-de-vie of vinegar~~ white wine for one night, then one melts it on a slow fire. Others soak it in eau-de-vie.

For giving the color of all kinds of metals to wood & other things

Take touchstone & pumice stone as much of one as of the other & grind them together & mix with a hide glue stronger than that used for painting, & paint it on whatever you like. Once dry, rub this layer with any metal whatsoever, then burnish it.

Against windy colic

Take a dozen dried common walnuts & throw them one after another into a good brazier where they may catch fire, & take them out with small pincers, and let them burn & flame well in the air, and extinguish them in a glass of good wine. Next, let the wine cool and strain it, & pour half of it, for six extinguished walnuts are for one dose. Excellent cure against the suffocation of the matrix.

For relieving the pain of G.[c_007v_01]

Take half a lb of finely pulverized golden & yellow marcasite, half an ounce of storax, 4 lb of urine, incorporate everything well together, little by little, in a mortar, then boil all together quite thoroughly. But the pot needs to be well covered in order that the fumes do not exhale. Next distill the ~~it is~~ urine, imbibed & separated by inclination, in an alembic, well-luted & covered with a copper helmet & soak a linen cloth with the said water & apply it lukewarm on the pain.

Against gonorrhea^[c_007v_02]

Aquæ FABRORUM antiquæ 1b i., boli Armeniæ in tel tenuissimum pollinem redactæ ʒ.i., mellis communis ʒ.iii. coquantur ad mellis despumationem. Tum refrigerata colentur cum forti expressione & de colatura utatur per injectionem.^[c_007v_03]

Lettering of gold on paper

Write with fig tree milk then let it dry a little, next lay the gold leaf, & once quite dry, rub with a linen cloth and only the lettering will remain.

For bursting grenades and giving force to fireworks

Put among the powder ~~six times as much of~~ quicksilver and a sixth part of quicksilver.

Tempering of balls for piercing armor of proof^[c_008r_02]

Heat the lead ball as much as you can without melting it, and when it will be very hot, temper^[c_008r_03] it in the strongest vinegar that you can. And do this four or five times. Next, chop some lard very small & some linen also very finely, mix all together & use it as wadding, and by a little force & very precisely, force it into the arquebus or pistol. And before firing, ~~cha~~ if possible, make it so that the ball is hot.

For making a breach in a wall by night

Having made a hole in the wall as you know, put a petard^[c_008r_04] inside, charged with powder, which should be as if lying down, & the other upright, then plug the hole & give fire.

Polishing of the balas ruby

It is not polished with tripoli ~~but~~ like the others, but with marcasite powder & oil.

Or and argent moulu

You need to calcine your fine gold with ☿ and then cleanse your amalgam well & make the said mercury fly off. Next grind it on marble with gum water. As for silver one needs to take it as is ^[c_008v_01] & eat away at it with aquafortis, then take it out with a copper blade & rinse it thoroughly and next grind it with gum water.

Polishing of stones

There are three wheels for doing this, one of tin, one of lead & one of fine copper. On the copper wheel only the diamond, the ruby, sapphire & oriental jacinth are commonly cut or polished. The tin wheel is for more tender stones like emerald, amethyst & others.

M~~fillegible~~ixture of PEWTERERS

Because among the fine tin they quite often mix a half of lead, which renders the tin deaf, to correct this, they mix in latten filings to render it sonorous.

Perfect amalgam

Take the most delicate ^[c_008v_02]grais you can & hollow it in the middle. Put in an eighth part of ☿, ♀ & into this, while adding water, rub & wear down your ☾ or ☼ until the substance becomes like paste & even harder. Next, if you want, eat it away with good aquafortis, if it is ☾ or ♀. Then remelt it, having taken it out as you know. The ☾ will have a tint and, once melted, will leave some grains of ☼, & the ♀ will be very beautiful & will have almost no crust.

PLOWMAN

Because **millet** is by nature very dry, **HARVESTERS** beat it most often *at night in the cool & by moonlight*. Which could not be done with another **grain** that is more humid, for one ~~le~~ must let the sunbeams pass through, and one scarcely beats it until the *sun is approaching midday*. Quickly after the **millet** is cut, one needs to plow the earth because the root eats it & makes it lean as much as if the **millet** was still standing. The ground where the **millet** has been sown diminishes much in its fertility & ~~e~~, which one knows ~~well~~ *at the next sowing* that one makes after that. But above all the **grain** called *pomole*^[c_009r_01] in **Gascony** or *baillard* in **France**,^[c_009r_02] makes the earth shake seven *years* later, according to the common saying. **Beans** improve & correct the soil, provided that one lets the roots & stems rot in it.

PAINTER

Some, after having laid down their color, soften it with the flat of a *feather*. But the large paintbrush is best.

MERCHANT

They commonly have four books. The *tyrant*, which is a formulary for **APPRENTICES**, by which they can know how much every item of merchandise costs & ~~e~~ for how much it should be sold. The second is the waste book, where they put down in rough what they sell daily. The third is the sales book, where they reduce to clean copy and put the retail account of what is contained in the waste book. The fourth is the account book, which mentions the sale, the balanced account, the bill & the term of payment, & to this one ~~l~~ credence is given in **court**.

PAINTER

They completely melt **orpiment** in a **glass** bottle on very **hot ashes**, but it would be more appropriate to sublimate **orpiment** in a long-necked **matrass** as for making **garnets**. The **orpiment** thus turns red like **red enamel** & one needs to first grind it moist because once completely melted it is very lively & difficult to grind. Next, one can ~~br~~ thin it, once dry, with **oil** & it will make a deep yellow of heightened color. But to prevent **orpiment** from dying with the other colors & to render it compatible with these & to make it dry promptly, it is a secret held to be very rare to calcine **common salt** & to grind it in. *Vert de terre* is not used with **oil**.

MERCHANT

[c_009v_03]The rule that MERCHANTS are accustomed to keep in their books, that is to say, the waste book, the sales book, and the ledger, otherwise called the account book.

Waste book

And first, François du Cros[c_009v_02] owes from 2nd September 1581 / for 1 cane of cambrie at 8 livres per canne, I make this ____ 8 lb t. [c_009v_01]

Moved to the sales book at c. 25 /

François du Cros owes from 2nd September 1581 / for 1 canne of cambrie at 8 livres per canne, as appears in the waste book at c. [c_009v_06] 25

Moved to the account book at c. 55 /

François du Cros owes from 2nd September 1581 / for the merchandise taken by himself, as specified in detail in the sales book no. 7 / at c. 55 / the sum of 8 livres / of which the said du Cros has made a bill on the said day, to be paid on St. Andrew's day [c_009v_04] next, I make this ____ 8 lb t. [c_009v_05]

Counterfeit^[c_003r_02] jasper

Thin **glass** for this effect is very beautiful.

Take **horn** from which one makes lanterns, quite thin, & underneath make the figure of your **jasper**, **cornalines**, & other **stones**, which will be a work more appropriate than on **glass**, which is too shiny. And the **horn** presents a luster & fatty polish like **jasper**.

You know how, with scrapings of the said **horn**, **roses** can be imitated. The ~~horn~~ colors for this **jasper** want to have a base with **clear turpentine** or **spike lavender varnish**. And colors matte in body are not so appropriate here, although they are very beautiful. One needs to **oil** the unpainted reverse with **spike lavender oil**.

You can encrust beds with it & on the joints you can throw the **filings of talc or of pins** on the fresh **cement** of the said joints. One needs to join them with **gum ammoniac** soaked in **vinegar**. To better counterfeit **mottled jasper**, apply **wool with thick hairs** dyed in diverse colors & intermingled. After you have layered all the colors, scrape oblique lines on them, then layer **gold & silver leaf**. If you layer on the **horn** colors of **turpentine**, give it a base of **silver** or of **tin leaf**. You can also **file horn** & mix it with **strong glue**, & layer it onto the joints of the piece of **horn**, then even it with a joiner's plane.

Stil de grain yellow

It is made in **Lyon** from the **juice of weld** & **chalk** mixed together or better yet with **ceruse**, which is appropriate for **distemper** and **oil**.

Roses

These are counterfeited either with the scrapings of ~~fillegible~~ **horn used for lanterns**, or with scrapings of **parchment**, very clear & delicate & dyed & employed as you know.

Purple color

PAINTERS make it beautiful, making the first ground of **common azure**, or better yet **azur d'esmail**, & next they glaze it with **lake**, which will be more appropriate for this if you mix in **alum**, which gives it a violet tint depending on the quantity that you mix in.

Powder for hourglasses

It is made very fine & without being subject to rust & by its weight able to flow; taking 1 lb of **lead**, melt it and skim and purify it from its **filth**, then pour into it four ⅓ of **finely pulverized common salt**, and take good care that there be neither **stones** nor **earth**. And immediately after you have poured it, mix continuously very well with an **iron** until the **lead** and **salt** are well incorporated, and lift it immediately from the fire, stirring continuously. And if it seems too coarse, grind it on **marble** and pass it through a **fine sieve**. Then wash it so many times that the **water** *sembl* becomes clear, throwing away that little **powder** which will swim on it, renewing the **water** so many times that it stays entirely uniform.

For painting in **oil** on **taffeta** without the **oil** running

One needs to make a layer of **batture**, which is made of ~~well-cooked honey & turpentine~~ of **strong glue** soaked for 24 hours in **water** then gently brought to boil so that it is hardly strong. Next stir in a little **honey** to soften it, & make it boil all together. And on top of this layer, which will soon be dry, you will be able to paint in **oil**, which will soften the layer even more, and which can also serve you to make a seat for **gold**. **Alum water** also keeps **oil** from running.

Seat for **gold leaf** on **parchment** or **paper**

Make very clear **starch glue** & which does not show itself to have body. And make thereof six or five layers, & on the last, once it is half dried, apply your **gold**.

For cleaning **gold leaf** applied to **iron**

Rub your weapons or other gilt objects with **dry horse dung**.

For whitening **ceruse**

Hard-boil **eggs**, divide them in half & take the yolk out, & between the two halves of the white put a piece of **ceruse**, & tie them together with **thread**. Then boil in **clear water**, & it will become entirely black, & thus the **ceruse** will be left well purified. Some reheat it over fire & it becomes very white.

Painting *esmail d'azur* in oil

This is a secret that is hardly known to COMMON PAINTERS. Some take the most delicate they can & grind it with ceruse, which binds it, and next prick with an awl in several places the area they want to paint with *azur d'esmail*, in order that the oil enters & leaks in, & does not cause the azure, which in itself is heavy, to run. Others lay the panel flat & put down the azure on it, which is also done in distemper. The main thing is to grind it well on marble, and before that, to have washed it thoroughly. Some grind it with thoroughly with an egg yolk & then wash it in five or six waters and lay it on not with a paintbrush, which would be too soft, but with a brush thoroughly softened & crimped, & layering it thickly as if one were putting it down with a trowel; settling down it evens out and flattens. I have experienced that grinding *azur d'esmail* with egg yolk & next washing it in several waters is good. However, it loses a little of its vividness in the grinding of it. I have also washed it in several waters &, when it had settled a little, I removed the water, still a blue, with a sponge and squeezed it into another vessel thus where it settled, & from the residue I had the ash, flower, and subtlest part of the azure^[c_o11r_o1] without grinding it, which is the best, for in the grinding of it, it loses some of its tint. Those who make it in Germany compound it like enamel, in large pieces which they pestle, & pass through several sieves & wash.

To make azures beautiful, they wash or soak them in a rock water, as they call it; it is a water distilled from mines where azure or *vert d'azur* is found, which distills naturally through the veins of the mountain or is distilled through an alembic ~~par~~ from mineral stones of azure or copper.

Azure ashes are only good for landscapes because they die in oil. Only true azure holds on. *Azur d'esmail* cannot be worked if it is too coarse. Try it, therefore, on the fingernail or the oil palette. If it ~~illegible~~ happens to be sandy, do not grind it except with the egg yolk or, better yet, wash it in clear water & with a sponge remove the colored water after it starts to go to the bottom, and in this manner you will extract the very delicate flower, which will be easy to work with.

Color of Damascus steel on knives

Rub the steel with common aquafortis, mixing the said water with earth ^[gap] & next rub the whole with ashes or sand & the gold & the silver will touch as on a touchstone.

For getting rid of the redness of eyes or bruising

Make two small thin slices of raw mutton flesh, & with a head band, apply to the eyes *at night*.

For coating with or mat

There is nothing better than the black varnish of FURBISHERS to make a seat because it dries immediately & makes the gold appear very beautiful.

For diamond points for engraving

These are for tracing what you want to draw on stones & engraving, & when these points are fatty & cannot bite, one needs to rub them diamond against diamond. One rubs them with diamond pumice stone powder. One needs also to unpolish on a lead wheel either the stone or the glass on which you want to engrave, for the polish, which is like varnish on glass, prevents the diamond or sapphire from biting well. But This is why it does not bite easily on the nail, which is polished & fatty. But when the polish is taken off, it bites easily.

Polishing wheel of copper

Before polishing your stone on it, it is necessary to degrease ~~ter~~ it well, rubbing it with a piece of leather ~~en-tour~~ on the flesh side while spinning the wheel, if you have not worked on it in a long time.

For molding sulfur

Sulfur is made beautiful mixed with soot black or with pulverized sanguine, which renders it harder and stronger. Having let it melt well until it becomes liquid, like oil, mix it with verdigris, and you ~~m~~ will very neatly cast in plaster a lizard or something else.

One ought not to cast unless it is well cooled & unless it has lost all its pustules & bubbles, and has settled down well & become smooth like ~~illegible~~ water. The soot black gives it a fine sheen & makes it neater. The most beautiful yellow sulfur must be used, for the greyish & lively one is not good. Do not cast in wind & in cold, for it would become porous.

Chimolée

The *terre chimolée*, otherwise known as *FULLER's earth*, with which they dress the *cloth*, is excellent for molding hollow or in relief; & if you want to reheat it, it must first be warm, & reheat it on a gentle fire at a distance & little by little, otherwise it would crack. Put the figure to reheat in a *pot* in an *oven* or in a *covered oven*. It is very soft, neat & beautiful. You can make a hollow form of animals from *chimolée* & cast *lead* in it.

The work needs to be dried for 4 or 5 *days* before you reheat it. When you mold & make a hollow form from *chimolée*, do not press suddenly, but gently, for it would crack.

Paper

The whitest & finest is the best. And when the hollow form is quite clean, as of *sulfur* or *cooked chimolée*, it is made very neatly. You can give it one or two layers of *white* with a border of *gold* to imitate *alabaster*. And after you have applied the *white*, you can burnish it with the *tooth*. But in order for it to be burnished, one needs to temper the *lead white* with *glair of egg* & *peelings from the fig tree*. Or better, varnish your work with *white varnish*. Also, when you are molding with *paper*, as it starts to dry, burnish from the back with the *tooth*.

Plaster

That from the *mountains* is greyer, and ~~the~~ the one from the region of *Albi* is whiter. It must be cooked with a closed fire, such as a *reverberatory furnace* or *BARBERS' ovens*.^[c_012r_01] And the most freshly cooked is the best to put to use. One needs to finely grind it on *marble*. After having prepared your hollow form from *sulfur* or something else, & having *oiled* it & enclosed it in a circle, temper not too thickly your *plaster* with *water*, & separate it well with your *finger*, and if it makes pustules, throw on top more *powder of the said plaster* & *[illegible]* grind it with the *finger* until ^[c_112r_02]

^[c_112r_03]

it makes no more pustules. Then cast & sprinkle once again with *plaster powder* & let it take well, then scrape the powder.

Molding **stucco** promptly

Grind & pulverize finely **brick** or **Armenian bole** or **sanguine** & incorporate it with **melted wax**, & thus melted, cast like the others on a relief medal, & thus you will have a hollow form where you will be able to cast with **plaster**, pestled **paper**, or *terre chimolée*.

Finely sieved **brick** is better, because the **bole** is too fatty.

Cleaning **yellow pearls**

Gently boil them in the **GOLDSMITHS'** *bouteure*^[c_104r_01] then, with **tripoli** & a piece of **leather**, sprinkled on the flesh side with the **powder of the said tripoli**, rub & polish the **pearl**.

For whitening **enilanroc**^[c_012v_02]

Some think that the **ceruse**-colored crust which is on top is natural, others say that it is a secret of **ANCIENT LAPIDARIES** that is lost, others say that it is **refired enamel**. And by means of the said crust, several ciphers, letters, circles ~~st~~ & other bizarre things can be formed. As for the method, I have practiced it thus. Once I wished to give it a layer of **arsenic** ground on **marble**. However, I experimented without this, and I put the aforesaid thing, **enilanroc**, in a small **iron** casket on the fire of my **GOLDSMITH'S** forge with three or four small half-burnt **charcoals**, and blew only with my **mouth**. And nonetheless the thing came to ~~redde~~ & ignition & turned completely white, not only on its surface but also inside, & then I let it cool on its own **near the fire**, for otherwise, exposing it suddenly to cold air, it would have burst. Once all white, I passed it through my **lead**^[c_012v_01] ~~tin~~ wheel, where I found it as hard as before, & uncovering the white a little, I found it a fair flesh color. Finally, I polished it & saw that it took a very beautiful polish & could paragon a very beautiful **agate** for cutting some beautiful face on it & bringing it on ~~the~~ a table of

agate of various color. But because this total whiteness did not respond to make this white crust on the surface that I was seeking, leaving the rest of the thing of its natural color, I made an opening in a brick of the exact size of the thing & put it inside. Then I reddened two GLASSWORKERS' solders, & as they were red, I presented them one after the other onto the surface of the thing until I had the white crust that I required, on which I made such drawing as I wanted, uncovering up to the red base with a diamond point, and I polished it with small hog bristle brushes and tripoli. I do not know if it would be better to reheat it under hot ashes, & if it would be good to encase it in alabaster, which is very cold, as I encased it in the brick.

Flesh color from arsenic

Sublimated arsenic, that is to say, the white one that is sold as stone, when ground on marble, mixed with vermillion or lake or minium, makes a beautiful flesh color that is always shiny. Yellow arsenic has a very beautiful color, the white one is good in oil and agrees well with the lake.

For dyeing

Mix sal ammoniac & vitriol & boil them together. Then mix in lake or verdet & azure or similar, & dye. This will not come off unless the animal sheds. *Non bona.*^[c_013r_01]

Polishing of stones

Engraved *tai* stones are not polished on a copper wheel, but with brushes and tripoli. Yet stones cut in facets and flat are polished on the aforesaid wheel.

Fine sieves of raw silk

One makes tammy of raw silk on a loom, to make fine & delicate sieves. And for that effect, you must not choose raw silk whitened by sulfur smoke, which renders the silk *ehas* charged with a sticky vapor that would hold the flour & in the end would prevent it from

passing through so well. But choose for that effect yellow raw & natural silk because it is stronger & casts out flour like horsehair.

For knowing the good *cendrée*^[c_013v_04] of azure for oil

The one that accumulates in small clods and is lumpy is the best because it is the most subtle. Also the one that is very pale in color, because oil darkens it. Certain SOPHISTICATORS mix them, but you will know this if you pour some onto a piece of paper & press it & spread it with the finger since, if it is mixed, it will be found variegated & as if striped with a pale one & a darker one, but if it is unmixed it will be even & of one color.

Whitening of pearls

When they have been applied in embroidery on some garment, they are greasy & are cleaned in soap water.

Toadstone

The kind which comes from the head of the toad & has the figure of the toad painted naturally, as you have seen, is the most excellent. It is held that if one puts the powder of it on a brazier in the chamber of some persons *at night*, they will be neither able to move, nor speak, nor thwart THIEVES.

Snakes

It is said that if one calls a snake in Greek, saying *OΦH OΦH*,^[c_013v_02] it will flee. Likewise, if one ~~nom~~ calls a swine in Greek, *ἦ ἰον*,^[c_013v_01] it will come.

Candles

CANDLEMAKERS never make a good candle when the *Autan* wind^[c_013v_03] blows because the candle always tends to melt, however good the tallow they use for it.

For walls of **earth** and rustic construction^[c_014r_01]

Swallows have taught us this craft, making their nests out of **mud** mixed with **wisps** & **stalks of hay or straw** to make it bond. Therefore, in places where **stone** & **brick** are lacking, one can use **earth** to make partitions & walls. And for this, **light earth**, which does not form clumps when plowed, but which is as if intermixed with **arene**, holds first rank, because it can be beaten & tamped down better. It is true that one needs to moisten it & ~~la~~ cut it into the shape of sods with a *ditch-spade*, and thus place & arrange it. This one lasts longer and there is not as much construction work, and ~~not~~ dryness does not make it crack & split. But, because such kinds of **earth** are not found everywhere, those who are on **good & fertile land**, after marking out with a measuring line the width & length of their foundations, drive ~~into the ground~~ in along the edges, on this side & that, long ~~eh~~ poles & or chevron beams to support boards between which they throw the **earth**, making each layer one **foot** thick or thereabouts, intermixing it as if **S.S.S**^[c_014r_05] with **branches of heather** or similar things, then with beaters of three different forms they *tamp* it & beat it. One is called the *mallet*, which has a triangular form like A, and with this, one first *tamps* the **earth**. Next one uses one which is made of **blocks of wood** pointed at the tip & helved to a large stick, & this one is for pressing the **earth** well at the extremities and edges of the wall, which adhere to the *boards*, & is called.

^[c_014r_02]

The other one is called the *bat*, which is for flattening & beating the **earth** for the last time, as shown in .C.^[c_014r_03] Then one makes another layer of **earth** & **heather** and beats it as was said, & continues thus until the wall is complete, which one covers with **heather** & then with **earth**. Some ~~m~~ intermix rows of **bricks** in the said wall. They also make the wall tapering, giving ~~a~~ width to the foundations according to how high one wants to raise the wall. Which, when old, whitens, & thereby shows that it has **saltpeter** in it. That is why, when they fall down, **GUNPOWDER MAKERS** profit from them.

A

[Figure: fig_p014r_1]

^[c_014v_01]

Damasked cloth

You can damask a cloth with two different colors and imitate embroidery without adding anything to it, in this way. Once it is dyed yellow, pounce onto it such a pattern as will please you. Then you will baste some string or a thicker cord onto the pouncing and thrust it into a dye of guesde woad or pastel woad & it will become green, except that which is beneath^{us}^[c_015r_02] the string, which will remain yellow because the green dye will not have penetrated there. And you can do thus with other colors, and instead of cord or string, add some pieces of paltry cloth, cut into moresque^[c_015r_03] shapes, on top of the first colors. In that manner, you will have cheap embroidery.

Foundry casting

One casts candlesticks and small works in a frame with sand. And after having imprinted the work, one sprinkles it with flour in order to make the e-metal^[c_128r_03] copper or latten run better. When the sand has been used for a month, it is necessary to take some new, because the one that was used, being reheated in fire +^[c_112r_02] dries out & loses its bond. However, it is used to mix among the new, for it makes the work not so porous. One casts large works such as artillery, bells & similar things in earth, & copper cast in earth makes less of a crust, and is whiter than the one cast in sand. The earth is sandy clay mixed with horse dung & cloth waste. That which is has been used for founding, which is black, cooked & as if burnt, is east mixed with artificial sand, & is very good. / To soften^[c_015r_01] & make the copper run, throw in, once it is melted, a little lead, which does not form an alloy but is found on the surface of the cast.

+^[c_112r_03]

by the heat of molten metal

Casting gold and silver

It is necessary that the sand be from something very dry & arid & reheated well in the frame, because, if it were humid, like FOUNDERS' sand, the gold and silver would spatter, & cause damage. It is also necessary for the earth to drink the metal, for cast gold or silver is becomes very spongy. That is why it must be beaten again, otherwise it is frangible, as one sees in spoon handles.

Tablets

Some are made from **boxwood** inlaid with **ebony**, **sandalwood**, **ivory**, or **gold** and **silver** like **damascening**. Then one writes on it with **silverpoint**, and next erases it with a **cuttlefish bone** by rubbing them.

Letter, more legible

One cuts the largest pieces of **beryl** or **crystal** round on one side & flat on the other, then one sets it with a **little handle** and one sets down the flat side on the letter.

Stamping

If you have some **bronze** medal & you want to make it very light, make of it a hollow form of **lead**, then spread upon it some **thin plate of gold**, or **plates of lead or annealed silver**, & set your **bronze** medal on top & strike with a **wooden mallet**.

Softening horn

Those who ~~æœu~~ mount Agnus Dei^[c_015v_04] & make circles from **horn** for certain little boxes soften *ladiete* the said circles by soaking them in **hot water** and next fashion them on a **round** or oval-shaped triblet.

Ears

When some **defluxion**^[c_015v_01] occurs there, one needs to be very careful not to put anything inside, and according to the proverb,^[c_015v_02] **one ought only to touch the ear & the eye with the elbow**. However, it is good to put on an affected **ear musked cotton**, that is to say, kept in **musk**, for it **comforts quite well**.

Toothache

Some put a clove of garlic in the ear which is on the side where the tooth is hurting, & within two or three hours they feel well because of it. Others put in the nostril which is on the side of the ailing tooth green skin scraped from the ^[c_170v_29] small branch of *visaube*, ^[c_015v_03] namely the kind which is under the grey one which resembles a small branch.

Founding of soft iron

Most PEOPLE consider that iron, once melted, cannot be melted again because they only heat it in small forges, in which it only becomes red-hot. ALCHEMISTS undertake to melt it mixed with realgar or lead or orpiment. But without all that, some have found a manner of the melting not only brittle iron, such as the kind used for iron pots, but also soft iron such as that of pigs & ingots, which is the most difficult kind. And to this effect they make a furnace in this manner which has a width of one pan & a half & ~~one pan & a half of~~ a depth of two pans. And the blast-pipe, which is the barrel ~~through~~ marked A through which the bellows' pipes enter, has to ^[c_016r_01] be placed in the middle of the height of the furnace such that there is one pan of the mouth of the furnace above the blast-pipe & one pan underneath.

Each pan of the mouth of the square furnace contains one & a half quintal, & the pan of the round furnace holds two quintals.

[Figure: fig_p016r_1]

The MINERS, to make the iron run, put at the mouth of the melt, two or three handfuls of wallwort when they want to make the melt run, and this renders the iron wonderfully ductile and flowing.

It is also necessary that the blast-pipe enters through to the middle of the mouth of the furnace, which is a principal part of the secret because the wind will hit the edge & the wall which makes up the belly of the furnace & by such means, it spreads equally everywhere & above, like the flame in a reverberatory furnace, & by such means heats much more; for if the wind were to hit directly from above, the substance which is melted or ready to be melted, it would cool it down & prevent it from running & melting. It is also necessary for the bellows to be driven by the leaping & running of water as in forges, because in this manner, the bellows run with measure & compass & with great speed, which the strength of WORKERS could not do. Therefore one raises the wall as you see & the furnace on the surface of the ground at the edge of which you make a channel as with other founding, to put the molds of that which you want to cast & to do this, you unstop the opening that you had made at the bottom of the furnace to make the melted substance run. You will be able to melt two quintals of iron each time and to do this, you will choose the biggest charcoal you can find & put a load of it at the bottom, on the plane and surface of the furnace & with the bottom piling up as if to a point, up to the top of the wall

Some make a mold of the caliber of the piece, & temper it, then beat a soft iron piece cut to size, & when this piece is very red, they beat it into the mold & round it off with a large file, considering these balls to be stronger than the melted ones which, being brittle, are more subject to breaking.

which is usually of a height of ~~d~~ three pans ~~& will reheat well the~~. But first, it is necessary that you have reheated your furnace with a little of the big charcoal, such that the bottom is red hot and then you will put there the aforesaid load of charcoals in the middle of which you will put your iron, not all at once but ten or fifteen lb each time. And when this will be swallowed & at the bottom of the furnace, always put in as much again. And add three or four shovels of new charcoal which should be of the biggest kind and remoistened, in order that it may have more heat & not be consumed too soon. And when you see that your furnace is full of substance, around two quintals, or less if you do not ~~of it~~ have that much, you will leave the charcoal to be consumed by itself. And when the charcoal is as it were reduced down to the level of the furnace, you will be able to pour into molds & iron or metal^[c_016v_05] shells, which is even better because one iron attaches to the other. And it is necessary that the inside of the mold be well ashed with tempered ashes, in order that it does not adhere to it.

Against Go.^[c_016v_01]

Soak quince seeds in clear water & of this mucilaginous water make an injection.

For removing fine hair from the forehead

Take a needle's worth of fine silk & pass it tightly across the places with the hair & it will attach to the silk like fine cotton^[c_016v_03] wisps.

Silk

Crimson is more abundant than all other silks because its color does not charge^[c_016v_02] as do blue & green, which are also more profitable for the WORKER. Black is less abundant because it charges much.

Keeping oranges

One needs to choose quite whole ones which are not rotten & put them & fill a well closed and tin vessel with them & they will keep six months.

Candles

They keep well in bran which makes them white & long-lasting, so say some. I believe, however, that it is enough to keep them in a cool & dry place, in such manner that they are not pressed together. It is better if there is a hemp thread throughout the wick, which gives it more light & makes the wick hold up straighter. Otherwise, if it is all of cotton, as those of Montauban make, it is necessary to snuff it out often, for after it has burnt ~~it~~ a little, the cotton droops & makes the candle drip.

On the GUNNER

The **cannon** fires at point-blank from five to six hundred paces. But not for battering, in which it can only perform well from two hundred paces, or three hundred paces at the most, and it should not be any farther. Its ball commonly weighs 40 lb of the **KING's** caliber. There is a **cannon-perrier**, which weighs xxv quintals, which are **small, short cannons**. It is for fighting the **ditch casemates** & for battering at close range. It bears a large ball of the **KING's** caliber like the others, namely of 40 lb. It bears in the breech only the width of two balls & a quarter of a ball. The front only bears the width of one ball & a third of a ball. Its charge is similar to those of bigger ones, namely xx lb. And for this reason, when one wants to try them *[illegible]*, one ought not to over-charge it, for this damages the **piece**. And for the first time & until it has fired five or six **pieces** shots, it is better not to give its complete charge, for the **piece** is still proving itself. And the test that one can do is to give it a charge of xx lb of **fine arquebus powder** instead of **ordinary cannon powder**. And four good **horses** are sufficient to drag them. They are easy, & close up they have as much force as the big ones, especially for **private houses** & **small towns** & **fortresses of little importance**. They are no more subject to bursting than the others because they are short. For that which gives great strength to the **powder** & puts the **piece** in danger of bursting is the length of the **piece**, because the **powder** is burned entirely before exiting, & ~~the~~ its impetuosity is held constrained for *longer* in a **small long piece** than a *gr* short one. The **cannon-perrier** is commonly seven to eight pans long. It is true that this is a pan of **Montpellier** & not a **KING's** pan, which is not used in the founding of **cannons** for making them good. For the pan of **Montpellier** being ~~of~~ shorter, the **cannons** ~~more~~ proportioned there are shorter also, & compensate in thickness ~~ee~~ the length that they would have by the **KING's** pan, by which measure they will be found longer. But also they would be thinner. The ^{e[c_017r_01]} ~~great cano~~ strength of the **cannon-perrier** for making a battery is 4^{xx[c_017v_02]} paces.

The **double-canon**

The **great cannon**, because of the weight of its ball, carries a range of only a thousand or xii hundred paces without landing, & bouncing, it commonly bounces iii times.

The **cannon-perrier** does not have a large effect if not close.

One recognizes the good alloy of a **piece** by seeing it. For if, with the greenness which they expel on the surface, they redden, that is to say that they are composed of a sufficient quantity

of *rosette*. If not, they are only of *metal*,^[c_016v_05] which shows up whitish. If they themselves do not make this demonstration, scratch & you will see.

The good alloy for *pieces* is of three parts of *rosette* & one of the *fine metal* of ~~the~~ *large bells*, where there is more *rosette* than in the *metal of small bells*. The *metal* commonly costs xv *lb* & *fine rosette* xv or xvi.

The pan of *Montpellier* is equivalent to six of the *KING's* inches, which contains in it two common ones.

It is necessary, for ~~a~~ mounting a *piece* well, that it be as high at the side of the mouth as at the breech. Otherwise, one does not mount well.

The large **cannon**, which is for great batteries,^[c_017v_01] commonly weighs fifty-five or lx quintals. At the breech it carries the thickness of ~~h~~ two balls & one ~~to~~^[c_017v_04] the three parts of one ball. At the front, it carries ~~ba~~ the thickness of one ball & ~~two~~ two of the three parts. It is thirteen or fourteen pans long. But they are very troublesome to drive. The head-on battery, to accomplish its task quickly is & batter with great force, is at ~~d~~ one-hundred fifty paces & at two hundred. ~~And~~ It is true that one batters well from three or 4 hundred paces, but it is necessary to give it more **powder**. Its common load is ~~p~~ of xx lb of **powder**, its ball of 40 lb. One needs xxv **horses** to draw it. When one fires it farther than its usual range, one puts in a half ladle of **cannon powder** more. A **cannon** can fire 4^{xx}^[c_017v_02] or a hundred shots per day, but one needs to refresh it every time after one has fired ~~di~~ nine or ten shots, if the battery is steadily continued. For if there is a break, it is not necessary to refresh it as often. For two quintals of **copper**, or two quintals & a half if it is for large **cannons**, one puts one quintal of **metal**.^[c_016v_05] ~~#~~^[c_112r_02] The **metal** is composed at the beginning of eight lb of **tin** for one quintal of **rosette**, while for large bells one only puts six lb of **fine tin** for one quintal of **rosette**, to give it a *bigger voice*. For the more **tin** there is, the clearer the *sound* is. ~~Its~~ For **gun** founding, if one provides the material & **charcoal**, as one commonly does, for **MASTERS** do not have the means, one gives x to xii lb per quintal. And ~~for the mat~~ when the **MASTER** provides everything, one gives him 40 lb, according to the **KING's** ordinance, per quintal for **large pieces** & such as **cannons**, and for **small pieces**, L lb. For the more material there is, the more profit the **MASTER** has of it. One founds another kind of **cannon-perriers** of xxx quintals which are longer than the others, and easily eight pans long, & they are for battering defenses & **casemates**, s placing them via **trenches** on the **edge of the ditch** by night.



On each side of the opening of the breech they give the thickness of half a ball. And then they also add on each side the third part of a ball.

Ain

One gives it two ladles of **cannon powder** for its charge, & one & a half of **arquebus powder**, & the same for the others.

~~#~~^[c_112r_03]

The composition of **cannons** of **France** is of one quintal of **metal** for two of **rosette**. But those^[c_017v_03] of **Toulouse** & **Poncet**^[c_049r_01] puts iii of **rosette** & one of **metal**.

The **rosette** for re-melting is more profitable than **cauldrons**, which turn entirely into **filth**.

Old pieces are composed of almost ~~de-dem~~ as much of one as of the other, namely one part of rosette & one of metal. One recognizes this composition with a burin. For its substance is found to be brittle & the particle taken from the burin is found to be mixed with yellow & white.

Large culverins are for battery & piercing are forty quintals & eighteen pans long. Their ball, of the KING's caliber & for battery, is 30 lb and thus lighter than that of the cannon. And thus, it does not carry so much ammunition for fifteen lb suffices for its charge. The cannon makes a bigger opening due to the size of its ball, but the culverin hits more fiercely & propels faster, having greater force due to its length. At the breech it carries the thickness of two of its balls & ~~es~~the ^[c_018r_02] three third parts of a ball, at the front the thickness of one ball & two thirds. Culverins serve to batter defenses from afar when one cannot easily make an approach, and cannons approach more closely. They also serve to support the battery. One needs fifteen or sixteen horses for moving it. They are ~~tout~~ of the same alloy as the cannon, as are all pieces ~~that-exceed~~ smaller than average, for to these, one adds a little more metal^[c_016v_05] in order that the melt runs better. And for two quintals of rosette, one adds six twenties lb of metal for the smaller pieces. They shoot 8 or 9 hundred paces at point-blank, & up to a thousand paces if the powder is strong, & half a league at range.

Some invented the loading of cannons with cartouches.

Some ~~pe~~ do not put the powder in the cannon all in one go but in two & ramming each time, saying that each ramming raises & gives a further thumb's breadth. But this is not certain for large pieces which are loaded with a lot of powder.

The *bastarde*, which is a *culverin* middle-sized^[c_018r_01] *piece*, weighs thirty quintals and its ball weighs ~~xx lb~~ xv lb and carries as its charge x or xii lb of *powder*. Its proportion is at the breech the thickness of two of its balls & the^[c_018r_02] ~~three~~ ^{three}ird parts of a ball. At the front, the thickness of a ball & two of three parts. ~~or~~ They serve to batter defences of little importance such as *gabions* and *garrets topped with a tower* & similar things. It is thirteen or xiiii pans long like the *large cannon*. Ten *horses* can move it. It accompanies well the *large culverin* for point-blank because it carries small ammunition.

Some give it the thickness of three balls at the breech & at the front of two balls.

The *bastard culverin* weighs 35 quintals & is xxv pans long. It carries three balls at the breech & two in front. Its ball is like that of the *bastarde piece*, weighing xv lb. These are *pleasure pieces* which *s* cannot be moved by carriage, but are for *city* defences. Some make these xxvii or xxviii pans long, like the Cow of *La Rochelle*. But to such *pieces* one gives reinforcement at the breech as of three balls. At range, they can shoot around one league, & a half league at point-blank. Its charge is like the *bastarde*. And if one wants to fire at some *CAVALRY* quite far off, one increases the *powder* a little. A tail of *smoke* follows the ball which *de* guides your sight *e* to where the ball is going. This goes for the *cannon* and for the *culverin*, and not for *small pieces*.

The average weighs 18 quintals & measures xii pans long. Its ball weighs eight or 9 lb & its charge is six pounds of powder. ~~And for~~ At the breech it carries a thickness of three balls, & in front, two. It is more appropriate for the defense of a city than for battery. However, one takes it sometimes either to break a barricade or to support the battery after the cannons have fired, in order to prevent the assailed from re-fortifying after the cannons have played or fired. Four horses can draw it. It shoots eight or nine hundred paces at point-blank & almost as much as the *bastarde*.

To cannons & large pieces one givesⁿ as much powder as is the diameter of a ball & a half, at which point the escutcheon^[c_018v_02] sits. To medium pieces, such as field pieces, & smaller ones, one gives them powder the thickness of two balls. To the *passe-volant* & other smaller ones, one gives them powder the thickness of three balls. In general, one charges all pieces up to the escutcheon. One charges with the ladle all pieces from the cannon to the piece of four quintals *de char*, and one gives them two ladles of cannon powder or one & a half of arquebus powder. To smaller ones, one only gives one ladle, & those of one quintal are charged with a small charge.

The field piece weighs ten or twelve quintals & is ten pans long or 12. Its ball weighs vi or vii lb & its charge is 4 lb of powder. At the breech it has three balls & two in front, as do all pieces that are smaller than the average. One gives them more of a breech because one makes them longer in proportion, and also because in a house or elsewhere one fires them more frequently than the large pieces. Their caliber is also small, which makes the breech 3 balls thick. They are used for following a camp promptly & for the defense of cities & houses, putting them on the walls or on a tower. One needs three good horses for drawing it.

The *passe-volant* weighs vi quintals, is eight or nine pans long. Its ball weighs two lb, & for its charge, a lb & a half of powder. At the breech it has three balls & two in the front. Two horses can move it, for a single horse does not begin to move a piece. It is used for the defense of houses, or for taking among the INFANTRY to break a rank of CAVALRY.

The falconet weighs 4 quintals, is x pans long. Its ball weighs one lb & a quarter, its charge is half a lb of powder. At the breech three balls, at the front, two. To move it, two horses, although such pieces are hardly moved insofar as they only serve to defend houses. The ones which are carted around either for battery or for siege combat, are cannons, culverins, medium-sized *bastardes* & field

pieces. The *falconet* is loaded with a *ladle*, and one commonly gives it only one *ladle*. There are also other *falconets* weighing three quintals, and which are nine pans long. Their ball weighs half a lb. Their charge is a quarter of *powder*. It is loaded either with a *ladle*, but more commonly with a charge. At the breech, 3 balls, & 2 in front. To the small *pieces* which are under 3 quintals one gives them at least 3 balls & a twelfth part of a ball at the breech, & sometimes takes away from the front to make this addition to the breech, according to the length one gives them.

The strength of the *piece* is at the level of the trunnion, which is the point of departure of the lit *powder*.

The strength of the *berche* is at the *maslée*,^[c_019r_01] & at the back of the breech.

A *double musket* weighs 2 quintals, is seven pans long, carries a ball of a quarter of a lb or a little less. At the breech 3 balls, two in front. One loads it with as much *powder* as ball, up to the top of the escutcheon,^[c_018v_02] which in these *small pieces* can amount to 3 or 4 balls of *arquebus powder*. For if one uses *cannon powder*, one can load it to a thickness of ϵ five balls.

One needs to understand all of this as *iron* balls. When one shoots a *metal* ball, one overcharges by a quarter *ladle* because if a *cannon* ball weighs 40 lb, the *metal* one weighs 1x lb. One also takes the gun-sight higher when shooting a *metal* ball. For if one shoots an *iron iron* ball point-blank, one takes six lines higher when shooting *metal* balls. A *metal* ball makes alloyed with *copper*, in order that it is not frangible, is more effective hitting at close range than that of *iron*. But the *iron* one hits more fiercely from afar.

A *simple musket* weighs one quintal, is six pans long. ~~carries a ball weighing [illegible] qu~~
One has no consideration for those which are under two quintals, which readily carry *lead* balls ~~un~~ of the weight of the ball, but of the caliber. However, those which can receive balls of *metal*^[c_016v_05] or *iron* do better because they will penetrate more than six *lead* ones. Its charge is up to the escutcheon, namely the thickness of 4 balls.

Arquebus à croc weighs 1x lb, that is to say the large one is five pans long, its charge is up to the escutcheon, namely the length of 4 balls, it carries *lead* balls, and is for the defence of houses. Of these *arquebus à croc*, both the large & the small ones, one makes *orgues* which are θ appropriate for an assault, both outside & inside the place. They are founded separately as if to serve for uses other than *orgues*. See the 4th leaf following, marked

[Figure: fig_p019r_1]

[\[c_019r_02\]](#)

Mathematical figures without ruler and compass

You know how to draw a circle correctly with the quill & or else with the **nail of your right thumb** & the bent **big finger**. If you do not have a ruler, fold **paper** in two five or six times to use it. And if you want to draw a column, arch, oval, escutcheon correctly without a compass, fold your **paper** such that the fold **e** gives you a straight line, at the required distance from which, trace a point & a or a line & saturate it well with **ink**. Then fold again the **paper** & rub it on the back &

[Figure: fig_p019v_1]

it will print however much you have made. In that way ~~the~~ **l**, A is the line without **ink** which the **paper** fold gives you, B is the line you have traced, C is the one which is printed.

[Figure: fig_p019v_2]

[Figure: fig_p019v_3]

[Figure: fig_p019v_4]

For writing as well from the left as from the right

p[\[c_019v_02\]](#)

Write as best you can with **well-gummed ink** on as many little **cards** as you want *[illegible]* to write words. & once each letter is well saturated with **ink**, put it down on your **paper** & rub with a **tooth** the back of the **card**.

Clysters^[c_019v_01]

One used to give them with **leather** sleeves or bags, which for the best result ~~is~~ must be of **cat skin** which is more mitten-like than any other. And then one would start to fold back the sleeve on one side & one would continue to fold it back & twist it around itself & in that way the clyster would run gently. But this manner takes longer & is less convenient than the syringe which has been discovered since, with which a man alone easily gives a clyster. It is true that it always causes **wind** at the end.

^[c_020r_01]For making **millas**

[Figure: fig_p020r_1]

It is necessary to have **millet** pilled to remove the **husks** and then you will clean it well. Next one needs to grind it again quite finely and pass it through a *hair sieve* quite finely. This done, it is necessary to mix the **flour** with **melted fresh butter** and **milk**, and that there be as much of one as the other, in such a manner that it is very light in color, like the **dough to make fritters**. And you will put in **egg yolks** according to the quantity of **flour**, so that it amounts to two **egg yolks** for each **millas**. Then you will put in some **saffron**, if you like, to give them a little color.

Next, you need to have **molds**, and it is necessary that they be **earthenware**, in the fashion of the crown of a catholic hat, but it is necessary that they be open at both ends. And then, having made a good fire, you will clean the place in the **hearth** where you want to put your **millas**, and then you will take your **molds** and grease them quite heavily in order that the **dough** does not stick when it is cooked. Having done that, you will put your said **molds** on the well-cleaned place in the **hearth** and will put a little **flour** at the bottom and fill them with the aforementioned **dough**. Next you will cover the said **molds** with **lids** which will be made like the **molds**, but it is necessary that they be larger and not be open at the top. Then having done that, you will put a little **hay** on the said **lids** and plenty of **embers**, and make a good charcoal fire all around. That done, you will uncover one of them soon thereafter and see when it is cooked. It should be hard.

GLASSWORKER

Glass from Lorraine is smoother & more even than plate glass and it is sturdier & more durable. But commonly it is stained by veins, in straight lines as if tanned, which happens because the GLASSMAKERS, having made it, put it when totally hot on straw, which stains it in this way. However, this is removed with varnish & salt & other drugs that the GLASSWORKERS put on. Glass from Lorraine is sold by the bundle^[c_020r_04] & each bundle is composed of three tablets. The bundle costs usually x sous. Plate glass is sold in made in France, it is whiter & clearer, but alternately it is not so durable as that from Lorraine. It is also commonly blown & in that case, it is better to make little diamonds rather than large square pieces in the shape of a frame, because they cannot be set quite evenly.

Plate glass is sold by paniers. Every panier contains 24 plates that are commonly sold at x or twelve lb.

For whitening the face

Pestle puffball in cistern water, & no other, & wash with this whitened water. This is considered quite singular. And I believe that making it from wheat starch & to use it would be even better.

Against winds, colic, &c

Sap squeezed or water *[illegible]* distilled from orange peel is excellent against the windy colic. Candied peel, too, is excellent for the winds of the belly. And to make a trial of it, having poured foaming wine in a glass, squeeze orange juice on the wine foam, which proceeds only from vapor & wind, and you will see that the foam will immediately disappear. Also, if you squeeze juice against a candle it will burn all the brighter.

Skirret root

They want to be planted in a very humid place where with such a rodier well or fountain one can water it often, for by this means they are tender. Otherwise a hard heart forms inside, which takes from it all its goodness.

Against burn

Pestle an **onion** with **verjuice** & leave it to soak like this, then apply it. Or else, apply **black soap** on the burn. Experimented.

Common saying

Bell tower of **Rodez**, **church** of **Albi**, bells of **Mende**. However, one holds the bell of **Toulouse** named Cardaillac^[c_020v_02] as one of the most beautiful in **France**, all the more since it weighs two hundred and fifty quintals.

A form of regimen

Every morning, take two or three **eggs** laid one or two *days* ago. Heat them ~~until~~ & do not cook them. Take the **centers** well dusted with **sugar**. And next drink one **finger** of **wine**. And apart from being **nourishing**, it **makes a good stomach**.

GUNNER

As for small **cannons** which are not loaded with a **ladle**, one charges them with **powder** up to the **escutcheon**,^[c_018v_02] which is placed on the **piece** with due proportion.

To point a **cannon**, that is to say to take its aim, one needs to take the sight, that is to say aim, from the sides before the top, that is to say above the **cannon**. For by aiming along the top, you will be better able to find the line tending to your target, but you would not find out if the **cannon** tends more to one side than the other. Therefore take your sight on one side, then on the other & adjust your **piece** to the point at which you aim. Then take your sight from the top of the breech, which will be done quickly. Next, lower your **piece** a little at your discretion if you are within true range, because the force of the **powder** usually makes it rise. But if you were farther away than your **piece** shoots at point-blank, you would need to consider that the weight of the ball would make it lower.

For firing a **cannon** at night

Some keep their **pieces** loaded ~~and~~ from the day. Then, in order that the **GUNNER** can fire into the breach where the assailed are perhaps making repairs, the besiegers raise a false alarm in order that the besieged throw **torches** & **artificial fire** into the moats or around the breach, at which the **GUNNER** aims. Sometimes, by using the reflection of **mirrors** or **flasks** full of **water**, the assailants light up the breach. The method you know, with a **quadrant** & **plumb** line, is very good. Others nail two or three rows of boards with **strong iron pegs** on the **wooden** platform made for mounting the **cannon**, and leave empty notches into which the wheels of the **cannon** can just fit. And by such means you will always ~~te~~ place it at a similar ~~q~~ point, that it will not incline more to the right than to the left. And in order that it be neither too high nor too low, when you fire during the day, you place a **ruler** fixed well in the ground, which comes just to touch the the bottom of the edge of the **cannon** after it has been pointed & adjusted for firing.

If the platform, the wheels, or the wedges break or are disturbed, this invention is of no profit.

Others place two poles fixed well into the earth such that one is **equally** as far from the edge ~~and of~~^{fc_021v_03l} the muzzle of the **cannon** as the other. And underneath they place the above-mentioned **ruler**. Then when they want to fire at night, they push their **cannon** straight toward the above-mentioned **ruler** & make it so that the edge of the mouth rests on the end of the aforesaid **ruler**. Next, they measure with a **ruler** or similar thing cut to measure, from one pole to the side of the **cannon** & if it is too close or too far from it, they adjust it & do thus from the side of the other pole.

For unspiking a **cannon**

Some say that one should remove the ball if the **cannon** is loaded & give fire through the mouth of the **cannon**. But it is to be believed that the fire would sooner exit that way than going to seek its exit through its usual touch-hole which is spiked & constrained. The most reliable way is that the **GUNNER**, who is often a **FOUNDER**, wedges & thoroughly rivets the **nail** that the enemies placed, and with a **trepan** makes ~~at the side~~ another touch-hole next to the one which has been spiked, which will be done in an hour. And if with time the violence of the **powder** loosens the **nail** with which the **piece** is spiked, you will make a **thread** in the second touch-hole & place a **screw** in it quite perfectly which will never come undone. *M*

Defense of a town

There is nothing that has a greater effect for the defense of a breach than **petards**^[c_008r_04] placed at the entryway at the time of the assault. They carry a lot of ammunition. ~~be~~ One fills them with **cart nails**, **large steel dice**, **bits of chain** & similar things. And when one senses that the enemies are close, one sets fire to all. **Grenades**, too, well-made and aptly thrown, cause great damage. And to make them worse, one puts **coarsely** ~~pestling~~ **pestled** **glass** either in the **molds** or in the *crucible*, when one wants to cast them; this worsens the **wounds**. The **grenades** ought not to be too brittle. But it is good that they be somewhat alloyed with the **substance of the pieces** in order that, holding the blast a little rather than breaking, they have more violence.

Cannon ball, weighing

40 lb, having 12 lines,
king's foot

A little too big, see the one ~~of~~ that follows.

[Figure: fig_p022r_1]

Orgues

[Figure: fig_p022v_1]

[c_022v_01]

Then one mounts them on a medium thick board close to one^[c_022v_08] another & one makes notches on the board this way

[Figure: fig_p022v_2]

& through these notches one passes the hook of the **arquebus** which has a hole through which one passes **iron** pegs from under the board. Then, when one wants to aim it, one mounts the middle one & that on both sides. If you want to make a double row, or triple or quadruple or more, you need only place a similar row of boards like the first, one on the other. ~~For the other~~ This kind of **orgues** penetrates & is quite stable. For the other ones which are made of one piece like a solid square have **cannons** only ~~three~~ ^{four} one pan & a half long. Also, they only serve for making a salvo at an entry or for defending a door.

A small **arquebus à croc** weighs 40 lb, is four pans long, is loaded up to the escutcheon, ^[c_018v_02] has three balls at the breech & two in front.

The **double cannon** is no different from the **large ordinary cannon**, except that it carries ~~[illegible]~~ its ball ~~[illegible]~~ which has one line^[c_022v_02] of thickness, or of diameter, more. The line is a twelfth part of the ball of the **cannon**. At the breech, it has one line of thickness more than the **cannon**, & half at the front. Its charge is six or seven lb of **powder**, more than a **cannon**, namely by two big **ladles**. Its ball weighs 56 lb. One needs thirty **horses** to draw it. It makes much more of a fracas at the wall than the **cannon**. But it is very troublesome to draw. It is for this reason that one hardly uses it today, and it is more for moving to some nearby place & battering at close range or for an entry, than for ordinary business. One calls^[c_022v_06] them **basilics**, and they are **pieces** made for pleasure.

On petards

[c_054v_01]

Such a **petard**^[c_008r_04] is made which weighs three quintals, carries a cannonball flat on the side on which it must exit & round on the inside of the **cannon**, as if it were a cannonball cut in half. It is two pans long. It is charged with xxv lb of **powder** for ~~at~~ it needs to be full up to the mouth & it needs to burst. It does not have a different thickness at the breech than at the mouth & is all of one piece. Its substance needs to be better than that of **pieces**, & for 4 quintals of **fine copper** there ought to be only one quintal of **metal** in order that it holds the blast, &, bursting with more force, has a greater effect. It is for putting against a door with a large **iron** cross in front of the ball, and ~~sonce~~ loaded, it needs to be covered with a well-sewn **thick canvas** which should be anointed ~~e~~ all over with **turpentine**. It needs to have four handles, made while it is founded, for it is thus easier to place. The **iron** cross is joined to the mouth with the **canvas** with which it is covered. ~~To place it, it~~ The handles must be kept at the edge of its muzzle, as you see. To place it, one needs three or four **iron** pegs one pan long & as thick as a **finger** which should have their point like a ~~wimble~~^[c_168r_01] gimlet, & the entire leg as a **screw**, like an **auger**, & a ring on the other end to turn them with a **short stick** which has play within the ring. And the **pegs** are placed in the door ~~but~~ not straight ~~but~~ for they would not have any strength, but at an angle as if you wanted to fix them toward the middle of the **petard**, and to do this, the hole of the handles needs to be quite large. In this way, the firing **petard** pushes the **pegs** along & across into the door & makes more of a breach. Once it is placed, you need to have a **buckram** sausage^[c_023r_01] made in this manner: take eight or nine canes of **buckram strip** or more if the ditch is larger, and let the strip be four or five **fingers** wide. Have it well sewn in such a way that it is like a gut through ~~which~~^[c_023r_02] a stick as thick as a **finger** can pass. Fill it completely with good

This one is for putting below an undermined tower with the muzzle pointing up. One makes two large **iron** rings & with a **bar** or two, four men carry it. They are also used for putting in breaches but here one needs only half a charge, namely x lb, & to fill it with **flint stones** & **cart flint stones**

[Figure: fig_p023r_1]

One needs to cover it entirely with **waxed canvas** & rubbed with **turpentine** & **combustible things**. This cover is made in order to secure the ball, such that it does not fall and in order that when the fire takes to the cover, the **primer powder** does not fail. Precisely at the fuse, you will need to put in a good quantity of **primer powder**. Some put a cross of **iron** on the ball which extends beyond the mouth of the **petard** by two paces. Others only put the ball.

powder. When the sausage is full, dip it ~~well in~~ lightly, to wet the **canvas** & not the **powder**, in two parts of **vinegar** & of one of **eau-de-vie**. Next, let the said **canvas** dry well, and then one needs to join to the said sausage a long **string** or **cord** which should be two times longer than the sausage, & one ought not to tighten it to the sausage but only to bind it to it at both ends & to sew it on the sausage in a few places in the middle. Next one needs to anoint the entire sausage with **very good turpentine**.

And at whichever end of it you wish to join to the touch-hole of the **petard**^[c_008r_04] for giving fire, you can sew a or tightly attach a **large strip of canvas** one empan wide which should also be well soaked in **turpentine**; & this strip must be split in the middle in order to wrap & tie it around the **petard**, and one needs to attach it in such a way that ~~the touch-hole should be close to the me~~ the tip of the sausage, which should be open, should be joined to the touch-hole of the **petard**. Then one needs to put a lot of tightly-pressed **powder** onto the touch-hole of the **petard**. And next, the one outside the ditch needs to pull the **thread** & **cord** that is joined to the sausage until it is moderately extended, but not so much that it is detached~~sen~~. And if there was **water** in the ditch, one would need to support the sausage with **forks**. Then, the one who holds the end of the sausage will be able to give fire, having gotten himself to safety, & the others also.

[Figure: fig_p023v_1]

On petards

Petards that one wants to place on doors or **iron** grates are sufficient if they weigh 40 or 50 lb. Moreover, as for its charge, ball, & fashion of proceeding, one needs to do all as is already said above, concerning the one of 3 quintals. One man can carry it.

The ball needs to be round on one side & flat on the other like ~~a half ball~~ a half of a cut ball. It is also necessary that the cross is held to the ball and that it, when the ball is founded if you make it from **metal**, is bound up with the middle of the cross.

Grenades

Grenades must be made from the **finest metal**^[c_016v_05] one can find, for there is **fine metal** and **crude metal**. **Fine metal** is that of a large bell, because one puts in more **copper** to give it a bigger voice, & for small bells one puts more **tin** to give it a **bigger** clearer sound. The **metal of a large bell** is made ~~one~~^[c_024r_05] with 3 quintals of **rosette** & twenty or xxv lb of **tin**. ~~Tan~~ Each **grenade** must weigh four to six lb. And in order to throw them, it is necessary that they be full of **powder** mixed with **coarsely pestled glass**. And for a quarter lb of **powder**, one needs half an ounce of **glass** which is put with it, in order that on the **face** or places where the **powder** will have its effect, the **wounds** will be all the worse for it. The **best arquebus powder** is required here. The hole needs to be as large as the thickness of a **swan's** quill, & you need not bother to make it threaded, but it is enough to make it even. Next, you make a well-soldered pipe of **fer blanc**,^[c_024r_02] which can enter into the hole & enter into the middle of the **grenade** & which comes out of it by the width of one **finger**. You will fill it with **good powder**, pestled in a mortar & lightly mixed with **good eau-de-vie** or **strong vinegar** ~~which seems~~. ~~And when~~ This is done to temper the **powder**. And to know if it will be slow enough to allow leisure to throw the **grenade** without danger, try this **powder** thus bathed in another pipe. You can keep ~~d~~ your loaded **grenades** in a **very dry place**, & on the contrary you shall keep your pipes filled with that bathed and well-compressed **powder** in a **humid place**. And nonetheless, you shall have some already inserted into ~~the~~ some **grenades**, to be always provisioned. And *every three days* you shall change them if you recognize that they have become too dry. To throw your **grenade**, take it bravely & in one **hand** & with the other give fire to your pipe with ~~the~~ a match,^[c_024r_03] & throw it promptly amidst the **powder** troops. The thickness of the **grenade**^[c_024r_04] should be twice the back edge of a knife.

For bringing a **cannon** over **land**

~~If you have~~ To bring a **cannon**, one needs a hundred **PIONEERS** or more to flatten the tracks by levelling ditches & others obstacles, such as **trees**, **stone** mounds & similar things to make gabions on the way. Once one is close to the place one wants to batter, the **GUNNER** goes *at night* to reconnoiter the most convenient place to mount the battery

Know the magazines of **France** for the **artillery**.^[c_024v_01]

It is good if the platform is slightly inclined toward the front because the **piece** is more quickly mounted for battery & holds the blast better & batters more fiercely.

& if he does not see well, one gives a false alarm in order that those on the inside throw **torches**. Very often, one batters where it is strongest because the assailed, disdaining the battery, do not make repairs there. Commonly, there are not many garrets & other defenses in that place. And when one has made a breach at the strongest part & the **cannon** removed, it will surprise the assailed. One approaches **fortified towns at night**, but to **poorly fortified towns**, **PIONEERS** bring gabions and ~~carry~~ once these are placed, one puts some boards or planks behind the gabions to keep the **PIONEERS** safe, while behind, they fill the gabions with some **earth** by means of their **shovels**. And while one does this, one raises some false alarm on another side. And before, one has

Fowlers

are those which have a reinforcement inside, in the entire space which contains the **powder**, and the ball can only ~~a~~ roll up to the opening of the said chamber. These do not penetrate so much & are irritating to load but they do not heat up as quickly.

fired a volley at the defenses. ~~The gabions~~ The **PIONEERS** carry the boards to make a level ground or a platform of four **fingers** or half a **foot** thick, and one sets them into the **earth**. The platform is five or six ~~eano~~ **feet** larger than the wheels of the **cannon** on each side ~~m~~ if there is only one **cannon**. But if there are more, the platforms touch. The distance which is between the **pieces** is the width of two gabions. As long as the battery lasts, the **GUNNERS** sleep & eat close to a **cannon**. In small spaces, one does not bother to dig trenches to reach the **pieces** but one puts plenty of gabions that are high & goes running to them. In large

A steel touch-hole

is put in the **cannons** in the manner of a screw so it will not be damaged during firing like the others very quickly will be. But these screws are prone to blow off & cause damage to the **GUNNER**. There is nothing for it but to use a proper touch-hole.

places one digs trenches. There are always in trenches or behind barricades ~~some~~ some companions-in-arms on guard duty to defend the **pieces**. One keeps the small **powder** magazine, of three or four kegs, separately,

A touch-hole at the level

of the breach is the best because in ~~in~~ this way the **cannon** hardly pushes back.

a hundred paces away from the battery & one surrounds them with barricades or trenches. And there one goes to get powder in bags or frails. And each piece has its own frail for loading three or four times. Then, when the cannon is set on the platform, one puts a board that is proof of an arquebus between two gabions. Then a GUNNER loads it with a ladle, & with the rammer which is at ~~ten~~ the other end of the ladle, two men ram the powder as much as they can, in nine or ten pushes, until they find the powder to be hard & well-compacted. Next, another puts hay or straw and the ~~r~~ others ram a little. Another puts the ball and the hay-bearer puts in as much of it as before & one rams a little. Some put wooden bungs but this runs the risk of making the piece burst. And where one has to fire many cannon shots, one would need many bungs, which would cost much to carry. Once the cannon is loaded, xx or xxv PIONEERS push it forward with bars, keeping to one side behind the gabions without taking off the board until the cannon reaches it. Once the cannon is in front, the GUNNER mounts it with the wedges which are at the back, taking the sight on each side and then in the middle. Then another who is nearby gives fire. Each gunner cannon needs 3 GUNNERS: the loader, the one who aims, the one who gives fire. Sometimes, against a camp or into a breach, one shoots cartridges, made as you have elsewhere, or else one uses a basan full of flint stones, cart nails & similar. *P* A *eh* cannon must not move unless it has two harnesses, be they of wood or iron. And to furnish the wheels, powder box, and other furniture of the cannon, one needs seven quintals and a half of iron. ~~For the pre~~ The best battery is done at a curtain wall, some say, ~~for~~ that is, as if at an *bieve* angle, for by doing this you shake loose several stones.

Some put small wheels of the piece and a thick board to the end of the carriage of the piece in order that it may be drawn more quickly and without making a noise. Others put leather all around the ~~the~~ wheels & also put leather soles or shoes on the horses' hooves in order that one does not hear them.

GUNNER

There are three reinforcement rings on a **cannon**, one at the breech, one in the middle, one at the mouth. When **FOUNDERS** want to work on their craft or render the **cannon** or other **piece** lighter & easier to cart around, they make it from the ring at the breech to the ring in the middle of the thickness & proportion of the balls, as is said above. But from the ring in the middle to the ring of the mouth & they diminish it one line, or more or less, on each side, always taking their measurements with the **compass** from the straight line which they make in the middle of the **model** of **paper** or otherwise. And this reduction amounts to seven or eight quintals **reduction & lightening in weight**, and the **piece** is not less secure for it. This is done for **big pieces**, but for ~~gr~~ **small pieces** ~~from~~ **lesser than** the average, one needs to observe the aforesaid proportion, & draw the **piece** in a continuous line from one end to the other. The trunnions are commonly situated one **foot** from the ring of the middle, ~~from~~ toward the edge of the breech. But because some **GUNNERS** prefer a **piece** which is weighted at the front because it is easier to plant, to do this, one only needs to move the trunnions closer to the breech & further away from the middle. On the contrary, if you want to render it **s** more weighted at the back, you will move the trunnions closer to the middle of the **piece** or place them further up toward the mouth. When you bore your **piece** you make a fluted **cast iron** box like a bedpost & there ought to be sixteen channels or notches in which you will slot sixteen **blades** quite evenly, ~~with~~ in order that all together they cut & scrape in the same manner. Because if some were to not cut & scrape, chambers & waves would be made in the **cannon** which would make it lopsided and there would be a danger that the **piece** might break in the middle. In order to avoid this, it is necessary that the **borer** should pass evenly from the breech to the mouth, & that the opening of the **piece** should be evenly bored from one end to the other, because thus the **powder** goes off all at once with more force. On the contrary, if restrained, it goes sideways & makes the **piece** break.

Cannonball

*This is the true measure of the caliber, but the **borer** always takes away a little more.*

[Figure: fig_p026r_1]

Petard^[c_008r_04]

They are made better in crucible form, ~~hollow at the~~ narrower at the bottom & becoming larger toward the muzzle. It is necessary to pestle the powder thoroughly & put on top of it either sand or cork or better still a fitted plate of wax thoroughly pestled on top, for it seals precisely & makes for greater force. The ball only makes a hole, the powder alone makes more of an effect. One holds that, once loaded & kept in a dry place for fifteen days, they have more force.

[Figure: fig_p026r_2]

Culverin ball

[Figure: fig_p026v_1]

Bastarde ball

[Figure: fig_p027r_1]

Medium ball

[Figure: fig_p027r_2]

Field piece

[Figure: fig_p027r_3]

Falconet

[Figure: fig_p027v_1]

Falconet

of 4 quintals,
alternatively passe-
volant, is 8 pans **long**

[Figure: fig_p027v_2]

3 quintals,
is 9 pans
long

[Figure: fig_p027v_3]

2 quintals,
is one cane
long, which
is 8 Montpellier pans

[Figure: fig_p027v_4]

1 quintal,
is six pans
and a half

[Figure: fig_p027v_5]

1 quintal
and a half is
7 pans **and a half**

[Figure: fig_p027v_6]

Musket,^{[\[c_027v_01\]](#)}
of 60 lb,
is 5 pans
and a half or 6

[Figure: fig_p027v_7]

5 quintals
is eleven pans
and a half

[Figure: fig_p027v_8]

The measure of the caliber of **pieces**

[Figure: fig_p028r_1]

The numbers and dots show how many quintals the **piece** weighs that carries the marked caliber.

PEWTERERS

They deem the best **tin** is the one that comes in *saulmons*,^[c_028v_04] which has not been remelted since it came from the **mine**, because the **MASTERS** remelt it *æ* in *grille*,^[c_028v_05] weighing two or three lb, to easily cut it up and sell it by the piece. And in this they often make a mixture of leftovers from **plates**, **solder** & **common tin**. And to recognize the best one, it is the most lustrous, which looks burnished, because it is the softest. Sometimes in their *saulmons* they find pieces of **iron**, stones & similar jumble to cheat on the weight. The **tin from England** is so hard that the **MINERS** put in **lead** to soften it. The one that comes by way of **Germany** is softer.

Commonly, the SWORN MASTER PEWTERERS from *bonnes villes*^[c_028v_02] add six lb of fine lead on or eight on a quintal of fine tin. The OTHERS, WHO WORK IN THE COUNTRYSIDE, put fifteen or 20 or as much as they can, and to cover up the blackness of the lead ~~it~~ and its softness, they put in looking-glass tin, 4 lb per quintal, +^[c_112r_02] ~~pe~~ which whitens & hardens, and a little six or eight lb of rosette on a quintal to render the plate *sonorous*.

To mold platters & dishes, they make them out of *pierre porte morte*, which is *grais*,^[c_008v_02] & they turn & polish ~~around~~ them on the wheel. They melt their tin in an ~~dest~~ iron pot on a charcoal fire, and with an iron spoon that holds almost a sufficient quantity for a platter, they cast ~~leu~~ in their cold molds, which they keep joined & tight between their knees. And soon after, they open the molds so that they do not heat up, & having taken out the cast which is on the female side, & which breaks easily. Then, with a cloth which soaks in water, which they always have beside them, they rub the middle of the back of the dish & around the edge, so that it comes out better, and rub the female mold with it.

+^[c_112r_03]

When the tin is fine, one adds less glass-looking tin, namely 4 lb per quintal, but if the tin is base, that is to say alloyed with a lot of lead, one puts at least five or six lb of looking-glass tin to it.

If there is hardly any looking-glass tin, one puts about two or three lb per quintal. One puts eight lb of rosette. But if there is a lot of looking-glass tin, ~~one~~ like 4 or 5 lb, one only puts six of rosette. And commonly, per quintal of tin, one adds x lb of both.

Go to the fifth leaf.^[c_028v_01]

Stucco for molding

Take **tragacanth gum** and put it to soak until, having drunk its **water**, it is swollen & rendered like **jelly**. Then grind it quite hard on **marble** & next take **rye flour**, which is better than **wheat** because it is more humid and does not make the paste as brittle, and sprinkle your **tragacanth gum** with it, & continue to grind and mix in thus, little by little, ~~it and mix legi~~ the very finely sieved **flour**. And knead it as if you wanted to make **bread**, until ~~you~~ you perceive that it has enough body & is as firm as **bread dough** that one is ready to put in the **oven**. This is recognized when it can stretch enough without breaking. And if it was not strong enough, it would not *sti* release well. Once the paste is prepared, rub the hollow form ~~at the u~~ with **oil**, with a **brush**, in order that the **oil** penetrates everywhere to make it release better, and press the paste inside quite hard. And if it does not release well, mix in more **flour** until it has enough body. With this you will mold whatever work you like, masks or garlands, which will be dry within one **day**. Next, you will apply them with **strong glue** or **paste glue**, as you like, and you will be able to paint and decorate them with **gold** & all colors. One makes ceiling ornaments with it in **Rome**. One can make bed ornaments with it. *If you want that the work stays white*, it is better to mold with **plaster** instead of **flour**. It is true that it is more brittle and firm as well, but one needs to prepare it like this: temper it, when it is powdered **strong**, in a good amount of **water** so that it is clear, & grind it several times a **day** for fifteen **days**. Then pour off the **water** by tilting, and gather the **plaster** & grind it finely on **marble**, & place it in some kind of clean **lead** vessel, so that no dust & dirt falls into it, & leave it **in the open air** & **in the serain** for fifteen **days** with its **water**, and it will become matte, strong, white and light, very suitable for making a seat for burnished **gold**. And this, in powder form, you can mix, instead of **flour**, with **tragacanth gum**, and your work will be very beautiful. Lacking **plaster**, you can mix in well ground **chalk** or **ceruse**, & try **bole** & similar things. This **stucco** with the **tragacanth gum** has the quality that, yielding when it is not yet dry, it can be accommodated on either round or flat things, as you like. It is to make an ornament at little expense.

Flour is not good in this, but **chalk** or **ceruse** is.

Color of gold without **gold** on **silver**

Color your applied **silver leaf** with *terre emerita*, and once dry, give a coat of **spike lavender oil varnish** and of **sandarac**. And it will be more beautiful than **tinsel**.

Layer of burnished gold on paper

Make your seat of starch soaked in water & your gold will burnish very well. Clear starch water layered on the paper, then dried, & repeated in this manner 3 times, is a good layer for burnished gold on simple paper & has no body.

Removing stains

Good eau-de-vie removes them if you rub the garment with it.

Seat for gold

Ground terra emerita with some saffron, all of it tempered with very clear strong glue & passed through a linen cloth.

Extraction of oils

APOTHECARIES say that anything which does not adhere to the mortar while pestling is oleaginous.

Dragon's blood

The darker dragon's blood is the best & has more of a tint; it is the tear that is found in gr pieces like peas and large hazelnuts which look like

[Figure: fig_p029v_1]

.

Take a well chosen tear of it which shows off its transparent red. And in a glass bottle put the best eau-de-vie you can find, in sufficient quantity. ~~For it~~ And stop it well and so diligently that it does not vent, otherwise it would be worth nothing. And leave it thus for a long time, because the longer it stays ~~there~~, the more beautiful & better it will be & it will dissolve if it is good, otherwise it will become like wine lees. When you want to use it, make a small hole in the stopper of the bottle & pour a little & stop it again each time, then apply it on gold.

The good kind of dragon's blood can be found in large pieces like pieces of cake this one has no value and is adulterated, & once broken it shows on its edges scales, transparent as ~~no~~ rouge clair enamel, it is also lumpy in some parts like small rubies. The eau-de-vie needs to be very ardent & passed^[c_029v_01] several times.

I put it in common eau-de-vie, mixing in some aquafortis to give it strength. At the beginning the water took on a slight tint, but at the end there was only an appearance of tragacanth gum with which I think they adulterate the dragon's blood.

When it is applied on burnished gold, it is prone to break. For this reason, some coat it with turpentine varnish. Cold delays the action of the water and the extraction of the color. And for this reason, one can keep it close to the fire.

Lead

The best, fattest & softest is brought from Germany and is not in saulmon,^[c_028v_04] but in lattes^[c_030r_03] of around an arm's length & three fingers' width. It is transported to Lyon, and from this, the leaf is made for small mirrors in Nuremberg.

[c_03or_02]PEWTERER

They also make their molds from metal which lasts longer & molds more cleanly than *grais*, [c_008v_02] because the plate comes out without flashing & smooth. But this is for the RICH because a mold costs fifteen or sixteen frans. They are mainly made of metal, for basins & ewers & salt cellars & similar things which are fashioned.

For pints, [c_03or_01] molds are made with white clay earth mixed with horse dung & cloth waste & well beaten, because the pints, being sunk in a half round, would not be able to release as well from the *grais* mold as from the earth, which is soft. One makes the *noyau* of the mold of the said pints in *grais*.

In metal molds, one makes vents and casts all at once, which is the reason that in the middle of the dish, no smoky black line which comes from the vapor & fumes of the metal that is cast, which is the cause that in that spot, the work is lumpy & very often pierced. However they repair it with solder of the ~~n~~, as is said. These fumes are made right in the middle of the cast, & in *grais* molds.

The plate can be hammered ~~mar~~ to make it more vendable. But it will not last as long.

Depending on the size of their platters & plates, they have notches on the spoke of their iron wheels. And when they want to apply

any dish or plate, they loosen & undo with the strike of a hammer the iron wedges that slide along the spokes of the wheel. And, when they are at the notch and points that they need, they tighten the said wedges, wedging them with the hammer.

When their plates or dishes have been cast, soldered if needed, & purged of surrounding flashing with the hot soldering iron & then with a large file, they adapt it on the wheel; & first of all they wrap their *desgrusoue desgrusouer* with a rope, as thick rope as the little finger, & lean it firmly on the crossbar to secure it well. And while someone else promptly turns the wheel, they guide the sharp edge of the *esgrusouer* by hands toward the edge of the round hollow, & gently guide it to the center of the circle. And this *desgrusouer* is for removing the first rough & lumpy skins of the work. And next they even it out with a cutting iron called a *plane*, the sharp edge of which they rub with a little putty on leather nailed onto a piece of wood having, and this in such a way that the flesh or grain is on the outside, for if the sharp edge of this *plane* was not thus rubbed & burnished, it would not polish & not burnish the tin, ~~au~~ which would stay white, & not black & burnished like a mirror. Moreover, they repair the work for the second time with this *plane* as they did with the *esgrusouer*. Then, with a knife or another sharp iron, they scrape the edges of the platters or plates to smooth them so that they are not found sharp when handled

Their hammers must be quite even & polished, and if by chance the rust, the or some other use, has damaged them, they first polish them with emery stone powder, then they finish burnishing & smoothing with the putty. Otherwise they would not strike neatly. It is also necessary that the surface of the anvils be the same.

New vine

Having taken well, if you want it to grow strong branches, having plowed it, put at each foot two handfuls of pigeon dung.

Colored waters

Distilled urine, distilled vinegar and eau-de-vie take on a cerulean and green tint from pulverized and finely ground *æs ustum*. And this tincture is red copper in its residue if you distil the aforesaid things through a filter.

Varnish resistant to water

Flanders varnish, made with turpentine & oil of turpentine or mastic, can come off and does not hold up in the rain. But that made with white walnut oil, ^[c_o3ir_oi] as you have done, holds in the rain and is very clear & beautiful & dries soon. This is why one uses this one for painted banners & signs that one carries in the rain.

Fruit made from sugar

One does not paint them with a paintbrush like other s things with moistened color, because the sugar would melt. But one rubs them with color with the finger.

PAINTER

SCRIBES achieve darkening of lake & other colors for garments with egg yolk, but this is trumpery and does not last.

Others glaze reds from minium & others which are not beautiful in oil M using glair of egg, and it appears to be done in oil. But humidity corrupts all this.

Brushes

Take those that have been used a little by WHITE-LIMERS, for the harshness of the lime & use make them more handleable.

Painting from nature

One ought not to undertake to work on it in overcast weather because you would make your flesh colors browner than one ought to.

Painting on glass^[c_031v_01]

For blue, they take the coarsest *azur d'esmail* & grind it on *shale*, & mix in two or three rosary beads' worth of *rocaille*^[c_031v_02] or more, according to the quantity of the work. And having done their drawing with *noir d'escaille* (which is painted toward the light with the piece of *glass* upright), they lay all their pieces on *white paper* ~~when~~ for knowing by the whiteness of the *paper* the lighting of their histories and ~~as~~ set down all colors which are of one kind all in one go. Then they heat it up.

The body of the cuirass

The high plates of the pauldron of the *brassard* are like a masterpiece of the *MASTERS*, for it is necessary that these pieces be very precisely hollowed^[c_032r_01] & adjusted in order that the movement may be free. Cuirass bodies must be very evenly beaten & driven^[c_032r_02] with the hammer.

Morions from *Milan* are all in one piece & thus better than those that are of two.^[c_032r_03]

PAINTER

As soon as the colors of panels are well dried, the *Flemish* varnish them so they do not die any more than they already have & remain in that state.

The one who knows to work well in *distemper* will work well in *oil*. But, on the contrary, the one who knows how to work well in *oil* will not work in *distemper*.

For layering gold in distemper

Common PAINTERS & SCRIBES make *batture*, that is JOINER's glue tempered with water on the fire, moderately clear, mixed with very little honey, that is to say a few drops to make it stick. And with it they form letters, or that which they want to gild, with a paintbrush, and immediately after layer the gold, but they never do their work quite neatly, and if there is a lot of honey it dries only with great difficulty. This layer is undone in the rain.

Others do better, they temper candy sugar in water and mix it with sanguine that they call *cocon*, thoroughly ground, adding in a little soap. This is done neatly, & renders gold beautiful if one uses it as the seat.

MAT MAKER

They make two kinds of them in Toulouse, one to hang on the partition walls of rooms, which they weave almost as fine as the straw phats worn by VILLAGERS. And they make them in long bands, some the width of ten to straws, others of thirteen. And they work on them mainly in summer. And in winter, when they put it to use, they sew it. But beforehand, they put it in dye and commonly make it in three colors, green, red, and sometimes violet. The green one is made in a single pastel woad dye, because green being made from yellow and blue, the pastel woad discharging itself onto the straw, which shows its dark yellow, one obtains bright green. For the red, they use alum and brazilwood. For the violet, they use pastel woad & a little copperas, which browns the blue with its black tint.

GLASSWORKER

They do not have the invention for making a perfect red in a work which one needs to reheat. Nonetheless, try the red from Germany, which is *rouge d'escaille*. They make their common red with sanguine, looking-glass tin, rocaille,^[c_031v_02] litharge & a little iron scales.^[c_032v_01] The said red is applied on one side & the other of the glass in order that it has more color; if it were applied on one side only, it would be too pale orange.

FOUNDER

They buy rosette at xx lb a quintal, which is harder to melt than latten because it is softer. For, the softer the great^[c_012v_01] metals [#]^[c_112r_02] are, the soft more difficult they are to melt. The tin for bells, which is fine tin is more and which is brittle, is easier to melt than lead, which is soft. Latten made brittle by the calamine is melted more quickly than red copper. The metal,^[c_016v_05] which is the substance of bells, mixed with tin, and very brittle, is soon melted. The more silver is alloyed, the sooner it melts, that is why solder is made with it. In Germany they make very light candlesticks, it is because they turn them by means of water, but they are breakable. A quintal of per fine COPPERSMITH's rosette is sold for xxx or 40 lb. Another, which FOUNDERS use, is sold for xii or xv lb. The quintal of metal, six lb. Put in

[#]^[c_112r_03] Gold, silver, copper,
latten, iron.

Knife for cutting the nose or a finger

[Figure: fig_p033r_1]

This is a well-furbished knife, nailed through the middle in such a way that it easily moves to one side & the other & the side ~~fillegible~~ A, as readily as the side B, is hidden inside its handle marked C. The two tenons you see at the tip of the knife are for locking it on one side or the other against a nail which is at the butt of the said handle, in order that, when one wants to press hard on something to cut it, it does not come out from the handle. You may allow the side marked B to cut for demonstration purposes, but not much, but the side that is notched A and marked A must not cut. It is sufficient that it be furbished well. And also the notch needs to be as thick as the back of a knife in order that it cannot cause pain. And you will only show the part of the knife which is not notched, for the side with the notch needs to be ~~mar~~ hidden inside the handle. And when you want to cut the nose or a finger, pretend to sharpen your knife on the thigh and, while while doing this, turn the knife deftly. & the part with the notch, which you will cover ~~t~~ with one finger, will come into your hand, and you will place the notch, colored with brazilwood rosette or black cherry juice, upon the nose.

The CONJUROR ought not to amuse himself by watching what he is doing, but look at the SPECTATORS and give them plenty of good hocus-pocus words so that they look at his face & not at his hands.

X^[c_084v_02] For relighting an extinguished candle between your hands without blowing

[Figure: fig_p033r_2]

X Take a small stick of well dried ~~between~~ wicker and cut from it a small piece like a toothpick, & ~~it-m~~ put one end between your index finger & middle finger and clasp both your hands, fingers well joined, and pass them deftly around the lit candle as if you wanted to cover it with them, & your wicker will light, & immediately remove your hands ~~je~~ thus clasped, & immediately put out the candle. And then put your hands around it again as if you wanted to cover it, & your little ~~of-light~~ ^[c_033r_01] wicker light, by means of the smoke that you are holding with your two palms the candle will light. Then immediately extinguish your wicker & secretly cast it aside.

For making it seem that to someone that he has a piece of silver on his forehead

Take a token or piece of silver and wet it and make it hold against your forehead. Then say to the BYSTANDER that if you put it thus on his forehead, he will not be able to make it fall without lifting his hands to it, no matter how he shakes his head. And making it seem as if you are placing it on his forehead, retain it in your hand & wet your thumb with your saliva then press it quite strongly on his forehead. And thinking he has the piece on his forehead due to the coolness of the saliva, he will shake his ears & will get nowhere.

For making blood or wine issue from someone's forehead or from a wall

[Figure: fig_p033v_1]

Take a funnel or funnel of fer blanc which is double-walled in the body & but not in the spout. Make a small hole at the top edge & another, slightly bigger, on the inner wall that will be a little above the spout, just as you can see in the adjacent example. Then when you want to use it, put in wine or liquid rosette of Brazilwood or black cherry juice, and blocking the hole of the spout with your little finger, make sure that the funnel is well filled in order that the wine can enter there between the double walls through the hole at the side, & if it does not enter well, making it seem as if you are tasting the wine, suck & draw in a little air, drinking where the little hole is. Next, make one of the close BYSTANDERS drink the rest of the wine or cast it aside or let it flow through the tip, but before, you must have pressed your thumb well over the hole on the top edge, because in this way, by the compression of air, the wine will be retained between the double walls. Then with a bodkin rounded at the tip & that goes into its handle, you make it seem as if you pierce the forehead of someone who holds a glass in his hand, and while you pierce, you cover what you are doing with the funnel that you hold close to #^[c_112r_02]

#^[c_112r_03]

his forehead. Then removing your thumb from over the hole on the top edge, the air, being free, will make the wine issue from between the double walls through the hole marked B, & fall through the tip marked C into the glass. But you must make the FELLOW bend his head enough in order to do it well.

For telling someone that by putting holding a finger to his forehead, you will prevent him from exiting a chamber

X^[c_084v_02] Make him put his arm around a bedpost or something similar, & with the same arm, let him hold a finger to his forehead.

X Wager someone^[c_034r_05] **that walking to a certain place and back, he cannot say boot without spur four times in a row**

X If he tries to say^[c_034r_04] it, but be sure that he speaks *loudly*, once he has been there & back, you will tell him that he has lost, because he needed to say boot four times without saying spur, for that is your wager.

For making a candlestick hold to the wall without making a hole in it

X Make a SERVANT hold it to the wall.^[c_034r_01]

X How not to break a glass with a log or a large stick

X You will cut from it a small piece as thick as a toothpick, & thus you will give him something from^[c_034r_02] a log or a large stick with which he will not be able to break the glass.

Writing cunningly

Cut some long strips of fine parchment & mark them according to their order with A B C & cetera, then have them sewn inside the hem of a shirt of rough cloth, like that of a MESSENGER, who, if you want to tear up his shirt, will know nothing of it.^[c_034r_03]

For melting or transmuting a jewel put inside a box

[Figure: fig_p034v_1]

Take a box of **boxwood** banded with rings, as you see, into which will easily fit another small box, like that which you see marked B, and make it so that it does not touch the bottom of the large one marked A, but that there is some distance. Also, that which enters the large box must be smooth, but the rim must be made with rings so that, being joined, it appears as if they are one and the same box. You must also have a round **leather** cover of the same length as the box, as you see marked C, which fits ~~let~~ easily & surrounds the said boxes thus placed one within the other. But before you do your trick, you must put at the bottom of the larger box **powdered gold or silver**, or **mercury** amalgamated with **silver**, and then place the little box marked B on top. Next, holding the box with your **index finger** on top, you present it, and seeing only the bottom of the smaller box marked B, one places a jewel or something similar in it. This being done, placing the box on the table, you cover it with the **leather** box, and making the requisite gestures, you will remove the **leather** box, & without showing the inside, will put it on the table & let it be recognized that the jewel is ~~in the~~ placed in the bottom of the small box marked B. Then you will gently place the **leather** box back, & after saying *inhonorificabilitudinibusc*,^[c_034v_01] you will take the top of the **leather** box with two **fingers**, and ~~with the~~ clasping it more firmly than usual, at the same time you ~~d~~ will lift ~~pe~~ the smaller box that is inside & which contains the jewel, & you will gently put both on the table, then you will pour the **powder** or **amalgam** that is at the bottom of the large box, then replace the **leather** box with the box inside it, as it was at the start. Then, removing the **leather** box without removing the smaller one, you will show the jewel at the bottom which has returned to its previous state, holding your **index finger** on the rim of the box so that it does not slip.

For telling someone that you will ~~show~~ teach him something he does not know, and neither do you^[c_035r_01]

Take a string or a small stick and take the measurement from the tip of his **ear** to the tip of his **nose** and show it to him. Thus you will teach him something you did not know, and neither did he.

For supporting a bucket of **water** on the tips of three knives laid down without touching the ground

[Figure: fig_p035r_1]

According to the strength of your knives, either **kitchen** or table, you will make them support a large weight on their tips laid down & arranged in a triangle, edge to edge, as you can see, & they would not touch the ground. And if, after arranging them this way, you turn them the other way without unjoining them, the tips of the handles can also support a large weight without touching the ground. You can easily adapt this to another use with pikes, with joists, or to promptly make a tripod in a camp with three halberd points. If the edge of the knife marked A faces from right to left, the butts of the handles will rise, but if the edge of the same knife faces from left to right, the tips will rise.

For boiling an **egg** in **cold water** without fire

Empty an **egg** from both ends so that nothing remains inside, then fill it with **quicklime** & **natural sulfur**, then stop the holes with **wax** & put it in **water** so that it floats by two or three **fingers**.

For making **rabbits** come out of a **burrow**

Take some **embers** in a pot, & having put **sulfur** on top, put it in the **burrows** & block it with something light.

For preventing someone from eating a **foodstuff**

Dry some **calf's foot root**, otherwise **arum**, & sprinkle the **foodstuffs** with it. There is no danger in this. See **Mathiol.**^[c_035v_01]

For transmuting **grain** from one vessel to another

[Figure: fig_p035v_1]

Take two small **wooden** bushels of the same size, which should be hollow on the bottom exterior by about the width of the back of a knife or more. One of these will remain empty, & on the bottom of the other you will glue **kernels of grain** with **starch** such that it will be covered entirely with **grain**, & it will seem to be filled with it. Take also a **wooden** bell into which you will place as much **grain** as can be held within the capacity of one of the bushels, and over the top put a simple piece of **leather** that fits tightly inside the bell. Put all into a bag or a napkin or a folded handkerchief, if you do not want to use a **CONJUROR's** pouch. First show the empty bushel, then in front of the audience fill it with **grain**, then put it back in the napkin. Next, leave that one there & take the other where the **grain** is glued with **starch** & it will seem to be the first one, filled with **grain**. Put it under a hat & place the bell gently on the table for the first time. And if you like, promptly & without stopping, show the bottom which will be covered with **white leather** of the color of the **wood**. Then pretending to show the bushel that is under the hat, you will turn it deftly to the side that is empty & leave it covered. Then you will command that by *invisibilium*^[c_035v_02] the **grain** pass into the bell, which you will have tapped shortly before on the table a little strongly, & the **grain** will fall to the bottom & cover the piece of **leather**. Then lift the hat; the bushel ~~seem~~ will be found empty and the bell full of **grain**, which you will scrape deftly along with the piece of **leather**

so that it cannot be seen, & you will very subtly with conceit cast it into the bag or pouch.

For transmuting a ball into a thimble, cunning

of leather

[Figure: fig_p036r_1]

Make a small sheath of plain leather, such as cow or morocco, somewhat thick, as tall as three fingers, sewn like the finger of a glove & large enough that two fingertips can fit inside & which, at the tip, which is a little puckered, has a round hole as large as a double liard. Take one two similar boxwood balls, & let one be hollow & open with a round hole on one side only so that the thimble can fit inside. Thus, when you want to perform, you will place your leather sheath on the table with the ball that is not hollow. Pass a stick inside the leather sheath to show that there is nothing there, also show the full ball, and hold the one which is hollow & has the thimble inside it by your little finger & ring finger, and do this with your right hand with which you are holding the stick. Next, you take your leather sheath & place it over the hollow ball which is in your fingers, & making it seem as if you are putting some oribus powder^[c_036r_02] over it, you put back the leather mold^[c_036r_01] that contains the ball with the thimble on the table, then you take the round & solid ball remaining on the table, and command it to enter from under the table into the leather sheath. Then, when lifting the leather, it seems to be the same, although it is the hollow one. Then you cover it again & command it to become invisible. And then, lifting the sheath while pressing it, you will remove it & the ball along with it; & putting it aside with the sheath, & a illegible in its place will be found a thimble for the ladies whose bottom hurts, that is to say, the bottom of the needle.

FOUNDER

Kitchen pots are made well, in order not to give a *bad taste to the food*, with the same metal^[c_016v_05] the bells are made of. It is true that FOUNABLESDERS mix in more latten to make them yellower, to make them more vendable. But the latten by itself, & at a mere touch, is *stinking* & of *bad odor*.

Latten does not lose, or only slightly, its calamine in an *four à vent* when it is melted in a crucible, nor in a wood furnace, but it does in a bellows furnace because bellows give violent fire.

Four à vent

It is necessary that it be narrower at the mouth than at the bottom. And it is enough that the crucible be able to enter in it, & that there be space to remove & take it with pincers.

GLASSWORKERS' glass

One says that in Lorraine & in Flanders well-made glass is made of fern ashes & pebbles, and first they blow a long bubble, which another WORKER, with long shears, cleaves & cuts lengthwise. Then, having set this long, cleft bubble on a stone or large plate that is in the furnace, a little less hot than for the melt, it is left to stretch out. And again in addition to this, they flatten it with a long & thick round iron rod, then they remove it to the annealing furnace. It is made in the same way in England more beautifully. Near Rouen in France, plate glass is made with some salt of saltwort & pebbles, that is whiter & more delicate than that of Lorraine. For plate glass can be melted with a candle & not that from Lorraine. That of plate is blown in a long bubble, of which another cuts the end, then the blower flattens it while turning it & while touching it to a surface that is on the ground, A then puts it to anneal. [c_036v_01] Thus the middle, whence it is begun, still remains.

The glass can be cleft again with the light of a candle by wetting, but not as precisely as with the hot iron.

FOUNDER

The metal[c_016v_05] whitens the more it is melted, because the tin does not go away but rather mixes in more. And, by holding it a long time in the fire, the filth is eaten away, which is what makes it brittle. If you want to chase the tin from the copper, after it is quite hot, throw in saltpeter often. This only & not the fire separates it, & purifies it, & eats the filth. The metal is cast very neatly. The copper is prone to swell, but because it is soft, it can be fixed with a hammer.

Medicine for the stomach which heats it and unstops the liver

Take

Take wormwood powder, dissolve it in *capilli veneris*^[c_037r_01] syrup or preserves, & make with it an opiate of which you will take once a week on a host soaked in wine. Then you will be able to drink a finger of sufficiently tempered wine. This dissipates the phlegm & the winds which arise from it. You can take six pepper grains & grate their rinds such that they are smooth, & swallow them without chewing. This benefits the stomach without heating the liver.

Foil backings for the ~~fillegible~~ gemstones

Once made, one ought not to keep them in any case of iron or metal, for this stains them, but in some box of^[c_054r_01]

For keeping candles from dripping and making them white

Having made them, put into the mold fresh water well beaten with bran, which should not at all be purged of its flour, so that the water becomes white. And dip your candles in that, then leave them to dry. And do thus two or three times.

GARDENER

For sowing melons well, it needs to be at the end of a moon cycle, for otherwise they would bud too many leaves & not bear enough fruit. Make small e holes, two fingers by two fingers, with a stake & put in each two or three seeds. Next, take very fine earth & fill the holes lightly with it. Next, spread over all the thickness of a thumb of havets, that is to say wheat fl chaff, in order that the coming rain does not beat the earth & prevent their birth. Havets attract field mice who eat the seeds. And for avoiding this, one must moisten them with a decoction of wormwood.

GLASSWORKER

Some do not apply *gris d'escaille* to the glass for painting on glass, but trace on the clean glass with *noir à huile*. But it is very necessary that the wood^[c_037v_02] be rid of grease, for if it has grease, however little, the color will not take on it at all. And likewise, if the GLASSWORKER who is working has a stench from his nose or his mouth, ~~the~~ & he breathes on the glass, the color will not take on it. Those who discovered the invention of working in small works of soft enamels use only *esmail d'azur*, which is blue, & *esmail colombin*, which is the color of purple, which they soften with *rocaille*^[c_031v_02] or leaded glass. As for the yellow, they make it from silver, the red from sanguine, as is said elsewhere, the black & gray & shadows with *noir d'escaille*, either strong or weak, the flesh color with clear sanguine. The green is made first from yellow, then on top they coat *esmail d'azur*, either strong or weak, according to whether they want to make it bright or dark.

Yellow Amber

It is cut with a file, then one passes a certain pulverized salt over it, which an Englishman called *desramonet*. But I suppose that this was pulverized pumice stone, for it had the harshness of *arène*. And with a taut cord, he polished his amber, then passed tripoli from Bretagne on it with the finger, others with a piece of leather or a cane. Amber loses its color if an unhealthy person wears it, & becomes whitish. But to restore it, it needs to be soaked for one night in urine, then boiled a little in it.

Sapphire

One finds sapphires that one calls of the trellis, because they are pierced and it is said that a certain KING had made from these a certain ornament in the shape of a trellis, as would perhaps be the Screen of Charlemagne,^[c_038r_02] as it is called, in the treasure of Saint Denis, in which the gemstones are mounted without leaf, so as to have the enjoyment of the light on one side & the other, & to show their vividness. I have a white one ~~one~~ that seems to be rough & pierced, and is spotted all over with blue blemishes. I am of the opinion that these are artificial & that they are of taffer or very clear *esmail azuré* melted entirely on the sapphire. The file bites on it as on the beryl.

Saffron

It is counterfeited^[c_003r_02] & augmented with marigold leaves half-dried, & twisted like a thread, & put in the hottest sun to dry, & is mixed, & the said marigold even gives some color.

Sapphire

STONE CUTTERS sometimes choose old pieces of antique glass in church windows, which are much thicker than those of today & are of more lively colors. If it is for *souf* sapphire, they choose beautiful blue & from such a place that there are no *pieees* grains, if it is possible. And having cut it in squares with emery, they cut it in bevel & polish it. And in this manner, they counterfeit very beautiful sapphires. The old *esmail d'azur* for silver verging on aquamarine was very appropriate for counterfeiting sapphires, but it is scarcely found. One counterfeits aquamarines with white glass, but they take it from the bottom of the glass.

Amber

The orangeish color that is in transparent amber and in the other one that has body is not internal, for on the inside it is whitish. But through age ~~it~~ or wearing it, it acquires this reddish crust. This is why those who cut it with the file or on the wheel do not remove, if it is possible, this crust. But they only polish it, rubbing it with a willow stick or other soft wood dipped into water & dusted with tripoli of Brittany, and it takes a beautiful polish. If it is too straw yellow & you want to intensify its color, hang it inside a chimney where there is much soot & smoke, and it will take on a reddish-orange color. Try to take the most whitish transparent one, and put it under dung to turn it green, like bones. Or smoke it in a closed space, with the smoke of safre or manganese & other drugs that you know. Or in urine & distilled vinegar mixed with colors, or in the vapor of aquafortis boiling in copper, or aquafortis boiling with silver & sal ammoniac. & some cut amber in facets on a wheel of soft wood with putty instead of emery, & jet also. The salt called by the English *de armonic* is a mineral salt that resembles marble stone and is a very hard mineral with large pieces, like that of Cardona & Monserrat.

I have experimented by making it boil in lye or corrosive water, it turns reddish on the surface. And if it is rubbed against fir & soft wood before it is cooled, it is easily cut.

Black color for dyeing

Take lye of quicklime & litharge, mix & soak, & you will make a tawny dye, & by reiterating it you will make black. Try other colors with lye of lime.

Against nosebleed and for dyeing

Pestle some sorrel or *lapathum acutum*^[c_038v_03] of the sort that is red-veined, which is called dragon's blood, and apply it of the to the forehead of the one who bleeds. This herb is a strong dye & makes beautiful violet.

Beautiful artichokes

One needs to prune them every year so that only one stalk is left, & water them thoroughly. ~~Also~~ Also replant some every year, for the second year they will bear very beautiful fruit.

Planting trees

One says that rarely a tree planted on *St. Paul's day*^[c_038v_04] fails to take, & for covering the bark, cow dung is very appropriate, for it is not undone in the rain like earth.

MERCHANT^[c_038v_02]

Those who sell velvet & es other stuffs by retail do not make double-entry books because selling by retail & in detail it would be too much effort for them. They have only their sales book^[c_038v_01] & their account book. But those who sell in bulk & those who traffic in pastel woad have double-entry books.

Scarlets

Because one aulne costs seven or eight lb to dye, they use cloths worth seven or eight francs an aulne. But whoever wants something beautiful ~~se-la~~ should buy white cloth worth fifteen francs an aulne & have it dyed with pure scarlet pastel woad & a little cochineal. Black cloth is thin so that the dyeing is inexpensive.

GOLDSMITH

They assemble silver filings with saltpeter which refines it & does not make it brittle. But gold filings are assembled with borax or, to save the borax, with lead, which refines the gold & softens it, for the saltpeter would make it brittle, which silver does not do. This is why, to save money, GOLDSMITHS use it to assemble, in order to save borax, which costs viii sous per ounce, & saltpeter x sous per lb.

When GOLDSMITHS have thus assembled their silver filings with saltpeter, a red enamel vitrifies at the bottom of the crucible. I do not know if the copper mixed in with the silver is the cause. Try for enamel.

Pastel woad

It is grown in Lauragais where the depth of the earth is so fertile that if one were to grow wheat there every year, it would lie flat for being too vigorous. This is why one alternately does pastel woad and wheat there. For the cultivation of pastel woad, one ploughs the soil with shovels of iron, as GARDENERS do. Next, one harrows it with rakes, & breaks it up finely as for sowing cooking herbs. One commonly sows it on *St. Anthony's day in January*.^[c_039r_01] One makes eight harvests of it. The first ones are better. The best pastel woad of Lauragais is the one from Carmail & the one from Auragne. And sometimes the pastel woad is good in one field & in the one close by it will hardly have worth. The goodness of the pastel woad is known when, put in the mouth, it gives a taste as of vinegar, or when crumbling & breaking it, it has some mold-like veins which are as if golden or silver. One assays it in the DYERS' vat, and to fill a vat with it, one needs six balls of it. In this, one dyes several locks of wool, and if it dyes fifteen times, it is said to be fifteen florins, if it gives xx dyings, xx florins. The good kind dyes up to 30 times & commonly up to xxv or 26.

Enamel

Enamel takes more readily on copper than on silver. It is true that the cut needs to be well hollowed out & rough. Azure in body & the red called gules, white enamel & dense green take to it very well. Having enamelled, one gilds the *foeillages* of the engraving^[illegible]. Copper has a similar hardness for engraving as fine silver or pistolet^[c_039v_01] gold.

Colors for illumination on glass

In order that your turpentine colors do not spread, & hold together, mix in a little of tear of mastic together with the turpentine.

Tracing some history on glass

If you want to trace some history in intaglio on glass, you can do it in different ways. Lay your glass pane ^{on}, the thinnest you can find, on the printed history, & having cleaned the glass well with lye & ash so that it is not greasy, trace over the lines visible to you with *noir à huile* or *noir d'escaille* with the paintbrush; if you want to paint with colors in the fashion of GLASSWORKERS, who wash their glass pane with *noir d'escaille* & then scrape & clear the parts which they want to coat with color, leaving that which is necessary for shading. But if you want to make gilt histories on glass with a background of colors, which imitates the basse-taille of GOLDSMITHS, gild your entire glass pane with gum water or garlic juice or milk of the fig tree. Then moisten your printed history between two wet linen cloths, and lay it down on the gilt glass. Then with a pin mounted on the end of a small stick, follow the lines of your history as if you wanted to pounce it, & thus you will exactly trace it on the gilding of the glass. & next you will clear the background & that which needs to be blank with a quite pointy steel awl, & neatly follow once more the lines & accomplish your work & make your faces & flesh colors in *argent moulu*; then you shall fill the background with *azur d'esmail* or verdigris or fine laque platte^[c_039v_02] platte tempered with clear turpentine, mixed with a little of tear of mastic if you want that the colors are more even & do not spread. Next, layer on the back of the glass & over the colors a white tin leaf. And once this is dry, you can cover the tin leaf ^{of} with color to hide your secret. The tin leaf gives light to the colors. Thus you will be able to paint without being

at all expert in painting. If your **glass** pane is bulging as if taken from the belly of some jar, it will show all the better for it.^[c_032v_01] When you apply your **turpentine** colors to your **glass** panes, first place them on a hot tile &, once they are hot, spread your colors & leave it a while on the tile, then lay down your **tin** sheet.

Dye

Some take the **root of** *lapathium acutum maius*,^[c_038v_03] which resembles **MONK's rhubarb** or **sorrel**, & with the root, which is yellow in the *summer*, they **dye thread** & similar things.

Aquafortis

Some put ~~on~~ ^{four} for four pounds of substance of **aquafortis** ~~four~~ which are in the **retort** four ounces of **common water** in the **receptacle**, which is better than putting it into the **retort**. One de-phlegms & calcines **alum** in order that the **water** does not have as much dregs. Several make it without de-phlegming the **alum**.

Vinegar

One holds certain that heating red-hot the **mineral salt**, which resembles **marble** & which one calls **Cardona salt** in **Catalonia** & at the border of **Spain**, ~~jee~~ & throwing it ~~in the~~ all red or quite hot into **wine**, that it turns it into **very good vinegar**. Some make it with **water** poured on **pomace soured** after being pressed by **VINTAGERS**, but it does not keep, & spoils in heat & **thunder storms**.

Buttons of *vermeilles*

Because *vermeilles* do not fear fire, one cuts them into lozenges flat^[illegible] on one side, then one joins them together in a star shape in a **paste of ground enamel**, next one melts it & one **gilds** the **enamel** with **gold leaf** which one reheats.

Grottos

To fill some empty place that cannot be laden with some sort of hanging rocks, one puts a piece of **thick parchment** close to the fire, which shrinks & crumples. Then one paints it with **distemper**, then in **oil**. Next one affixes it.

Cross of the COMMANDERS OF MALTA

This beautiful **rouge clair** which makes the field of the white **enamel** cross is ~~blood~~ of fine tear of **dragon's blood** tempered with **eau-de-vie** or else **Indian laque platte**,^[c_039v_02] which in my opinion is made in **Flanders**, tempered with **clear turpentine** & tear of **mastic** & laid down on a **silver** leaf, not the kind which the **PAINTERS** use, but a thicker kind, which is burnished by **THOSE WHO MAKE GEMSTONE FOILS** ~~At~~ or by **GOLDSMITHS**, & that gives it this beautiful brilliance.

Latten and calamine

FOUNDERS do not melt **latten** in a bellows furnace ~~à vent~~ but in crucibles, for in a bellows furnace *à vent*^[c_040v_02] & amid the **charcoals**, the **calamine** would go away. ~~A~~

Metal^[c_016v_05]

Tin should be pure for if there is any **lead**, it will go up in **smoke** while melting. Mixed **tin** holds in the fire for a *long time* but the **cendrée**^[c_040v_01] separates it.

Aquafortis

If your retort is well luted, you ought not to surround it with **ashes**, which would only get in the way of chasing the **spirits** properly. But when, at the end, you give it violent fire, surround it with chacoals which should be lit elsewhere beforehand, as those in the furnace should be, in order that they do not crackle & do not make **smoke**. Put the said lit charcoals around the body of the retort, & not close to the neck, which does not need to be heated as vigorously. The top grate, where you set your retort, is sufficiently far, one dour or half a **foot**, from the bottom grate where the charcoal is placed, for by doing this not as much of it is wasted.

Earth for casting, for FOUNDERS

It renders itself fatty once beaten and also mixed with horse dung. POTTER's earth would be too fatty and would crack & would not hold in the fire, but one needs to mix it with half as much sand and a quarter or a fifth of horse dung. And leave it to dry, then turn it to powder, then sift it to render it fine & purged of gravel, which would prevent it from casting neatly. The dung renders the earth more amiable & tractable, but it is necessary that it be well free of straw & other things. And when the earth is very fatty, one needs to give it more sand & more dung.^[c_032v_01] But one does find fatty earths, in and of themselves mixed with sand. If they are not, do it by artifice. One always needs to reheat the earths before casting.

Garden lily

If one breaks it at its first blossom & it will bud & bloom only in the following year, & I believe bulbous herbs do this.

Sand

The sand east for casting should be chosen neither so lean that it has no hold, nor too fatty. And although it is found in nature, it is nonetheless not everywhere. And if you are in a place where it is not found, you can make it, but not with fatty earth, for the sand does not want it at all, for it makes it very porous. But you can give it bond with brick thoroughly ground on marble, or plaster or calcined alabaster or something similar, or the burned marrow of ox horn or burned aspalte throughout. If you grind it quite finely on porphyry, it s acquires hold & then you can burn it with aspalte or mix it with a quarter part of tripoli. Guard against bread falling into your sand because it makes it very porous.

Try mixing in soot black.

Ducks

Young domestic ones do not grow for a month after they are hatched, but remain in this state. But after that they grow quickly, especially if they go into the water. One feeds them with boiled millet grains, crumbling in bread for them and scattering in well chopped lettuces.

GLASSWORKERS' black

Iron scale taken from bars that have been in the fire for a *long time*, & which is thick, is much better than that common delicate kind that falls under the anvil in the forge, because it imitates niello. To the said black, described elsewhere, some add & a little minium to it.

Sheared ewes

If the SHEARER sometimes wounds them, he puts *[illegible]* the very dung of the ewe on top. When they are fat, they are easier to shear & do not get wounded so easily.

^[c_041v_01] If the SHEARER wants to *viscorter*^[c_041v_02] them, that is to say castrate, when they are one or two years old, he must not have been with his wife for this would make the sheep die.

Colors and gilding on glass

One ought not to give as strong gum water on glass for ~~the gold as for~~ the silver layer as for the gold because a silver leaf is twice as strong as a gold leaf. Also, silver is harder and therefore does not scratch as easily. ¶ And if the gum was not a little strong for the silver, the latter would not split so neatly. When you work, ~~the humid~~ the exhalation of your breath moistens the leaf laid on the glass, & therefore it would be good, while working, to heat it up a few times. You need to be very careful to wash that which you want to be blank & serve as a background for painting with colors, for if it were not quite clean of the gum's greasiness & viscosity, ~~the~~ & of other things, the colors would not be so neat on it. To advance your works, you can pounce, or, better still, layer the gum & leaf on a cut paper. In this way, you will only need to repair very little. If you want to make gold color there without gold, mix soaked dried saffron with a little massicot.

FOUNDER

The mold of earth is reheated until, sometimes, it is as if red, for otherwise the metal would spatter & would not do anything good. And similarly, the *noyau* on the inside should be very reheated, & mixed with charcoal powder.

Wax for seal and imprint

For the large wax seals, you need to have tepid water always ready & ~~apre~~ keep your wax in it. But before, it should have been kneaded between your hands to render it very uniform, for otherwise the water that would get in between would prevent it from becoming uniform. Next, you will press it into whatever you want and put three or four pieces of paper on, & with a stick ~~you~~ even & round like a pestle, you will roll it as if you wanted to polish it, and it will attach itself to the paper, which will help you lift it off the mold. Thus you will imprint better than if you were to cast it molten. You can carve the figures & gild them, silver them, & paint them with colors in varnish, & transfer them onto a base of glass painted with colors in turpentine & mastic. And if you want to apply these plates by incrustation, do it with gum ammoniac tempered with vinegar, and you will have good glue.

For casting in plaster

Melt some wax, & with a large brush coat the relief of which you want to have the hollow form, as if you wanted to paint it. And a light crust ~~upon which~~ ~~qu~~ will form, upon which you will cast ~~you~~ plaster, to give it body and strength. Next, in the hollow form of wax, you will also cast your plaster in order to have your relief, & it will release very easily because of the wax. This is done more for large pieces in high relief than for others.

Pounced design for scratching satin

After you have pounced with flour or ground chalk, in order that the dots of the pounced design be not erased, follow the trace with glair beaten with the milk or bark of the fig tree, which will immediately make it clear up like water, & without becoming thick, it will keep the trace, which you will follow again & scratch with ~~a~~ a piece of glass or a penknife.

Canvas for painting in oil without breaking

In order that your picture in oil does not break & spoil in the folding of it, make your layer with honey, ~~oil~~ a bit of oil, & water & flour.

Painting in oil on taffeta which

In order that the oil does not run, make your first layer with honey, alum water & starch water.

Sand for casting

The main thing is to grind it well on marble, & that it be impalpable & mixed with a little calcined alabaster.

For outlining a portrait

Follow the lines with lake ground with olive oil, which will not dry.

White varnish on plaster

Give two or three coats of quite white glue for painting. Next, varnish with varnish of sandarac, spike lavender oil, and a little mastic. And *in the evening* put it into a vessel, all pestled well together, without fire, which would turn it yellow. Then with a paintbrush, it is dry immediately. Pour the oil, which will have taken the substance.

Mericotons and pavis

One should graft them ~~en~~ during *Advent of Christmas* provided that it does not freeze too much.

White bronzing on plaster

One needs to give four layers of PAINTERS' distemper glue on the plaster portrait, always leaving each layer to dry. Next, with minium from England ground on marble, or burnt lead, grind ~~av~~ & temper with a bit of gum or ~~ge~~ glue, & coat lightly. Once dry, rub lightly with a little cotton and the plaster portrait will seem to be of lead. Others grind minium with quicksilver.

Purple

R *stagno* dolce, meza onça, farlo fondere in un *cochiaro*.
Depoi fonduto, gectarly dentro una 3 de ȝ, mesedar insieme.
Essendo freddo, macinar supra il *porfidio*. Dapoi piglia
una 3 de *sal armoniaco*, una 3 de *solfo* del più giallo
que se possa troval, macinar tutti duoi. Et poi mesedar
molto bene tutti gli matteriali sopradetti. Dapoi metter tutto
insieme dentro un ~~a~~ *pignatta* sublimatorio di *vetro*, tenerlo
sopra picciol fuoco una *hora* & una *hora* un poco piu forte
& una *hora* bonissimo fuoco, et sarà fatto. Dapoi, per
adopearla, datte il *negro di resina* con *colla* di *PINTORI* da
pintar & per doi o tre volte, fin a tanto che sia ben negro.
Dapoi datte un poco di *vernice*. Essendo secco, datte a secco con
ditto la *purpurina* dove vorrette. Tanto più ne darette, sarà
piu bello. Dapoi, si volete, datte *vernice* sopra.^[c_043r_01]

White bronzing

Apply black with *glue*, as was said, on the medal, then *varnish*. Once dry, grate *minium* from *England* on top with a paintbrush or a *finger*. The said grated *minium* embellishes *lead* medals.

Varied and transmuted wine

Grate *brazilwood* very finely, put it to soak one or two *hours* in *clear water*, then take this *tinted water* & add to it some *clear water* & you will make ^{e[c_070r_03]} *wine* as claret colored as you like. If you please, put a drop of *lemon or orange juice* in it & it will immediately turn white. It can be drunk without danger.

Pearls

It is said that *pulverized talc* blown into with a *lamp* renders them thus.^[c_043v_04]

ARQUEBUSIER

For firing your **arquebus** precisely, it is necessary that the end of the breech be & come precisely to the edge of the touch-hole, because in this manner the **powder**, without blowing, catches & burns all at once & has more force & does not push back. On the contrary, if the breech is made hollow, as they commonly are, the **powder** catches sooner in this place, makes it push back, & blows, which a **chambered arquebus**^[c_043v_01] clearly shows, which pushes back more than another. And since the barrel is thicker at the breech than at the muzzle the sights are also uneven, for that at the breech is higher than that at the muzzle. And then, the thickness of the barrel gains about one line over the caliber, and the sight another. It would therefore be necessary to either make the barrel all of one thickness or to raise the stock ~~on~~ at the end & toward the muzzle, & sink it in & lower it toward the breech.^[c_043v_02] The weight of the **powder** must be the third part of the ball.

Hail shot of the **arquebus**

If you want it to go together, set a piece^[c_043v_03] of **felt** or **leather** or **paper** on top, according to the distance, & let the^[c_017r_01] piece be made with a cutting-punch precisely cut ~~at~~^[c_043v_05] according to the caliber of the **arquebus**.

The range of an **arquebus**

The proportion ~~is~~ of the **fowling piece** is 4 king's feet long & the ball xviii **deniers**, the charge vi **deniers** of **powder**, its range ~~iiii~~^{xx[c_017v_02]} pans & 3 feet ~~lxi~~ & a half, two inches & a few lines, which is the **Paris** aulne. The medium **hackbut**,^[c_044r_01] which is the usual one & the easiest, carries a ball of xv **deniers**, v **deniers** of **powder** & a range of lx paces.

PEWTERER

They mix viii lb or ten of **lead**, per quintal of **tin** in cities where they are SWORN MASTERS. But elsewhere, they add as much as they can. One also uses ii lb of **looking-glass tin** to bind it & three lb of **debris**, that is to say the **copper shards that COPPERSMITHS make**. This makes the plate more *sonorous* and it is not as breakable.

This **tin** is called **common tin**.

Arquebus

To keep it from pushing back, it is necessary to clean your **arquebus** every eight days, & rub it with **oil**, & when you fire, wet some **linen cloth** in **oil** & put it in instead of **paper**.
[c_044r_02]

Lake

To test it, temper it & apply it to **paper**, & if one or two **hours** later it does not die there, it is fine and good.

Dyes from flowers

The **red poppy**, which grows amongst **grains**, makes a very beautiful columbine on **white leather**. The **cornflower** makes a very beautiful blue. A **plant which grows in hedges**, which has a stem similar to **flax**, a long & broad leaf like small **bugloss**, which has a violet flower verging on blue & is shaped like the **lily flower**, makes a very beautiful **turquin**, surpassing azure. Another flower, the **columbine**, of the shape & size of the **bugloss flower**, which has a petal resembling that of the **pansy**, also makes a very beautiful **turquin**. It grows amongst **grains**, in light soils.

Horsehair sieves

They are made at **Coustance** in **Normandy** with **horse tail hair** which they clean with **lye** because they sort them with the **mouth** & separate out short & broken ones. They do not make the **reed** longer than the sieve, & the reed is round. They attach to both edges of the **reed** the **hair**, either black or white, according to the work they want to make. And the weft is ~~is~~ done over & under as for making any other fabric. And passing a **small flat stick** of ii or three **fingers** wide between, next they pass two **hairs** at each step of the pedal and weave with three pedals. There are xvii^{c[c_044v_01]} **hairs** in the entire sieve. They sell them by the dozen & each dozen xxx **sous**. They bring them to **Toulouse** to transport them afterward to **Spain**, and take **silk tammy** in exchange for it.

Excellent water against the plague of Monsieur de Montorsin^[c_044v_03]

Take some theriac, rue & dittany, & good vinegar, put the whole in a glass bottle, leave it half-open & well strapped, and put it in a very long bath for three or 4 days. Then separate your decoction from the residue, of which^[c_044v_02] in time of need you will pour some on a flaming red tile & receive the vapor of it & also fumigate your clothes with it. This is a very rare & tested secret.

White soporific oil

Take x or 12 mandrake apples, put them in quarters in olive oil, the whole in a ~~vial~~ glass bottle which you will place in a bain marie for two days and your oil will turn white. If you rub the soles of your feet with the same, you will soon feel like sleeping.

Stucco

For glueing stone, some do not use ~~pøi~~ resin & black pitch resin because it is too fatty, but take rosin & sulfur, as much as of one as the other, & as much of wax as the two together, and mix it with pestled brick for greater strength. Others, white chalk or white stone pestled & pulverized & sieved.

Loading an arquebus with hail shot

[Figure: fig_p045r_1]

One needs to make a **wooden** pipe as long as the width of 4 or 5 **fingers**, which should be hollowed precisely according to the mouth of your barrel, of the form represented in Ð A. Then, having cut **strong paper**, ~~of the~~ **as of large printed books**, in the form of D, as wide as you want to make your cartridge^[c_045r_01] long, wrap the **paper** around the **baton** B & at the end, where the point F will be, fold all around the said **paper**, & your cartridge will be formed. But in order to make the bottom more uniform, put it into **pipe** A, then put in the **baton** B and, through the other end of the **pipe**, which is marked G, put the **baton** C & beat so as to tamp & press the folded tip of your cartridge, then take it out, & load it. Put three or 4 pieces of shot or tears^[c_045r_03] into it. Then, with a **cutting-punch**, marked E, which should be of the same caliber as your **arquebus** or **pistol**, punch round pieces on **cardboard** or **felt** or **waxed cloth**, and put this round piece into your cartridge, and push it onto the pieces of shot with the **baton** B. Next, more pieces of shot, 3 or 4, then a round piece. And do thus until the cartridge is full, then put it into your **arquebus**. If you want your hail shot to scatter sooner, make the round pieces out of **paper**. If you want it to reach farther without scattering, make the piece out of **cardboard**. If you want even farther, make the round piece out of **waxed cloth**, or else of **leather** or **felt**, & a piece of **waxed cloth** on the top. And if you make the cartridge itself of **waxed cloth** or **waxed paper**, it will reach one hundred paces & will make for great piercing, & the hail shot, barely scattering, will make an opening.

But if you make your cartridge with **waxed cloth** or a material stronger than **paper**, you ought not to make so long the part coming from the square to the point as in D, because it is enough that it wraps around twice, [#]^[c_154v_03]. In this manner, the hail shot barely scatters & makes for great piercing against a door, cuirass body,^[c_045r_04] and others.

as Ð H

Loading an arquebus

You ought to have different charges according to the range that you want to give to your arquebus, all of which should have a screw on the end that fits in the nut of the ramrod of the said arquebus. Thus, when you have put the powder in the charge, which is in the nut, hold the ramrod upright. And raising your arquebus up, insert the said ramrod until the charge is at the bottom of the arquebus, then right the arquebus, the mouth of the barrel up, and remove the little ramrod. Thus your powder will be entirely in the breech without any of its grain or dust attaching to the sides of the arquebus, which always has some filth in the chamber. Thus it will not push back, and you will shoot more true.

[Figure: fig_p045v_1]

For adjusting a crooked cannon

Take off the breech and place it on an smooth & well-leveled table and pass through the inside a very smooth string without knots, on each end of which there should be a plumb hanging from each side. Then look into the barrel along the string, and if it does not touch equally all over, note the place where it does not touch & hit with a hammer on the outside on that side & in the same place, & thus it will be righted, & do thus all the way round.

For the teeth, oil of sulfur

Some people whiten them with confections of aquafortis; however, one says that this corrupts them afterward & causes a blackness on them. One says that oil of sulfur is excellent, but one needs to mix it in this way: take as much clove oil as can be held in a walnut shell, and as much rose honey, & seven or eight drops of oil of sulfur, & mix it well all together. And after having cleaned the teeth with a small burin, touch them lightly with a end little cotton dipped in the aforesaid oils and leave it there for a little while, then spit or rinse your mouth with tepid water, and reiterate two or three times. Oil of sulfur penetrates & is corrosive, and but the clove oil & the rose honey correct it. Therefore use it with discretion.

Wheat oil

Applied to hair, it makes it fall out & keeps it from being born.

[Figure: fig_p046r_1]

Against the falling sickness

Take ~~or~~ four or five fresh crow eggs, & ~~the~~ over the space of 4 or five mornings cook one of them, and, having mixed in it a bit of powdered gentian & one drop of oil of sulfur, give it to the patient. It is held that the pain will not return.

Against cold gouts^[c_046r_01]

Oil of guaiac & of sulfur mixed together, applied.

Go Flowers of trees

Those that are seen with everyes^[c_046r_02] new ☾ scarcely come to profit. One ought to leave only two buds on the graft.

SCRIBE, oil of sulfur

If the SCRIBE wants to clean his quill promptly of the thickness of the ink which has dried on it, one only needs to soak in oil of sulfur. And it will immediately be white & clean. Urb.^[c_046v_03]

SHOEMAKER

If he wants to do some tanned work on black leather shoes, he can dip a writing quill in oil of sulfur and paint with it what he would like on shoes, boots, and colets.^[c_046v_02] And he will obtain a reddish color which will not disappear by any effort. Urb.

Erasing a letter

Dip a writing quill in **fresh & good oil of sulfur** & thus retrace all the letters with the dipped quill & they will disappear on **parchment**. *Urb.*

Writing without ink

Write with **oil of sulfur** & heat & the letter will turn as black as this one. *Urb.*

[Figure: fig_p046v_1]

Making a letter à jour on **paper** and other work

If you write *d* or trace something on the **paper** & heat it quite soon, & immediately it will turn black; then by rubbing with a sponge, the letter will be cut because it will be burned. *Urb.* Or retrace the letter with a dry quill *of*.

Making someone's boots burn

Rub with the aforesaid **oil**,^[c_046v_01] & as it becomes warm, they will burn without a flame. *Urb.*

On **stone**, black letters

The same **oil**^[c_046v_01] on letters engraved in **stone** & heated turns black & penetrates.

For teeth

Sal ammoniac i ʒ, **rock salt** 1 ʒ, **alum** half an ʒ. Make **water** with the retort, and as soon as you touch the **tooth**, **the tartar & blackness will go away**. It is true that it has a *bad odor*, but you can mix it with **rose honey** & a little^[c_047r_01] **cinnamon or clove oil**.

Antimony oil

It yellows quite strongly, even **silver**, if you put it on it being heated.

Against falling sickness or vertigo

Hung round the **neck**, wear **root of peony** which should be picked *at the waning of the moon*.

Crucibles

Those from **Bayonne**, which seem to be made of **grès**^[c_008v_02] are better, for they last, without comparison, longer than others. And because they are not very thick, one wastes less **charcoal** melting **gold** & **silver**, for they heat quickly. They do not drink as much **silver** as the others, & for this reason, there is hardly any **residue**^[c_047r_03] to be found in them. They are less prone to tipping as others that have a flat foot.

Against diarrhea and dysentery

Against **diarrhea**, it is very good to use **preserve of symphytum**, also called *consolida maior*. And if it is **against dysentery**, you can rub with it the **temples**, the **hollow of the hands**, & the **soles of the feet** with **wax oil** & take one drop or two of it with a **spoonful** of **broth**. The **root of consolida maior**, **pestled** & put between **pieces** cuts in a piece of **beef**, then boiled, rejoins them, as they say.

A drink having a taste of wine

Take **tartar from large vessels** & soak it in **water** & it will have the *taste* of **wine**.

Founding

Some, to make it run neatly, put half *metal*^[c_016v_05] & half *copper*. Others take one part of *potin* & one part of *copper latten*. Others take one part of *candlestick latten* & one part of *basin latten*. And among basins, the *latten* of larger ones is brittler than that of skillets, because for making the curve of the round so small it is necessary that the substance be softer. For big ones, to which they give a more ample curve of the round, a brittler substance can be taken. In any event, the brittlest *latten* runs better & casts more neatly, but let it be cast very neat hot. ~~One~~ When one wants to cast, one casts *lead* into the substance, which makes it flow & run & goes up in *smoke*, & keeps the *mold* from corrupting. And if you want to cast fire pieces, mix in more *rosette* than *latten*, in order that it be less breakable. The *crucibles* for melting *metal* should be better than those for *GLASSMAKERS*, as *glass* is not as heavy as *metal*. And in this instance, one needs to lute the *crucibles* with *earth* and pestled *glass*.

Crucibles

Those that are made *in winter* & *humid weather* are not good. Those of the *FOUNDERS* must be thick and must be luted.

Casting

Finely *calcined pumice stone* casts 22 carat *gold* without repair, but it needs to be ablaze and red like the *metal*. And it withstands several casts.

FOUNDER

The heating

[Figure: fig_p048r_1]

For a furnace for melting a large quantity of *metal*.

Curing dogs of mange

Give them a pill of precipitate,^[c_048r_01] that is to say iii or 4, or up to 5 grains, mixed with their food. Having given it to them for one ~~one~~ week, give them another seven or eight days after.

Excellent mustard

Dry bread in an oven, then lard it with cloves & cinnamon & thus put it to soak in good wine. Then, pass everything through a tammy cloth, being well pestled, & incorporate it with your mustard seed.

Keeping birds and animals

~~Skin them~~

Take a measurement of their body, which is fleshy & more subject to decay, with some canvas that you will cut to their size & width. And having ~~ew~~ filled it with cotton & sewn it, skin them, ~~birds~~ leaving, however, the head, the neck, the wings & the feet on the birds, & the head, the legs & the feet & tail on the animals, because those dry easily. Then fit that skin on the ~~a~~^[c_034r_04] ~~to~~ mold made of canvas. Small ones are dried in an oven or prepared with sal ammoniac & *[illegible]*.

Extraction of regulus

R one lb of **antimony**, half a lb **black soap**, and half a lb of **tartar from Montpellier**. Once the whole is pulverized, one needs to boil in a **varnished earthenware pot** on a big fire while stirring the whole often with a **pick of wood or iron**, & the said **soap** will be consumed and burn off and the rest will stay as if red, and it will be necessary that it is reduced by a third. Then one needs to cast it on a **tile** and it will turn blackish. One will need to melt this four or five times and pour it on the **flat tile** and then you will have the **regulus** drawn from **antimony**.

Others pulverize the **antimony** & mix it with **saltpeter** & **pulverized tartar**, as much of one as of the other, &, having heated a **pot** or **crucible** red hot, they put a little of it at a time, & **se** turn their **back** for fear of the **fumes**, and continue thus until everything is put in, and strengthen the fire until everything is thoroughly melted & melt it again several times.

Lead, tin

They become brittle having been put back to melt often or for a *long time*, and they thicken and burn, in such a way that even when one melts a *saulmon*,^[c_028v_04] the **tin** thickens at the bottom if, while casting, one does not stir it often. It is best for casting to melt little **lead** & the or **tin** & **stir** to renew it at each melt. The **antimony** renders them breakable. The **looking-glass tin** whitens them. ~~One~~ **PEWTERERS** put in ~~on the~~ **fine tin** one lb of **looking-glass tin** per one quintal of **fine tin** & two lb & a half or three lb of **red & soft cauldron copper**, which is better than **latten**. There is **fine & soft tin** & **brittle tin**. The brittle one is cast in *grille*^[c_028v_05] by the **PEWTERERS** to sell it better. Θ They come out better & more neatly in **stone** molds than in a **copper** mold, because **copper** is fatty & sticks unless one heats the mold well or one casts large works. Three quarters of **lead** per one lb of **soft tin**, makes a very liquid line & proper for casting, which has a shine like a mirror. **Sandiver** lightens them. And all things that thoroughly lighten **metals** & remove their thickness & dense nature & render them ~~like~~ liquid like **water**, render them proper for casting, for it is the thickness that prevents them from running. **Soft tin** is more even ~~even~~ than the **brittle one**, which is whiter and seems to be burnished like a mirror.

^[c_048v_01]To alloy well **tin** & **lead**, one needs to melt one by itself, and then mix in the other, small pieces at a time, and throw it often on the **marble** or the **square tile**. And when you will see it become quite even ~~like~~ & shiny as if it were burnished, it is good. For sometimes it becomes spotted due to too much **lead** & sometimes due to too much **tin**. There is some **tin** which takes more **lead** than another. **Common tin** is the one that is mixed with **lead**.

Casting of lead

Those who cast those small works that are sold in front of churches, ~~in it~~ melt ~~one~~ for one lb of tin a half of lead, & cast in stone, & if they want their work whiter, they put ~~p~~ half tin and half lead, but the first mixture is the best, & does not become porous. One needs to cast it rather hot, for otherwise, it would not flow. Others smoke their molds with a resin candle to cast neatly. The antimony makes the substance brittle & breakable. The looking-glass tin makes the work whiter, but not more runny; as for tin, it works well ~~to the~~ with pure lead. Those who make very neat lead casts, use puncheon. PEWTERERS cast in a copper mold. [c_032v_01] One says that one makes lead take hold on glass with resin. Some put into the lead a quarter of tin. Looking-glass tin renders the work stronger.

Poncet [c_049r_01]

They cast with solder that PEWTERERS GLASSWORKERS use.

Lump of iron

Calcined ~~iron~~ oyster shell

Sand for lead casting

Rye straw ashes well boiled then dried & then well sieved. Bind it with glair of egg. [c_049r_04]
One can cast copper, latten, and others in it.

Another

Burnt & calcined pumice stone. Burnt & calcined cuttlefish bones, as much of one as of the other; & ashes of walnut tree or vine, well boiled, dried & finely sieved, bound with glair of egg.

PEWTERERS

They put into one quintal of fine tin one lb of looking-glass tin, which renders the tin thicker. There are two kinds of tin, one of them nearly like lead, which runs better, the other brittle, which becomes thicker. They cast in solid & thick tin molds or, to do it more neatly, in copper molds engraved with a burin, or in stone, or in earth. Since latten scraps, mixed in, only render the tin more breakable & harder & difficult to work with, they cast in their very hot molds & almost ~~roug~~ & with very hot tin. They fumigate their tin molds with resin candles.

Brittle ~~deu~~ tin is found mixed into saulmons,^[c_028v_04] easy to cut, but difficult to put to use & melt if it is not mixed with the other soft one. And without this, it would become waste.

Birds

Calandra larks & all birds taken from the nest & which have not had freedom are better, for these which are taken by net never sing so well. However, the wild ones give *[illegible]* much pleasure with their chanting, but they ought be taken before *St. Michael*,^[c_049v_09] otherwise they scarcely live. A small impostume occurs on all on the fork of their tail, occasionally, which some call *gaillardise*,^[c_049v_06] which makes them sick & sometimes makes them die, especially calandra larks. One knows this when they are sad & do not sing. One must pierce it ~~æu~~, not with a pin,^[c_049r_04] but very gently by turning with the tip of quite pointy feather. The calandra lark does not want to be without grey river sand, & the grey is the best, a little coarse. It rubs itself in it & purges itself with it.

Grain of lead

Take a ~~piereed~~ playing card, pierced with a pin or needle, folded on all four sides. Hold it with the end of a small cleft stick and, holding the said stick by ~~one end~~ the other end, put your card three or 4 fingers away from the water that you will have put in a dish or similar vessel. Then pour your lead, which should not be too hot, into the card & continually tap on the stick that holds it. And thus your lead will granulate itself roundly. And pass it through a coarse sieve to separate the largest grain from the smallest. The largeish one will reach 25 to 30 paces.^[c_049v_08]

Birds

Those that ~~can~~ are taken *at St. Michael* are good for keeping, but those that are taken in *March* die, because they are starting to fall into love. *Ortolans* are fed on *oats* *all summer* in order that they are nourished without becoming fat, to be more appropriate for hunting & catching others. Then, when one wants to fatten them for selling, one gives them *millet*. They sing *at night*. One needs to ~~e~~ take them *after mid-July until St. Michael*, for after that time when they have their young in this country, they go ~~t~~ away like *turtledoves* do. *Siskins* should also be taken ~~from All Saints' Day until Christmas~~, for after that they go to the *mountains* to brood.

Ortolans are ventriloquists, such that singing without opening the beak, one would say that they are.^[c_049v_05]

Keeping fruit *for the entire year*

R a *glass* ampul with an opening capable of receiving *cherries* and *plums* or whatever fruit that you want. Put in some *hot water* for the space of two hours. And when your *water* is cooled, throw it out & turn the opening upside down on a quite even & table, & *in a room where there is not a drop of air & of wind*. Then ~~en~~ prepare a stopper of *new wax*, wrapped in *waxed canvas*, and adjust it to the ampul quite precisely in order that it will be all ready to stop it when you will have put in the fruit. And when you will have delicately picked with your *hand* the *fruit* without it being corrupted & *on a warm & dry day*, return to the *well-closed room, where neither wind nor air may enter*, & put it gently & with dexterity in the bottle. Then stop the bottle well with the stopper & lute it & making the lute if it seems good with some *quicklime* & *oil*, & such that no *water* may enter in. Then put your bottles in a *vat* full of *water* *during the summer* ~~And in the winter because the cellar-s~~ *in a cellar*, and *in the winter* put your bottles into a basket furnished with some weights & lower it to the bottom of a *deep well*. For *in the winter* the *water of the vat* would be too cold if the *cellar* is not quite warm, for one needs the *water* to be like *river water*.

Molding

If you want to promptly mold something in half relief that comes to hand, fold some **paper** in five or six doubles, & place it on the **medal** & make sure the **paper** is folded on the back of the **medal** so that it is well secured. Next, take a **stick**, broad at one end & pointed at the other, well smoothed, and rub well on the **paper**, & with the point of the **stick** retrace the lines & proceed until you recognize that your imprint is well done. Then, at your convenience, slightly rub **oil** with a paintbrush *lemp* on the **paper** imprint and cast in **tallow** or **wax** or **sulfur**, & the **paper**, without burning, will render your portrait neat, which you will afterward be able to mold in **plaster** or **tripoli**, and then in **lead** & other **metal**.

Polished **carton** of little thickness & a little moistened is proper. Then if you want, strengthen it with **paper** glued on the back.

Small birds

Ortolans sing *at night* if they are left **in the serain**, but they are better for fattening for fine tables than for singing. **Chaffinches** are prone to becoming blind, & their eyes become swollen at the *beginning of August*. **Goldfinches** like **lettuce** seeds very much, & often one catches them in **gardens** on seeded **lettuces** with two **lime** twigs. But because such regular fare would be too expensive for them, they are ordinarily fed with **hemp** seed. The *passee solitaire*^[c_050v_01] is purged with a **spider**, which one needs to give to it **once a week** in order that no *gaillardisse*^[c_049v_06] comes to it. The **calandra** is purged with **dry mortar**, composed of **lime** & **sand** to keep it from *gaillardise* & fattening too much. **Young small birds** are purged with the same **dry mortar**, by putting some pieces in their **cages**. The **cuckoo** lays in the nest of *ortolans* otherwise called *verdaule*. This **bird** is very simple. In the past, I have given leave to two of them, which *after several days* returned to their cage. For feeding young **goldfinches**, one needs to pestle **almonds** with **pith** a very little amount of **bread pith** and **lettuce seed** or **hemp seed**. If it is for **linnet**, some **rapeseed**.

Curried steel and files

The steel that FARRIERS & IRON WORKERS commonly use is not refined like that from Germany or Biscay, which is reduced in hardness *p* in the bath of molten iron, but ~~only~~ in the iron bars which are transported in flat ingots from the forges of Foix & elsewhere, there is a harder & whiter & finer kind than the other, as it comes from the mine. And the WORKERS choose it & use it like the other steel. And because ~~that~~ it comes from common iron, they call it strong iron. But it is not as excellent as purified steel like that from Germany & Biscaye, which is sold in small beads. Some curry steel, giving it a heating, then temper it & ~~water~~ in a large quantity of water, then forge it. & fine steel, which is brittle, breaks and crumbles, & iron allows itself to be stretched. Thus they separate the finest steel, & which with another heating they reduce to a mass. The Germans make their files from strong iron.

One applies steel to tools *dess* not on both sides, but underneath the part where one sharpens & whets them. & in this part, they must be of very soft iron.

Levantines refine our steel because their country does not provide them with any. And they reheat it in a pot with bitumen, &c.

Counterproofing

Make some soap water & with this, rub & moisten the intaglio piece that you want to counterproof, then lay white paper on it & rub very vigorously across the top with a tooth or the bottom of a glass & you will transfer your printed piece. It is true that it will be in reverse, but if you oil your paper with spike lavender & ~~or~~ turpentine oil, it will represent from the left right on the other side. Then follow these lines with a paintbrush or a quill, then heat the paper & the oil will go away & leave your paper white. And if you want this not to be known, if by chance, you borrowed the piece, moisten the paper, and the polishing that the burnisher has made on the back, which shows what has been done, will not be known. The soap water will turn the piece yellow, but well-gummed water, which has the same effect, does not do this. If you want to, for the same effect, make gummed water, then mix some soap in it & do as is said.

CUTTERS OF PRINTING PLATES

To clean the copper plates, or to make worn ones print better, boil them for four or five good hours in a good lye quite spent in the wash water. Then make your ink with some linseed oil & not with walnut oil & press with the rollers. The copper plates are sooner made than wood blocks, but they are not so appropriate for printing promptly. The wood ones are laborious but also will sooner have printed twenty sheets than the other two. To carve in wood, the secret is first to poach, that is to say to lay the counterproof or drawn piece onto the wood block & to make sure that the side with the traced line is stuck to the wood. Once dry, you then gently rub with a moist handkerchief the back of the paper which, by rubbing, will become so delicate that almost only the line will remain, which, next, one follows in cutting the surface. You could do this with historiated glass & coat with *noir d'escaille*, to then scrape & layer your colors on the uncovered area. To make ink for copper plates

These rollers are good for promptly printing with cut cartons different kinds of pastes.

One can place the plates among the linen when the lye is quite pure, or in a pot.

which is different from that of the **PRINTERS**, one needs to boil **walnut oil** or, even better, **linseed oil** for a *long time*. & having boiled for a *long time*, you will put in **garlic** & **bread crusts** to rid it of grease & leave again to boil thoroughly, then finally you put in one part of **lampblack** that you have previously ground on **marble** with **oil**. And finally you will mix everything as long as & until you see that the plate prints well. ~~Which~~ And when you have spread the **ink** on it, wipe the plates well with the surface of a piece of **white paper**. & do this until the **paper** looks clean and then print. If you were to wipe the plates with a **linen** cloth, it would remove the **ink**. **Linseed oil** thickens while boiling & becomes like a **varnish** & is in danger of catching fire. Therefore, when you boil it, make sure it is in an **open space** or in a **place where the flame cannot cause damage**. Some burn **tartar** until it is black & grind it with **non-boiled linseed oil**, or **walnut oil** which others find to be better. This **black** is beautiful, but the one of **lamp smoke** is blacker. When you want to print *fr*, take with your **fingertip** of the said **black moderately thick**, the whole plate having first been cleaned in **lye** as said, then, rub it with the surface of a piece of **white paper** until the **paper** remains white & do not touch it with the **bare hand** *pourcee* but with a piece of **paper** applied on top. & having cleaned the plate perfectly, ~~mi~~ rub again with a piece of **paper**, fold the edges & sides. Next, take a small even table & on this a piece of **felt**, then a few sheets of **paper** & finally the one you want to print on, which should be moistened between two wet napkins. And on this **sheet** put your plate then another piece of **paper**, & finally another **felt**. Then pass between the rollers. And you can print a dozen pieces consecutively by always charging the plate with **ink** & cleaning it as you have done. But if you desist from printing, the rest of the **ink** will dry in the grooves of the plate. Thus you will have to boil it in **lye** or **urine**, as already said, to clean it. The rollers must not be too loose.

The work done in Algiers

Take a **colt** of three or 4 years & feed it on **rye barley** & **straw** ~~pig~~ cut in the manner one feeds **horses** in **Spain**, and water it with **good fountain or river water**. I do not know if it would be good to water it occasionally with **water of sulfurous baths**, & to sometimes give it **fenugreek** or other hot foods, for the intention of the **WORKER** is ~~to it~~ to use the heat of its **dung**, & the climate here is cooler than that of **Algiers**. Keep it in a **warm & close place** & so that none of its **dung & urine** should be lost, of which you will make a heap or two in order that while one cools, the other will be at the appropriate heat to continue. Also take a large **glass** **mattaras**, as thick as you can, & one **finger** thick if it can be done, & of the capacity of one **pitcher** or **earthen** jug. *Around the feast of **St. John**,*^[c_052v_01] put into it a dozen & a half **chicken** **eggs**, that is to say, the **yolk** without the **glair** & the (**germ**) see).^[c_052r_03] Others say lx **yolks**. And ~~it will be~~ with this dozen & a half **egg yolks** put in half an ounce (others say for lx **eggs** half a lb) of **female silkworm seeds**. And after having luted the **mattaras** well (I do not know if it is at all necessary for the generation that there be air), put it & bury it in the heat of the **dung** up to the neck, and leave it there until several ~~ffillegible~~ **worms** are engendered. And then remove the **mattaras** & do not bury it in the **dung** any longer, but only keep it placed on the hot ~~x~~^[c_052r_01] layer of the **dung** until all the **worms** will have eaten & consumed one ~~d~~^[c_052r_02] another, bustling & stirring, and only one remains. When this is the case you need to feed it *at regular intervals, day & night*, with the aid of two men, who by intervals will take care of it, and you will feed it with an **egg yolk** covered with a **gold leaf**, or with a liquid **egg yolk** with the **gold leaf** incorporated; & take good care that it does not want for such food (some say one **egg yolk** per *hour*, others three, but the thing itself will demonstrate the practice). Nourished in this way it will achieve its growth in two *months* or seven *weeks* & will become like a **snake**, one empan & 4 **fingers** long, & one lb in weight, and as its wings begin to grow, one will need to put it to death by making a ring of **charcoal** fire around the **bottle** one empan distant from it, and then stopper & lute the **bottle** well in order that it does not exhale.

Or to be safer, retire from there until the fire has died down & all is cooled, ~~Ap~~ for its exhalation would be dangerous. And for the occasion when you feed it with pincers, ~~b~~^[c_052v_02] wash your mouth with good vinegar & take some preservative & plug yourself up well. Once it is dead, put it in a linen cloth or a canvas of silk & fold it & hang it from the ceiling, where the air ~~of~~ & sun dry it. Once it is quite dry, pulverize it in a mortar. And keep this powder carefully, because one 3 of this thrown on iii lb of molten ~~o~~ reduces it to finer ~~o~~ than the other one. But it does not have as much weight. For this work you also need to choose the oldest ~~o~~ that you can, which has often been melted & finely hammered into sheets or other works, & purify it before by melting & throwing it into honey & vinegar. The term of the work is nine months from the feast of **St. John**^[c_052v_01] until the 25th of April.

Linseed

Whoever wants to have it beautiful & ~~p~~ very delicate needs to pick it before the ~~f~~^{illegible} seed is perfectly ripe. For if one waits for the seed to be perfectly ripe, the foot is so dried by the sun that it is brittle & breakable. It is true that in this way the seed is reduced by a third.

Colors

If you want to keep them beautiful in gum and such that they do not lose any of their true color, put white wine, the whitest and clearest you can, in a bottle with a little tragacanth gum. And having stoppered the bottle, scramble & shake it very strongly together, & let it rest until the tragacanth is dissolved. Also put in a little fine-grained white salt to brighten the whole. Some mix clear water with white wine, and with this mixture they temper the colors without grinding. And these show very beautifully in ILLUMINATION work.

Soldering a vise

It is good that the jaws of the vise should be high to make a long piece in it, and that the jaws join well to clamp a delicate object. To solder the nut, after you have forged the bolt, you will ~~make~~ will forge a long iron strip ~~quar~~ of such thickness that it can fit into the notch of the bolt when red hot, & you will bend it ~~p~~ all around, striking it with a hammer. Once it is well ~~j~~ wrapped around, you will insert ~~it~~ the bolt ~~o~~ around which ~~is~~ it is wrapped.

Copper

If, in the fire & melt, it touches the **iron**, this **iron** will be so brittle afterward that it cannot be forged.

Casting of **lead**

One mixes it, according to some, half **tin** & half **lead**, and to *l'esch* ~~illegible~~ *after* ^[c_053r_01] it, one mixes in a little **sublimate**. It casts well in small works in a **cuttlefish bone**, provided it is good.

Molding with **paper**

Boil over hot **ashes** some **cotton** in **aqua fortis** mixed with **sal ammoniac**, like **aqua regia**, and the **cotton** will become very fine, like powder. Temper it next it with **gummed water** & you will mold very delicately.

Almond trees, apricots

They come in quite straight if one grafts them. And all trees with pitted fruit, like **pavis**, **mericotons**, **alberges**, ~~vie~~ **apricots** &c, come in best shield grafted on an **almond tree**.

Casting of lead and copper

Lead & tin come out well in white chalk but the softer it is the better. The one from Champagne fetches the price that is set in Lyon. Burnt & calcined horse bones mold very neatly.

I believe that the marrow from the horns of oxen or sheep, that is to say, the spongy bone from the inside, molds very neatly and is better than bone.

Note that any brittle metal comes out better than the fatty. Also, lean sand receives & drinks it better than the dense one.

Silkworms

They are produced from seed, that is to say eggs, that which is sold by the ounce, which is commonly sold in Languedoc iii lb v s. The one from Spain that MERCHANTS bring there is considered the best because the worms which come from there are not so subject to illnesses & make more silk. In Spain, from one ounce of silk seed, worms are produced from it which commonly yield ~~or~~ xv lb of silk. But ~~the ounce~~ from one ounce of seed produced in France, only x or xii come out of it. Three ounces of seed are for producing such a quantity of worms, that with them you will be able to furnish a room accomodated with three or 4 levels of large shelves. Willingly they begin to molt around Holy Week. And to do this, one puts them in a fir box, like those where one puts sweetmeats, warmly among feather cushions. And at the beginning, they molt like f little black ants, & as soon as there are two or three molted, one needs to give them white mulberry leaves.

See *Hieronymus*

Vida Albensis episcopus

de b Cremonensis

scripsit carmine

de bombicum natura. [c_053v_01]

And then arrange them on the shelves. And three times per day, one needs to exchange fresh leaves. And if *during the day* there is some *thunder or rainy weather, cloud-covered & cool*, one needs to keep in the room three or 4 chafing dishes & with glowing charcoal, & put in incense until all the room would be filled with smoke. And when the *weather is warm & serain*, the silk abounds more & is all the better for it. Some worms make it whiter, others more yellowish. And even if it may be white, it yellows when one draws it with hot water. ~~From~~ The worms, *from their birth until u the their time when they make their cocoons & their prisons*, sleep & rest 4 times, & each time remain 4 or five days resting without eating, as if they were dying to be reborn again, for each time they change skin & begin by molting from the head then consequently, on different *days*, the *s* rest of the body, & from white turn grayish, & from grayish to white. ~~Finally~~ And if one of them has some illness who does not have the strength to molt, one needs to help it & be careful not to break it, for at that time rendering a yellow liquor, it is no longer worth anything. And further they scarcely profit after one has handled it with the hand. *Around Pentecost*, they begin to want to climb on the dry branches of *heath* or *heather* that one prepares for them *en* & attaches

How one moves them

on some of the high shelves, & at that time, one knows when they want to climb up when, on the leaf, they ~~hau~~ lengthen & raise the head & a part of the body. At that time one carries them to the heath branches where they stop & begin to spin their prison, which one calls cocoon, commonly the size of a pigeon egg, although one finds much larger ones because it sometimes happens that two or three & up to xi worms are put in a cocoon, which is hairy & downy all around, & the hair of which is ferret-silk or floret; & from the cocoon, which is a white, solid, continuous & firm skin, silk is made. The cocoon is so hard that one only cuts it with difficulty with a fingernail. And nevertheless, to leave its prison, ~~it~~ the worm gnaws it at one end, & after having stayed inside living on its own sap ~~it~~ for three weeks, it comes out, diminished by half. For when it begins to spin, it is as long as a ring finger & has eight feet, & coming out it is shorter by half & only has 4 feet. On the other hand, it has become a butterfly & has wings, without, however, flying. And there are male & female. As soon as they come out of the cocoon, the male charges the female & one puts them on a white linen, where they make their eggs, which the female would not make well & profitably if the male was not given to her. And when the male has detached himself from a female, one needs to throw it out, for it would not be good to give it to another. They have completed spinning & making their eggs in three weeks & around St. John's Day.^[c_052v_01] And at that time one keeps their eggs & seed until Holy Week, as ~~on~~ is said. Some spin among the leaves & make their cocoon there without climbing high.

The silk of the cocoons where there are^[c_054r_01]

On dry preserves

^[c_054v_01]

[Figure: fig_p054v_1]

To dry preserves ~~take-a~~ which are not liquid, take an open tub pierced on both sides with a small, square window, & pass sticks through these on one side and the other, & place on these a sieve made of strings in the form of a net. And on this, you will properly arrange the vessels with your preserves. And having put at the bottom of the tub a chafing-dish or two, cover the tub with a bedsheet folded double.

For making a horse follow

+One needs to give it **sweet bread** & it will know the one who will do him such good.

And for maintaining it in a good disposition for walking along, ~~put it~~ make it take a good gait from the start of the way & continue it.

Dogs

For keeping them from biting, it is good to have little **resin balls** prepared like those of **SHOEMAKERS** & to throw to them as they yap at you, & they will bite on the **balls** so much that their teeth will be stuck together & they will not be able to hurt you.

For disguising a horse

Cut its ears & tail, & with **lit hay**, singe the hair on its head & elsewhere.

Boots of hay

For lack of boots, you can make rope of **hay** & wrap your **legs** in it, & the **rain** will never pass through.

For firing a *schioppo senza rumore*^[c_055r_04]

Warm the pipe^[c_055r_01] well & plug the touch-hole below, & take a piece of **porkfat**, the freshest that you can, as long as the **joint of the little finger** & of the caliber, & put it in the pipe & move it up and down until it is completely melted. Next, load the pipe at the top with a **socket**^[c_055r_02] that is held on the ramrod, as you know, & it will only make a *little whistle*.

For tempering a ball that will pierce and **will make healing difficult**

Mix **fat** & **strong vinegar** & throw your ball very hot into this mixture.

Against wounds

Cut a **chicken** or a **dog** to test & in the wound put **sap** & pestled **herb** which is called *semperviva*,^[c_055r_05] that is the small one which has leaves like small grains, which some call *vermicularis*. And one holds for certain that **it will not die**.

Onenev elbirro^[c_055r_03] **heihw sllik fi eno spets no a draob ro a ueirse purrits**^[c_055r_06]

Take *in the month of June & July*, a number of the largest **snails** you can, with their shell, put them in a **glass** bottle with a sufficient quantity of very hard & thoroughly boiled **egg yolks** with **good vinegar**. Stopper the whole well & put it under **horsedung** for the **space of fifteen days**. The **snails** will first live on the **egg yolks**, then with the heat they will come out of their shells & eat & live on those. Finally, a white ointment is made with it, which, without cutting open the bottle *you-mee*, which above all for your safety you *b*^[c_055r_07] will always keep well stoppered, you will put **in the very strong sun & in the serain** for the space

of fifteen **days**. Next you will break it from quite far away & with a **long stick** without looking at it & having plugged yourself up well, you will put some of it where you want, or rub some of it on a stake in a **running river** or a **tree or a plant that is on the bank**.

Another for **waters**

Daot ni a top^[c_055v_01] with **quicklime**, which will consume all this powder afterward, &c.

Damascus steel^[c_055v_03]

Distill **earthworms** separately & **horseradish leaf** separately, & mix these two **waters**, as much of one as of the other, & temper in this.

For knowing the course one takes on the open sea

Soak a *ferlin*^[c_055v_04] in oil, then attach it to the stern of the ship such that it dips in the water, & it will make a trail that will show for ten leagues because the water is parted wherever the oil has passed.

For casting

Chalk most recently taken from the quarry is good for lead. One ought neither to wet nor grind it, but render it subtle by pestling or scraping & passing through a sieve. Thus for pumice, which one ought not to grind with water, nor corrupt its nature. Lead should be but little mixed with tin, only for giving it strength, and two parts of tin for lead for of one of tin or more.

Excellent tempering bath for cuirass bodies

Take river water, as clear & running as possible, & heat it to a little more than tepid. Then take a bunch of weld, & take the grain of it & put it into the said water & boil it thoroughly, stirring it with a stick, then pour it into a muid or other vessel, then throw into it two pecks of salt.

Next, take a big cauldron of the said river water & heat it to a little more than tepid. & take three or four double handfuls of fatty red earth, soak it & throw it into the cauldron with the said water. Take as much pigeon dung as the said earth, & as much horse dung, & as much iron filings, & mix the whole separately, & throw it into the cauldron & leave it for two or three days. Then throw it afterward into the said muid and stir the whole thoroughly together. And the older this temper is, the better it will be.

Varnish for distemper

You can make **marble** with **distemper** of **lake** or **rose of Ghent** & **chalk**. Once dry, glaze with **lake** tempered in **wine**, for the **glue** makes it die & blacken. And all will appear red, but the **varnish** you will put here, which will penetrate, will make appear dark & light that which ought to be thus. The **varnish** is made thus, mix with **clear Venice turpentine** some **spike lavender oil** & until all is clear & liquid enough, & it is done without fire. This one *es* is for things in **distemper**, and the **turpentine varnish** that you know, for panels. **Pure spike lavender oil varnish** is not good for panels, for **spike lavender oil** is too penetrating & makes colors sparkle, unless it was made *long ago*.

Painter

The lake & florey rosette of Ghent & others lose their color & die in the air.

All marble on which a knife can prick is worth nothing for grinding fine colors.

Chalk has no body in oil. Ceruse is appropriate. But lead white more excellent. Ceruse is the whitest, when ground first in water, the lead white grayish. But the white it takes on its perfect whiteness in oil.

When you grind your colors, first clean your workshop well, for when walking, if you stir up dust, this will damage your colors, which will never be beautiful if they are not very *be* clean.

Florey must not be mixed with *azur d'esmail* or another, for it makes it green.

For palettes to paint, ivory is excellent, knots of the fir tree, the pear tree, & if it is a walnut tree, make sure the grain of the wood runs lengthwise.

⚓ One always needs to apply imprimatura ~~don~~^[c_056v_01] wood to paint there in oil in order to fill the holes & unevenness, and make imprimatura with some *stil de grain yellow* & ceruse tempered in oil, then soften with a feather, which flattens better than a paintbrush. Or when the imprimatura is dry, scrape strongly with a knife.

To use *azur d'esmail* in oil, one needs to choose the most delicate. And to render it subtle, one ought not to grind it, for this makes it whiten. But one needs to wash it, & the coarsest going to the bottom, choose the one that is above in the water or, by inclination, pour out the cloudy water, then gather the azure.

^[c_056v_02]THE ONE WHO MAKES A PROFESSION OF WORKING IN OIL will hardly work well in distemper if he has not been trained well from adolescence. For the way of working is different, because when washing the paintbrush for distemper, one always leaves it humid. And on the contrary, when one cleans the paintbrush in oil to soften, one wipes the paintbrush well. Otherwise, the work would run & would soon be all disfigured.

The Italians soften by hatching with a large flattened paintbrush which makes serrations.

And they do not lay their shadow all at once like the Flemish, but make them hatching lightest toward the light then a little darker next & finally a little blacker to better make project & come out.

In **distemper** do not mix your different colors together ~~But~~, for this makes them die, but use each separately. And in order that they do not dry & that you have time to soften, moisten the back of the **canvas**.

Lake takes long to dry in **oil** and for that reason one must grind some **glass** with it. But one needs to choose **cristallin** because it is cleaner. And because it would be too difficult to grind by itself, one must redden it on the fire, then when entirely red throw it into **cold water**, & it will crumble & pulverize easily for grinding it afterward. Being well ground ~~it~~ with a lot of **water**, it resembles ground **lead white**, but for all this it has no body. I think it would be good for casting.

[c_057r_02] **Lead white** is made with **plate lead**, beaten thin & put under the **dung** heap.

White varnish of turpentine or of spike lavender oil and turpentine is colored with **pulverized terra emerita**, making it boil together. It gives a gold color on **silver** and more beautiful if it is burnished. It is dry in a *quarter of an hour*. **Aloe** would make brighter color still, but it takes long to dry & the other is dry in *a quarter of an hour, in winter* as well as *summer*.

Good **lake** moistened with **saliva** is promptly rendered dark. That from **Florence** is too gummed.

If you make a layer of **PRINTERS' ink** on **velvet** and there apply **gold leaf** and then stretch the **velvet**, it will appear grainy as if there were **gold powder** disseminated on it.

[c_057r_01] **Vermilion** ground by itself is wan and pale, but ground after **lake**, it is more beautiful.

For ridding **marbles** of grease, one grinds **common ashes** on it, which is good afterward to make the first imprimatura of a panel that is prepared in **oil** in order to seal the cracks & chinks of the **wood**. It has more body than **chalk** & it has ~~chalk~~ a certain fattiness. One mixes it with the said **chalk** or ~~ra~~ with the colors collected from the **vessel** where one cleans the **paintbrush**. It is desiccative and spares the color. ~~On~~ Once this first imprimatura is made on the **wood**, one scrapes with a **knife** to even it. Next, one makes there a second imprimatura of **ceruse** or of the meanest colors mixed together. In a painting in **oil** on **canvas**, one applies only one imprimatura, and the same **ashes** can be used there. Also, after one has ground a color, one grinds some **pith of coarse bread** on it to rid the **marble** of grease.

[c_057v_01]SHEATH MAKER

SHEATH MAKERS use small, very delicate skins of lambs and young goats, almost like parchment and keep them constantly re-moistened in humid places. When they want to imprint some history, they layer them in the hollows of their figure, then put over the top fine fatty earth with which cloths are rid of grease, having pressed & beaten it well & rendered it moderately humid and soft. Then they put on the earth a small even board and put the whole in a press and let it dry there. After the earth, only the leather remains neatly imprinted [gap] of the size of a pea. And then you give the leather two or three layers of copperas black and iron scale, one after the other, as even as the TANNERS do. And this dye, being astringent, makes the leather shrink & strengthens it and makes it imprint better. Once dry, one glues canvas on the back with strong glue. In this manner one can promptly imitate big statues & very subtle medals and paint & decorate [c_057v_03] them & are light and portable & last a long time. That which is imprinted on a relief is done differently and can be retraced with a hot iron.

PAINTER [c_057v_04]

Good crayons are not made with good glue but with women's milk.

Images made of carton, once dry, have to be soaked in thoroughly thinned and clear melted resin. This strengthens it, otherwise they turn limp in humid weather.

Venice masks are made with the hollow & the male face of copper.

The Flemish do not use any whites for flesh colors in oil other than lead white because the ceruse turns yellow.

4- or 5-year-old walnut oil which is clear is the best color, it keeps off dust. [c_057v_02] The kind which has recently been drawn with the press in the manner of almond oil is white, especially if the walnuts' skin is removed.

[c_058r_01] One needs to make at least three layers of flesh color to accomplish faces in **oil**. And at the beginning, one puts the black and umber where it is appropriate. Next, the e heightening with **lead white** must not be put on the black. Flesh colors, and [gap] where the **ceruse** enters will yellow in five or six *months*, but **lead white** does not change.

[c_058r_04] **Florence lake** is better than that from **Flanders** for in **Florence** the best dyes are made. To make a beautiful flesh color, the reddest & liveliest **lake** is the best, for the kind that contains **purple** & violet, by admixture of too much **alum**, makes flesh color like that of one who is very cold. That is why **ladies, wanting to color their cheeks**, grind **Florence lake** very finely, then fill a little **cotton** with it, which they next wrap in a little **fabric of Cambray** which is clear. And thus they pounce the **lake** on their **cheeks** & then, with another clean **cotton**, they soften it.

Cristallin having been ground with **water** appears to ~~be~~ have body, but with **oil** it does not have any. It is ground with **lake** & with **asphaltum**, which would not dry for a *very long time* without this.

Spike lavender oil is commonly put with **lead white**, & [c_058r_02] not entirely pure but mixed with a little **walnut oil**. The said **spike lavender oil** would not be good for **lake** & colors that do not have body, for it would make them glitter, but with those that have body & are somewhat fatty, it is quite appropriate.

Verdigris and **orpiment** must first be ground with **urine** before thinning them with **oil**. Thus they are beautiful & do not die.

Blacks

Black of charcoal from the mines, of **ordinary charcoal**, of **burnt ivory**, of **peach pits**, of **lamp smoke**, of **burnt bones of the feet of oxen**.

Shadows

When you are making a painting with several persons, just as the flesh colors have to be different, so do the shadows.

In fresco

Azure is not good here, but wan, & one needs to work with long paintbrushes. Fresco is not used ~~cont~~^[c_058v_03] on wood.

Azure

Turpentine oil renders it very beautiful. Test *palma christi* seed oil. Walnut oil in Flanders costs at least a hundred sous a pint. The azure requires a little fatty oil because it has no body.

Azur d'esmail hates more than any other to be ground, especially with water, for it dies & loses all its color. However, because it cannot be worked if it is coarse, grind not with water but with oil & grind it thickly, and in this way it will not die as much.

Always choose the most delicate one.

Paintbrushes

When the color has dried inside, & you want to clean them, soak them in spike lavender oil and they immediately will turn soft again as before, then you will finish to clean them in walnut oil. Walnut oil is not ~~as not~~ as appropriate to soften them as that of spike lavender, which is clear like water & penetrates & does not have body like walnut oil. The handle of paintbrushes is made by those who work with care from porcupine quills, by others from wood of arrows from Turkey ~~with whom~~ with which they also make small rods to rest their hand when they are painting.

To work well on a small scale very thin paintbrushes which have a firm point ~~z are~~^[c_058v_04] are needed. And because a squirrel's tail hair is soft, the most careful take the bristles of the oldest rats, especially of dormice if they can find them, & put two or three of them in the middle of the paintbrush. These make a straight line like a quill & all the other hairs

of the paintbrush stick to them as to the point. The bristles of beech martens & weasels & small animals that make musk are even better, for a single hair in a paintbrush suffices.

Lake & lead white & ceruse are easy to work in oil, but every kind of azure is difficult. And to make beautiful azure, one needs to layer it not with large strokes of the paintbrush but with small strokes of the point. Not only ash & azur d'Acre^[c_059r_02] but mainly azur d'esmail which one needs to choose to be very delicate. For it Otherwise you will not be able to work with it except with much work, and even then you need to allay it with turpentine to give it body, and mix it with a little lead white. Any azure wants neither to be ground nor washed for it loses color & becomes pale. But putting it powdered on your palette, you will thin it little by little either with walnut oil or turpentine oil, dipping a knife point in the oil, then tempering it little by little on the said palette.

Shadows

The first shadows which are closer to light need to be clear & thoroughly softened & then the last ones very dark to give relief well. ^[c_059r_01]The Italians commonly make three shadows, the first one, of light, very clear, the second one darker & the third ones quite strong, then blend these three shadows together by hatching them from the darkest to the clearest.

The varnish is more beautiful on the panel when the color has imbibed well.

[Figure: fig_p059r_1]

Azure

Azure is more beautiful when imbibed on the panel without with walnut oil with which it has been first thinned, without putting in spike lavender oil. And if you want to know if it is dry, breathe on it and it will not shine, thus appearing to be well-imbibed. If not, it will shine.

Azur d'esmail imbibed in oil tempered in oil, leaves it & returns to its primary nature if you mix it in water.

Colors for working in miniature want to be thoroughly ground, & work them with a point of a paintbrush if you want your work to be well-softened.

Black Painting of armor

Charcoal black mixed with a little lead white is very appropriate to make armor, mixing in a little of ~~illegible~~ azure if you wish. Charcoal black by itself is as if bluish.

Painting of crêpe

First one needs to make the background greyish with charcoal black mixed with lead white & a little azure, then ~~resh~~ after it is dry, heighten with strokes & lines in lead white.

Folds in clothing

In this, one needs to take care that none are made false, but that only that which the natural can do is imitated. A thick cloth hardly makes any folds, taffetas & silk cloth make more, & crêpe more still. ~~Make~~ Heed which ones should go lengthwise & others across.

Desiccative

Lead white & massicot are the most desiccative, nevertheless they need a good two days. If you want to prove whether an oil is desiccative, temper lead white with it, & if it produces a crust in a day soon it means that it will dessicate.

Double layers

Azures, flesh colors, & reds are layered twice. The others not.

Mending the cracks in a panel

If a painted panel breaks you can glue it well on the reverse, but to fill in the cracks well in order to paint on it & repair it, it ought not to be with glue, which rots in humid weather & would swell when touched with the oil of the painting. But take white wax, which is harder than the other. The oil mixed in among the wax prevents it from melting in the sun. The wax ought not to be hard, but soft as if recently cooled. Apply it on cracks & crevices with the tip of a knife, then scrape;

and to prevent it from breaking, mix in little **oil** & melt them together & fill the cracks & make them even and paint on them. And the **oil** mixed with **wax** will *q* better receive color, which is also tempered with **oil**.

First whitening of a panel

One layers two or three times with **chalk** tempered with **distemper**^[c_012v_01] **glue** on the panel, not with a **paintbrush** but with a **brush** in such a way as if you wanted to pounce, & leave to dry. And reiterate up to two or three times, then even out the last ground well with a **knife**, then give a coat of **glue** on top, upon which you will next be able to make your imprimatura and then paint. But make sure that your first white is not too thick for it would break easily. **Flemish PAINTERS** have such panels made by the dozen.

Neat work

When you are working, make sure not to stir up dust, & when you leave your work, cover it in order that the said dust will not fall upon it. Also layer your colors as thinly as you can, for if they are thick you will be not be able to soften them thoroughly.

Also do not layer color on color if they are not similar, such as white on black, but rather flesh color on flesh color, & thus with the others. And leave blank the space for shadow or a different color. *Ains* In this way, layering each manner of color on the imprimatura itself, they will not die & you will work neatly.

^[c_060r_01]**Oil**

Walnut oil extracted like **peeled almonds** is very white. The one of *palmachristi*. And when the **oil** has a little body, the colors soften in it. For if the **oil** is too clear, the colors run & do not have bond, even those that hardly have any body. **Fatty oil** that is not easily imbibed is appropriate for **varnish**. The **oil** is desiccative enough when it dries out as quickly as **common varnish**. **Oils** do not dry as quickly in cold countries as in hot countries. **Oil exposed to the sun** is clarified well. But it fattens, if you put in **ceruse** or **lead filings** or **lead white** or **calcined pulverized p glass**. To avoid this, put the **vial** in **clear water**.

Colors in **oil**, once dry, sometimes do not easily receive the second colors; to prevent this, breathe on them & the color will take there.

Varnish dry in an hour

Take white turpentine oil & turpentine & mastic, pulverized & passed delicately through a sieve, & boil together, stirring continuously with a stick until it is dry. And put in two liards' worth of good eau-de-vie. And if you extract the tear of mastic, it will be whiter & clearer. There is no need to put in turpentine, but only its white turpentine oil & mastic pulverized at your discretion, until it has enough body. +[c_112r_02]

+ [c_112r_03]

Which one knows when, being placed on a knife in the wind, it does not run. This one is excellent for panels and is dry within an hour and does not stick like the turpentine one.

Cleaning panels

Some clean them with soapy water, others with urine, others with white wine, for dust spoils the colors.

Spike lavender oil

One ought not to put any into colors for it is so brisk and penetrating that it makes the colors flake, which next come off. And for this reason, PAINTERS use it to clean their oil paintbrush when they have become hard, for it renders them soft & clean immediately, penetrating the dry color which encrusts them. Also, PAINTERS, sometimes envious of the work undertaken by another, *in the evening* secretly pour a few drops of spike lavender ~~on the~~ oil on the top edge of the panel such that, running down, it makes a stain that penetrates as far as the wood & makes the colors come off such that, to make the work even & of an equal composition, they are forced to do everything again and thus lose their work.

Wood color

One gives a layer of bistre, then a coat of varnish.

Work of the Flemish

They do all their works in oil with the tip of the paintbrushes, in *f* the fashion of good ILLUMINATORS, and grind their colors very finely, protect against dust, and often clean from their paintbrush the bits of hair which they sometimes leave there, for if these should remain on the work ~~it this~~, it would prevent neat working, which they are very careful about. In this way their work appears very soft, especially in small work, in which one needs to apply more diligence because one looks at them more closely. They usually finish the forehead, then the eyes, next the nose, finally the mouth and the rest. But they do not proceed like some others who *fo* layer two or three different flesh colors, one yellowish & the other darker, because the colors always mix & finally die. They simply *[illegible]* make their imprimatura properly,

and even it well, ~~then~~ and once quite dry, they draw their portrait & layer their natural flesh color, leaving the space for shadow, like the side of the forehead & the cheek, & the area around the eyes blank & dry until they have filled in the rest. Next they put their shadows separately, which they do not make so dark, but rather that which the natural can make. In sum, they do not put shadow on flesh color nor flesh color on shadow, but white on white & black on black, ~~Thus~~ & each on their own. In this way their work is neat & the colors do not die.

Flesh colors

You need to make two kinds of it, one more red to make the main layer, the other more pale for the highlights, as around the eyes. And then on this last flesh color, you will lightly touch the principal lights with a little lead white. But avoid putting too much of it for this will make it look like a face of death. The beautiful Florence lake makes a beautiful *re*^[c_061r_01] vivid flesh color approaching *[illegible]* the tint of rose alexandrine & incarnadine.

Certain colors do not want to be ground, like minium and massicot. The ashes do not want to be ground at all.

Rounding

If you want to model relief well, ~~and~~ soften round things by rounding them with the point of the paintbrush & the rest with the flat part if it is flat, & thus for the others according to their nature, & lightly with the point of the dry & flattened paintbrush & ^[c_061r_03] with patience.

Lead white

Without this, you cannot work on a small scale, for which one needs to soften with great care. But you cannot do it with ceruse because it does not have enough body.

Lights

Your paintbrush shows it to you by casting a shadow which must always follow the back of your hand, not in a straight line like this

[Figure: fig_p061r_1]

, for the light would be too crude & too harsh, but obliquely & as if at an incline, thus

[Figure: fig_p061r_2]

. It is necessary that the panel not be facing the light head-on, but half turned against it. And above all look for soft light, for it makes soft both the shadow & the work, as a harsh light a harsh work.

Water to give light for the PAINTER

Distill some vine water ^[c_061v_01] & put it into a big bottle. And behind this, put your candle, & it will not hinder your vision.

Frames^[c_061v_02] of the Germans

Germans who work in miniature make frames not of glass, but of canvas anointed with clear turpentine varnish, namely half turpentine oil & almost half turpentine, because this light, which is not as bright as from glass, makes features appear larger to them. And when they want to make something subtle like veins *de* & similar things, they use paintbrushes composed of two or three rat whiskers.

Azur d'esmail in oil

One needs to choose the most beautiful delicate that will be possible, for if it is coarse one cannot work with it in oil. And if you do not find any that is subtle enough, you can grind it well, not with water but with oil, & grind it thickly. Next lay it on your palette & mix in a little turpentine, but hardly any, to give it bond, and make it so that it is thick like butter or mortar, & then, with a fairly large paintbrush, work it by always moving the paintbrush back and forth. Then, to soften it, hatch across it in a tooth-like jagging with the tip of the paintbrush. The highlights will be made with *d* the same thinned with ceruse, which, giving it bond, makes it easier to work. I have seen it used thus. It must be very thick, & almost such that you are at pains to spread it with the paintbrush. And it is all the better if you lay down your panel. All these difficulties do not arise when it is very subtle & thin without being ground, and does not run.

Azure wants to be layered neatly, which is why *quan* it always dies somewhat when, to mend an old panel, one layers it on old, already tarnished azure. In such matters, it is better to scrape off the old layer & apply imprimatura again, then put down the azure. It is almost thus for other colors. Also, azure ground with oil always remains shiny, which is not a good sign for azure, for this makes it die.

Grinding colors

A slab of marble & p glass a glass thumb thick is more appropriate than anything else for grinding colors neatly, especially for lake & for whites.

Perspectives

Perspectives in **oil** *take a long time* because of several lines that need to be done with a ruler, and for this reason one usually does them in **distemper**. One takes the points at one's discretion. The main thing in this lies in having the knowledge of the point. One commonly makes two or three of them, sometimes five.

[c_062r_01]Ocher

It is put for faces, hair, skulls, and rocks.

Distant people and animals

One first does them roughly in gray or in purple, which is made of **azure ash** & **lake**. Once dry, one heightens & finishes with flesh color & other colors & with white. And it looks better & is sooner done than with white & with black. Armies are painted thus. **[c_062r_02]**

Drawing

After you have applied imprimatura to your panel & scraped with a **knife** to render it quite even, you will start drawing with the longest piece of **charcoal** you can find, for with a short one you would not see your line so well & would do it roughly. Let the tip of the **charcoal** be thin, & in order not to render it dull & blunt soon, drag the tip flat, thus you will constantly sharpen it. Also, hold your **charcoal** as far at the end as you can, ~~& do it~~ & accustom yourself ~~af~~ to make a light line. For if you accustom yourself to drawing delicately with **charcoal**, you will do likewise with colors. And he who is rough with **charcoal** is never exquisite with colors. And by a line of **charcoal**, **MASTERS** pass judgment on their **APPRENTICES**. First make the outline of your drawing, that is the contour, lightly & without any too careful work, but boldly. In so doing, you will teach yourself to be an **ARTIST**, and if you need to undo anything, you will not waste as much time as if you had elaborated it. Next, re-work all the distinctive lines, & do not keep too close to your panel, but occasionally step away from it to better judge the proportions. Once the first drawing seems good to you, retrace all the lines with the **paintbrush** in rose color or another color in **gum** or **distemper**. Thus you will work more confidently with colors, and with less effort.

Drawing

To become an **ARTIST**, one needs to draw by **eye**, without **compass** or **ruler**. **MASTERS** do not allow **APPRENTICES** to do this.

When the imprimatura has been *long* done, it becomes greasy. One needs to rub it with **ash** & **water**.

Perspective

To know the point, one needs to lay down a ruler over the lines, & at the intersection^[c_062v_01] of these, the point will be. Some make a hole at the end of their rulers to fix the point by that hole & move the ruler about. Others lay down a ruler across the panel, then on this laid-down ruler they set the tip of another ruler, which, attached to the former by means of a screw, moves about & reaches as far as necessary without losing the point.

The ruler and compass without the judgment of the eye cause errors.
Perspective is very difficult.

[Figure: fig_p062v_1]

To paint perspective in oil, you ought not to use a ruler, for you would smudge everything. But when layering your colors you need to keep to the & follow the lines of your first drawing.

To make plumb lines also, which go from the top to make vif to the bottom of the panel, you need to have a thread with some piece of lead attached to one end & a little hook to the other for hanging the said thread from the top of the panel.

[Figure: fig_p062v_2]

Panel

To draw & to layer the colors, especially in oil, it is necessary that you hold your panel as upright as you can on the easel, for if it is slanted there is a danger that some dust & dirt might stick on it. Keep clean & without dust the place where you paint.

Amaranth color

Although it is said to be immortal, it is nonetheless the case that white wine removes its tint & turns claret-colored, on & the dry flower ends up white afterward. Note that in this way the wine,^[c_063r_01] & I have p tested it. Eau-de-vie does as much.

Drying of oil

If the oil does not dry out, put in massicot & minium. There is no better oil than that of walnut, for it dries out neither too soon nor too late.

Casting

The Germans use lead from Flanders because it is very soft. And to cast better they take lead ore & melt it, & separate what is melted from the filth & ore, & pour it into a separate vessel, then ~~the bottom~~ they make their cast with it. For the lead must not have been put to work before, but rather completely new. Some cast into molds of iron & copper.

or new lead coming from the mine. They melt it twice in a crucible. In the first one, they purge it of filth. In the second, they ~~en~~ make the cast.

Shadows

German PAINTERS make their shadows on flesh color of men with ground jet, stil de grain yellow & ocher.

Bistre

It is only used in distemper, & with this wood color is made.

Verdigris and another very beautiful bright green

One ought not to grind it with water alone, for that makes it die. To render it beautiful in distemper, some grind it with vinegar, but that makes it turn pale & become whitish. To render it beautiful, grind it with urine & leave to dry. Then, whenever you like, grind it with oil. And after you have collected it with the spatula, before finishing to clean the marble, grind stil de grain yellow on it. And you will have a very beautiful green.

Velvets and blacks

One needs ~~needs~~ to make the ^[c_063v_01] ~~middle~~ main layer very ^[c_063v_03] ~~d~~ dark, & its folds & highlights very bright with white, & on the edges of ^[c_063v_02] ~~it~~ its light, you make a white line. For blue & green velvets, you ~~highlight~~ touch the shading with ~~peach~~ ~~pit~~ black, which is very black. For ~~lake~~, black of ~~pit~~ coal which makes a reddish black on ~~lake~~ for velvets. The ~~common~~ charcoal makes a whitish black. *P*

Armor

Soft wood charcoal makes a bluish color. It is good for making armor.

Stil de grain yellow

Is made with broom flower boiled well in water, putting in enough alum, then ceruse.

Rosette

Some with chalk, but the best has its body with ceruse & brazilwood dye.

Flanders blue

In the *month of May*, one puts the cow dung to putrefy under horse dung. Then one mixes with florey.

Snow-covered landscapes

Only three colors are used for it: white, black & bistre.

Softening

If you have worked & made your ground with some desiccative color, such as minium & similar, finish softening while the work is fresh, for if you were to wait until *the next day*, it would be dry & you would not be able to finish it neatly.

Working neatly

Never put down, if you can, two colors one on top of the other. But next, having made your design carefully, keep the place of shadows for them alone, & also separately that of lights & highlights, without layering one color all over & then highlighting or else shading on it. And in this way, you further your work, economize your colors & work neatly. Which is the reason that, the colors not being muddled nor mixed together, they do not die & you soften the colors better, since they are not so thick.

[c_064r_01]Yellow ocher

One needs a little of it in every flesh color.

Fatty oil

It is not good for working with colors because it ~~s~~ makes them thick, & as difficult to work as *azur d'esmail*. Therefore use the **clearest walnut oil** that you can, & the freshest.

Softening

One softens in the same way on **oiled paper** as on **wood**. But it is easier to soften on **canvas**, because the softening must be rougher on it.

Vermilion

One ought not to keep it in **water** when ~~tempered~~ ground with **oil** for it loses its color. It is better to choose whitish **vermilion** than dark & blackish. For **vermilion** is commonly mixed with a little **lake**, without which it would hardly be different from **minium**. But the pale casts more vivacity than the dark. It is not desiccative, & for this reason one mixes in **calcined cristallin**.

Eye

Every eye must follow the circle of the **compass** & not be flat & square.

Oil colors in water

Commonly, after grinding them one puts a *efθ* piece of tin leaf on top, & one puts them in water to prevent them from drying out. But this is more appropriate for ceruse, lead white, minium, & massicot than for the others, for lake dies there & loses its color, also azure, vermillion.

Double layer

Verdigris does not die, & thus does not need to be layered twice. But lake & others, & principally flesh colors, ~~the~~ require two layers. Colors hardly change when they are dry.

Apprenticeship of the PAINTER

First, one gives him an egg to do in which one has him make half a face, then a whole one with the ears, next the neck, then the parts of the body separately, next joined, then one figure, then two & three, finally a history, teaching him how to hold the charcoal by the end, & also the paintbrush. Once he knows how to draw, one teaches him how to *p* layer colors.

One also presents him with these strokes & lines.

€The^[c_064v_06] figure of the egg is the main pattern for faces and for bent bodies, & ~~the cross~~ as the cross is the model for a straight & whole figure.^[c_064v_01] Without these strokes you will never do well.

[Figure: fig_p064v_1]

Softening

To soften well, one ought not to layer the colors thickly, but rather layer them twice, if it is not *azur d'esmail*.

All colors that have no body
in *oil* have none in *distemper*, and
but in *distemper* they sink to the bottom.
Distemper colors want to be fatty,
which is recognized when they take hold
on the palette
once tempered
in *oil*.

Straight lines

You can use the *ruler*, but do not lay it flat on the panel, but as if lifted off, & resting on the edges of the panel. Otherwise you would smudge everything, & also you would not see the stroke well.

Distemper

Distemper colors need to be kept darker *pr* while you temper them, because they whiten while drying. But *oil* colors remain the same color.

Shadows

Because blacks make different colors, some a reddish black, others tending toward blue, and others toward green, choose those which tend toward yellow to make beautiful shadows in **oil**, for the shadow, especially that of men, is yellowish. And for this effect use very strongly ground **jet**, which you will mix with a little **yellow ocher** & **lead white**. Or else, after you have ground your **lead white** ~~bro~~ and ~~clean p~~ gathered it with the

[Figure: fig_p065r_1]

, [c_065r_01] grind the **jet** into it. Thus it will be more desiccative, & making on its own a yellowish black. A little white mixed in renders it perfect for men's shadows. Blacks which make a greenish black are appropriate for women's shadows. Take, then, some black of [gap], a little **sap green** & **bistre**, & you will have a perfect shadow for women in **distemper**.

The powder of **orberé grain** is darker than **umber** & when you lack **umber**, the said powder will do, but it does not have body.

Flesh color

You must know well the mixing of colors & the appropriate shadows, but above all make sure to soften them well. And note & observe that a thing which appears flat needs to be softened lengthwise, as if going from ~~lettre a ga~~ right to left like

[Figure: fig_p065r_2]

, and whatever ought to appear round must be softened in circles.

One cannot layer **oil** on cut **paper** & model as in **distemper** because the color would run. Thus, to **gild** with **or mat**, one needs to pounce & then layer the **gold color** with the **paintbrush**.

All fatty colors, such as **ceruse** and **minium**, **massicot**, **ocher**, **lead white**, are good for making gold color.

Mirror

When you make flesh colors, it is good to have a *crystallin* mirror, which represents nature well, and in which ~~it~~ you will see if your shadows are soft enough or too crude. But do not look at it with a candle, for *firelight* will make the shadows reddish. The *PAINTER* also teaches himself with the mirror, for he sees in it what nature can do.

Fatty colors

If some part remains shiny and does not seem dry after the layered colors have penetrated, it means that this place is fatty, & that the second colors one layers on would not take easily, unless you rub this place with *soap* or *breathe* on it, because the humidity will make the colors take.

Every color or thing that becomes dense when *water* is put in during the grinding has body. But those which do not have it, such as *pestled glass*, *lake*, &c, become clear.

Semi-lively colors

When colors ^[c_065v_05] absorb into the *canvas*, it means that it has been given imprimatura only once, & for this reason they become matte rather than being shiny. But this is the best, as long as you re-coat it twice, for in this manner, the colors, having more body, do not die & are all the more beautiful for it, especially *azure*, *lake*, & those do not have body. But those who want to rush their painting apply imprimatura twice on the first go, to be done with it. Thus the colors do not absorb, also they will not last as long. The second layer of these does not absorb & remains shiny.

From nature^[c_065v_01]

There are some who paint from nature on *oiled paper*, & if they do not finish in one go, they put their *paper* & unfinished picture in *water* so that it shall not dry.

Painting large figures

You need to put your **charcoal** at the tip of a **stick** such that you make your first drawing from a distance because up close, you would not be able to judge proportions as well as from a certain & sufficient distance. Also, ~~you~~ when you paint up close, hold your **charcoal** at the farthest end, & ~~de~~ practically with your **fingertips**. For in this way you will acquire an **ARTIST**'s stroke & ^[c_065v_06] will render your **hand** nimble.

ILLUMINATORS painting on **paper** temper their colors with **gum** & mix in a little **soap** to make them run better.

PAINTERS must all learn how to depict after nature, for to them it is travel provisions & revenue & sure means of earning their passage when travelling across the lands with only their **cocon**.
^[c_065v_03]

Glazing

One commonly glazes with colors that do not have body, such as **lake** & **verdigris**. However, to use other colors, one mixes in a quantity of **calcined & ground cristallin**, which also has no body & ~~makes~~ lightens the density of the others.

White and black

It is good that an **APPRENTICE** should work with white & black for two or three *years* to become an **ARTIST**.

Imprimatura

One needs to be quite careful about this, & not make it, as some will, with gold color which is made with the **washings of oil** paintbrushes, because **verdigris** & other corrosive colors which are in it will in the end make the colors die that are ~~meu~~ layered on next. It is good to do it^[c_065v_02]

Lead white

It does not die & has a lot of body.

[c_065v_04] with ceruse, & a bit of yellow ocher, & a little massicot, & make it not very thick in order that it does not crack.

Double layers

The Flemish & those who paint panels by the dozen only make one layer & finish at the first go, but the colors soon die. And when they are layered twice, they do not die. One needs to layer them lightly & not very thick, to soften them well.

*

Or mat

It is made with massicot, minium, ocre de ru, & yellow ocher, in order that the composition resembles gold. Gild *the day after one-jø* it is laid down if you ~~in the~~ make the seat for the color in the *evening*.

Shadows

For women, asphaltum, umber, & a little lake.

After having gilded,
let it dry
& rest one
day, next rub the gilding
with a feather & cotton in order
that no protrusions remain, then varnish with Flanders
varnish, which you make mixed with a little eau-de-vie,
to render it desiccative.

Painting in distemper on wood

Because it is very tedious to paint in distemper on wood, and because one is at pains to make a good a face on it, some thin their colors with glair of egg passed through a sponge, or mixed with the yolk, water, & thoroughly beaten with the peelings of the fig tree. With this [c_066r_03] they paint & soften on the wood, as with oil, and this supports the varnish, but this does not last.

The varnish will be dry in an hour. It will increase the color of gold. And this or mat holds in the rain, even if one rubs it. But it must be well dried for eight or ten days.

Gold color that is
made of different
colors cleaned
from paintbrushes for
oil is not so good, & with time,
tarnishes the gold because of the verdigris. One
must not touch with a finger the layer made for the gold because that will keep it from
attaching itself. The or moulu is spoiled
if water touches it, but the or mat holds well in the rain & in water. One must not burnish it,
because the tooth would remove it.

Gather the protrusions & small
flakes that the cotton makes lift off when the gold is dry & you clean it, for an ounce is still
gold. In Flanders,
women make gild.

It is more beautiful when it is
a little thick, but in France
they beat it too delicately.

Colors in oil that are imbibed

It is best that colors in oil are imbibed, that is to say they do not remain shiny after they are dry, for they do not die. But if in some places they are shiny, it is that the fattiness of the oil has remained in that part, which would make the colors die. The varnish mends all this & unites & renders it similar in one place as in another. | It is necessary that gold color be laid down thick, for if it were clear, it would be imbibed & would run.

[c_066r_04] On canvas & in distemper, one gilds with bole & honey & a little garlic juice.

Gilding molding for panels with or mat

see the other side of this folio this mark: *[c_066r_01]

The Flemish give a layer of distemper glue on the molding, then mix lamp black or soot black with the same glue & let dry. Next they pounce some moresque in the corners & paint it with minium, massicot, & ocre de ru, and a little yellow ocher, tempered with fatty oil in which they clean their paintbrushes for oil, because the three aforesaid colors are gripping & dry immediately. Next they lay down the gold, then varnish on top of all. And it seems to some by this means that all this black is painted in oil, but it would not be good because the gold would attach itself everywhere & not only to the moresque. Go back to the top to *[c_066r_02]

Breathe on the gold color, and if it fogs up, it is dry enough, but if it does not receive the vapor of the breath, it is not enough.

One ought not to gild with or mat after ~~with~~ having gilded. But wait *one day or one night*, ~~But take heed not to~~ and when it is as if dry, it grips the gold. Next, one varnishes.

When gold color starts to grip, it is a sign that in ten or twelve hours it will be dry & appropriate for gilding.

For preventing teats from swelling

or to diminish overly large ones^[c_066v_03]

Take large loaves of bread freshly drawn from the oven & split them in half &, as hot as may be done, apply them & ~~they~~ & do this 3 times a day, & continue 4 or 5 days. Next, make a plaster with Venice turpentine or better, common turpentine. Mix in sumac, blackthorn sloes, quince seeds, pomegranate flowers, olive tree leaves, & the like, decocted, & mix with the turpentine. But, I forgot, one needs, after having applied the hot bread, which softens & makes one sweat, to put on linen cloths soaked with water from a honey bee hive, that is to say honey & wax extracted all together from the *honeycomb*.

*^[c_066v_01]

To make *or mat* beautiful, put in a little varnish or fatty oil, not from that which is made from the cleaning of paintbrushes, but the pure, which is made fatty in the sun or mixed with ceruse.

Or mat of this sort is scarcely less beautiful than ^{es}^[c_066v_05] burnished gold, and lasts longer in the rain & besides, & is made sooner. Burnished gold cracks over time & comes off in the rain.

For attracting pigeons

Fry hemp seed in a pan with oil & give it to the pigeons.

Against bruising of the eyes

At night, apply very thin sheets of lead. Singular remedy.

Paintbrushes

To make them well, cut the hair from the tail of a squirrel's fur, as much in one go as one can hold in a card folded up like a cannule. And putting it thus into the said folded card, tap it & shake it such that the hair comes together & is rendered the same length. Put one or two bristles of a rat's whiskers in the middle, then, grabbing it with the fist & pinching it well with the thumb & index finger, thoroughly wet the tip of all this hair in water, then, moving close to the

light, pull out the hairs which make the tip too long with the ends of your fingernails, and this until the tip seems good to you, & until you notice in it the rat hairs which are entirely black & the hair of the petit-gris^[c_067r_01] is at the whitish from the root to the middle. When it pleases you, bind it and tighten it very well with a thread in two places, then cut the excess & fit it in a quill of a convenient thickness for it, of a duck or a crow for the small ones. Good paintbrushes are those that, once dipped in water, do not bulge when you trace on your hand.

Oil

All oil which is imbibed by paper & once heated by fire evaporates & leaves the paper clean, like turpentine & spike lavender oil, is good for making varnish.

Sand

Every ground & tempered thing becomes porous, according to some.

Bellows furnace

Before putting in the metal, it is necessary that it be red at the bottom, like a charcoal & well inflamed. Next, you *[illegible]* fill it & cover the charcoal & adjust the bellows, otherwise the metal on top would melt by means of the bellows & its bottom would be curdled & cooled & would not run. But if you proceed in this manner you will melt everything you like.

Varnish on paper

The Germans make boxes *p* covered with painted paper & varnish it with glair of egg mixed with gum & a little oil, not of spike lavender, but another fragrant one that resembles olive oil. Every work done with glair supports oil. It is with this that PAINTERS trick the POOR PEASANTS, painting their bands of taffeta with this glair, to be done sooner. But the first rain carries away everything.

Files

If they are not *trempees à paquet*, that is, in the fashion described, with soot, salt, & vinegar, they will not be good. The square large square files used by LOCKSMITHS for their rough work are only made of soft iron, but the soft files must be made of steel. FOUNDERS whose work is to repair latten & copper must have their files *d* coarse otherwise they would fill up with the copper which would make them smooth & soon render them useless. Latten, which is more brittle, welcomes softer files than copper does.

Bones of the foot of oxen for sand

Once having been burned well twice & pulverized, they mold very neatly in sand & need not be reheated, but simply heated with the flame of straw. But if you mold them *en noyau*, give it its first layer, simple & very thin, with a paintbrush, & leave to dry at ease. Next, fortify the following layers with wadding mixed with the said tempered sand of bone.

It is the neatest sand that can be found for copper.

Essential oils

Walnut oil mixed with as much of turpentine & distilled through an alembic renders an essence whiter than common water. But this has no body & does not give bond to colors that are immediately imbibed, and then leaves the color without hold and fading. These, imbibing in this way, would not give you leisure to work and soften any more than in distemper. But you mend this defect by giving it a little body with turpentine, not at all so thick as for varnish. And thus you can work with *azur d'esmail* & will make a perfect lead white. Turpentine varnish made with this oil is dry in one hour.

Fanciful tables

You can make various grooved compartments & in these, put **fishes** painted from nature & with colors on **simple carton**, & if you please, on **silvered & burnished paper** which will represent the scales. And next, cover this with **very clear lantern horn**. You can apply the same to other works.

Planting trees

One needs to plant them in **dry place dry weather**, & gather plenty of **earth** at the foot all around, like a mound, in order that the **rains** do not fill the holes & drown the trees.

Casting

I have tried four kinds of **sand** for **lead & tin**: **chalk**, pestled **glass**, **tripoli** & **burnt linen**, all 4 excellent. But as for the **chalk**, it needs to be of the softest kind you can find, like **the Champagne one that PAINTERS use**. It releases very neatly, does not want to be moistened with **magistra** or anything else, but needs to be completely dry, in its natural state, finely pulverized. The first cast is always the neatest; however, it will well withstand two or three. But there is only the first one that you need to take heed of, when you want to remake your frame mold to take new **powdered chalk** that has not yet been put to use, for the one previously used in the frame has dried out & does not have as much hold & bond like the fresh one. Pestled **glass** can be made from **common glass sand**, however, **cristallin** is more excellent, for common glass contains **glass salt of saltwort** only, but **cristallin** contains both **salt of tartar** & **saltwort** all together, which both help fusion, the **glass** once calcined & reduced as if to its prime substance. In order to calcine it perfectly, throw your pieces of **glass**, whichever it be, among the largest possible lit **charcoals** that you can, if you are lacking another amenity ^{for}^[c_068r_04] violent fire^t.^[c_068r_03] And when it is well red, throw it into **water**

Putty is considered excellent for these two **metals**.

and immediately you will be able to crumble it between your **fingers** and easily pestle in a mortar of **metal**,^[c_016v_05] or better yet, of **iron**. Next, it will be easy to grind it, not ~~only~~ on **common** marble that would corrode, but on **porphyry**, and it is necessary that it be finely ground with **water** so that when putting it on your **fingernail**, you find it soft without any asperity, like the ~~p~~^[c_068v_01] colors that the **PAINTERS** grind for **oil**. This one, once dry, you can use ~~au-lie~~ instead of **sand**, in a frame without moistening it with anything nor reheating it, if you do not want to; fumigate the hollow form with **sulfur smoke** or ~~of-p~~ with the tip of the flame of a **wax candle** that barely makes **smoke**, and it will make a very neat & shiny & polished work, in **pure lead & tin**. I would say the same for **finely pulverized tripoli** that does not want to be ~~not~~ reheated or moistened. **Burnt linen** gives less trouble than any other, because it needs neither to be reheated nor to be moistened, & molds and releases very neatly & ~~very~~, subtly & ~~releases-well~~ neatly, like the previous ones do as well, & withstands several fusions. First one ought to burn it with a flame, then leave it to rest & to be consumed with its fire until it wears it out, then finely grind it on **marble** or on a **paper**. ~~But because a lot~~ And if you reheat it in a **crucible**, red hot due to the fire, to render all of it fine & impalpable, I believe it will be even better. But because a lot of **linen** is reduced to very little when burned, if you want to save some, you can sprinkle only the medal that you want to mold & cover it, and fill the frame with pestled **slate**, which molds also very neatly. But note that the first cast is always the most beautiful & the neatest. If you cast opportunely, **soft tin** that seems to be burnished in little wheels that **PEWTERERS** sell, comes out very neatly & approaching the color of **silver**, without mixing in anything. It is true that one ought to cast it rather hot, & so that the molded object should be 4 **fingers** away from the cast. In order to know its heat, first melt it well, ~~with such a degree of heat~~ so hot that it promptly burns in a shiver a **paper** or **straw** placed inside. Then remove it from the fire & leave it to rest a little & cast. **Tin** mixed

with ~~half~~ **lead** comes out almost better than **pure tin** ~~pure or~~ **or lead**, even though in any case they come out well. Nevertheless take care not to cast **lead** at all as hot as **tin**. In big works it is necessary to moisten the **sands** with **magistra** or **glair of egg**.^[c_069r_04]

JOINER

Three things take the longest to make: leaves, hair & garlands.

Sand

You should not choose for casting the one that is in any way so lean & arid that it does not have bond, like **the one from the sea** or ~~desei~~ **from sandy paths dried out by the sun**. But choose them ~~or in t~~ in the first place from ~~quarries~~ **ries** or **rock caves**, because that one is best, provided that it is very fine. You will recognize the vein of it if, among the greyish **rocks** or **quarries** ~~qu~~ that seem to be made of **arene**, you see, **after rainy weather**, certain small patches like dust attached to the said **rocks**, or if due to the humidity, a small piece of it flakes off, which easily crushes between your **hands**. You will also find in **lean soils** some which comes off in ~~lep~~ large lumps like **stones of tuf** ~~and not~~, or among **terres bolvenes**, which are much better than those in **fatty & strong earths**. And one ought not to take it from the surface, for fear that it be mixed with **common earth**, but three or 4 **feet** below & the closest to the **tuf** or **stone**. Since it comes out in large lumps one would say that it starts to take shape as a stone. But when it is wet, it comes apart easily. One needs to make sure that when breaking it up it is quite granular, & that when crushed between the **fingers**, it renders itself into very great subtlety, ~~like impalpable~~, keeping nevertheless its sandy asperity, without **muddying** the **fingers** like **clay**. It is dried slightly on the ~~[illegible]~~ fire,^[c_069r_05] then it is pestled & passed finely through a double sieve or a **linen** sleeve, then is moistened with **wine** or **magistra** &c / Verte^[c_069r_02]

The **Toulouse** **MOLDER** reheats it strongly then grinds it finely on **marble** and passes it through a **linen** & moistens ~~pass~~ it with **wine**. He makes the cast very broad & ~~not~~ flat & barely deep. He casts **pure latton used for trebuschets** & similar thin things. He casts very hot.

Try **calcined vitriol**.

The **sand near my area** is very excellent. But one ought to, in order to make an excellent work, take it fresh, which has been hardly put to work. For it dries out after having been cast several times & is lean & has no body. If you cast some fine work which has hardly any thickness, it is necessary that your substance of **copper** be very hot so that it penetrates & runs. Some mix **lead** in this melt, but it is for large works & not for small ones.

Sand from oxen feet, burned twice & finely ground, melts more neatly with copper than sand that I have seen, & without crust. I have cast a high relief medal with it, and *f* with a thickness as delicate as a knife blade or a card. And it was hollow on one side, opposite the relief, which was on other side.

It is necessary that lean sands be more moistened than others, namely with *magistra* or good pure wine or boiled wine with elm tree roots & similar things. But very fine sands, like burned linen, which is fatty & soft on its own, want to be applied dry.

All moistened sand wants to be strongly beaten & stirred, to be ground finely & to flatten out the clods that it makes in itself when it is bathed.

The olive oil that some mix in with beaten egg glair makes it become porous.

Sand of calcined glass withstands several fusions, but there is nothing like the first ones. It also becomes porous.

Latten comes out well on its own, but it runs too quickly. It is good to mix it with a little copper, like a quarter part, with the substance of skillets.

FOUNDERS do cast frames up to 30 or 40 lb, but not more.

It is good for big work, but for small ones it is troublesome for releasing *H* because it crumbles. It is good that it be alloyed with some fatty thing which has bond such as molded tripoli or *ab* burned felt or sal ammoniac or tripoli & similar things.

When you have molded, it is good to reheat your mold on the fumes of the substance you are melting, because the cast is imprinted with the quality of ^[c_07or_03] the metal, which afterward runs more easily in something that comes from it.

Human bones are the best for casting once calcined.

To cast neatly, it is necessary that your substance be quite hot & to achieve this, when your substance is melted, throw in some iron scales, either in powder or otherwise, ^E for it heats copper a lot & cleanses it of its grease. At the end, when you want to cast, add some saltpeter, by folding your additions in a paper in order that everyone may not know what you mix in.

Sheep foot bones are even better than those of oxen foot.

Oil & tallow make it very porous, & pestled glass, & copper alone. ^[c_07or_02]

Cendrée ^[c_04ov_01] earth molds very neatly.

Ash does not have enough body to withstand copper.

It is better not to mix the sands, but to fill the frame with one only.

Latten is always fatty, & does not mold neatly. One finds that it comes out better alloyed with a quarter of copper, but let it be cast very hot.

Copper comes out well with a bit of metal. ^[c_016v_05] If you mix in metal within latten, it will be more brittle & more troublesome.

Slightly coarser sand has more body.

Sand from ~~corp~~ rock is always better, which seems like tuf in lumps, which has a beautiful & very fine grain, & a little fatty. One pestles it, then one dries it in a skillet on the fire, until it is no longer smokes, then one passes it through a fine & double sieve, & one molds with it.

Copper or latten cannot come out well if the medal does not sufficient thickness, & if it does not have it, give it some with wax.

Some cast through a hole made in the middle of the reverse side of the medal.

Some, wanting to cast large works in latten, ~~in it~~ mix in the sand some pestled glass to give the earth bond. But it makes it porous, and the work needs to be repaired.

One puts in **lead** for a large work to make it run, but not ~~not~~
~~for~~ in a small one because it would leave **filth** all around the work.

Copper ~~is~~ *meil* and **latten** are proper to cast & at the right heat when they throw off, while stirring them in the *crucible*, a very white flame & that the bath is very liquid.

Some cast in **well ground ceruse** ~~for the~~, others in **flour** moistened several times with **oil** & ~~g~~ & dried **in the sun**.

Others, for casting in **lead**, old **PRINTERS'** **type** or the **composition thereof**.

Others put into the **tin** or **lead** a substance of **fixed quicksilver** which makes it run. [\[c_070v_01\]](#)

Amber

It softens like **paste** when boiled in **melted wax**, and takes color boiled with ~~eeru~~ **fat of a young goat kid**, for that of a **goat buck** would make it break, principally if it is glazed.

Wood with streaked grain

The **elm**, in its knotty root, has beautiful streaks diversified with grey and black, and the **root of the maple**, but one needs to choose well the grain of the **wood**. One gives the **maple** a certain yellow color, then one varnishes it. [\[c_069r_04\]](#)

Mulled and sugared wine

The English, when they feel a cold coming on, mull wine in this manner. They heat it in a large tin pot until it boils, and when it is boiling up, they ~~remove it from~~ light it with burning paper to know if it is hot enough. Next, to ignite it entirely, they pour it from one vessel into another, as one who wants to beat *eau panée*, and as they are doing this, someone else lights with a burning paper what is falling from one vessel into the other, such that you would think you were pouring fire. When the wine is mulled enough, heat it again a little, adding a few cloves & a sufficient quantity of sugar. And they ~~bœi~~ drink it as hot as they can to overcome a cold.

The common English put sugar in wine to affect for themselves the sweet new wine,^[c_071r_01] which they cannot have because, owing to the *long sea crossing*, the wine has lost its sweetness and is clarified before it reaches their country.

Weary horses

For fortifying a harried horse, they make it drink some of the aforesaid wine through a horn, and it finds itself disposed for doing an even greater labor.

Eau-de-vie

The Irish do not drink any wine because they convert it into eau-de-vie, which they use almost as habitually as we use wine.

Varnish

To a half lb of **spike lavender oil**, put in 4 3 of **sandarac** & **mastic subtly pulverized**. And first, boil your **oil** in a **pot** on a **chafing dish**, and then mix in little by little the aforesaid **gums**, stirring continually with a small stick split and quartered at the tip, & when you do not collect **gum** with the tip, that is to say that it is totally melted & that your **varnish** is done. And to render it clearer, put in a small lump of **camphor** to decoct. It is true that with this it is not dry so soon. Heed well that the **spike lavender oil** be good, clear & not fatty, otherwise your **varnish** would be worth nothing. You can test it, ~~d~~ soaking some **paper** in it & heating it. If the **oil**, which will evaporate, leaves the **paper** clean, without ~~being~~ a yellow mark, it is good, if not, it is fatty.

Sheep fat

In a certain region of **England**, the **sheep** that graze there have very yellow fat and are nevertheless just as good as others.

Spider

In **Ireland**, there are none, & if one touches them with **wood** that is there, they die. This is why some **rich** people of **England** make their ceilings from this **wood**, & by this method, they never have cobwebs & **spiderwebs**.

Sand

Grindings are very good for casting in **copper**, but one ought not to take **those of** **CUTLERS**, because it is only **sludge**, but rather those of those who ~~mold~~ grind large shears.

Pierres de filieres,^[c_071v_01] with which **THOSE WHO SHARPEN** smooth,^[c_071v_02] mold very neatly, once scraped, for **lead**. It is commonly **slate**-colored. One frequently brings them to **Toulouse** from around **Carcassonne**.

PRINTER'S letters

Those who make them, mix into the **lead** some **nails nailheads** & **old horseshoes**, & **antimony** which makes it all melt. This composition is strong for printing, & holds up. It runs and is good for casting in **lead**.

Casting in **copper**

It is necessary that the **frame** be quite even & that it fits well also on the **board** where it is set, so that it holds firm & does not shift when one molds. It is necessary that the **sand** be clean & well chosen and well reheated, & pulverized very finely on **marble**, for the one that you want to put first on the medal, and that you press strongly when molding. Guard against **oiling** your medal, for this would make it porous. Reheat slowly and reheat well, & let cool. Moisten your **sand** with **wine boiled with elm root**, and cast **latten** which comes out well / namely from the **substance of the trebuschets** and similar thin things. Make your gate broad & even if it is barely thick, it will not be worse off, but it will enter well in the **mold**. Cast from the foot of the medal, in order that the face, further away from the heat, comes out better & more relieved from the violent heat. And if your **frame** does not have vents, make some **qu** in the **sand**, which come from the edges^[c_072r_01] of the piece, to go into the gate. Cast very hot, which you will recognize when you throw a little reserved substance in that which is already well melted, & if it melts quickly, this is a sign it is **fθ** quite hot. At that time, invigorate the heat of your **furnace** with **bellows** of the right size, keeping the mouth of the **furnace** well covered with some large **cuiv^r tile** or other similar thing, which should be very red before you cast. When you want to cast, take your red-hot **pincers** & the **crooked iron** as well, to clean the **charcoals** which are in your substance. Having cast, rub your work with a **latten** wirebrush. The **grindings from sharpening large scissors & large knives** is very good for **copper**.

One believes it to be a great secret to put in **persicaire**, which renders them soft as **lead**. Try to extract **salts** from it.

Casting

Lead, which is mortified & weighty, wants to be cast hot, more so than **tin**. And when it is not hot enough, it makes lines in the medal. ~~It~~ **Straw** burns in it, however little hot it is. One can make a **solder** so soft & runny that it can be melted in a **tin** dish. It is composed of one part **looking-glass tin**, one part **soft tin**, & another part **lead**. It runs very neatly and is cast in leaves, but the work is very brittle & breakable. The best **solder** is the common one for casting well, but ~~is~~ leaves certain points lumpy. Alloy **lead** with **tin** so that the ingot that you will cast comes out even & shiny & polished, & without any eyes or bubbles except for a small point in the middle. And this sign will tell you that there is enough **tin**, otherwise the **lead** dominates too much. **Sand** is good for **lead** & **tin**. The good one is very thin & fine & lean, which nonetheless sticks together between one's **fingers**. The **sand** wants to be reheated before putting it to use. And ~~one~~ to mold with it, it wants to be much moistened & then reheated, not all at once nor with a burst of fire, for this corrupts & makes it shrink & crumble as well. But if you reheat it gently, it renders itself very stiff, once well moistened. One ought to pass it through a **shirt sleeve** for the finest one, in order to put it first on the piece to mold.

One makes a **solder** with **quicksilver**, ~~But~~ which is white, but it is brittle. Make it so that your frame joins well & that one does not see the light between the joints.

The **Germans** cast their **leads** very thinly, because it seems they come out better than very thick ones, but in order that are not too pliant, being so thin, they mix a little **tin** with the said **lead**, which otherwise would bend like **wax**.

*The **blackest lead**, so some say, is the best & the softest & which runs the best. You will know its goodness by rubbing it with your **finger**, which will render it very black immediately.*

The alloy good for running **lead** & **tin** is per one lb of **lead**, one lb & a half of **tin**, ~~And~~ in order that the **tin** exceeds more than one part. It is **solder** which flows well & is good for casting, but it is brittle.

To make the **lead** flow well, one puts in a little **quicksilver**.

Rub **cuttlefish bone** on a well evened table to flatten it & one against the other & pierce through the two **bones** with **pegs** to mark the place.

Cuttlefish bone molds **lead** better than anything else. But try it to see if it needs reheating. ~~One ought to mold on the back of the **bones** & from this side for the **marrow** is more delicate there.~~

The **bone marrow** toward the tail is more delicate & does have not as many stripes & molds more cleanly. The **shell** which holds the **marrow**, once calcined, is good for making **sand**.

When you cast **lead**, you need to cast it ~~east very neatly~~ rather hot, & not at once & shake the frame a little & cast two or three times. However, if it is cast too hot, it will rise up & swell. When it is very hot, it becomes blue, let it then pass this color ~~deva~~ & rest a little before casting.

Some, such as **PRINTERS**, mix **iron or pin filings** in the **lead**, ~~But~~ in order to render it hard. But this renders it brittle & ~~not~~ it breaks under the hammer.

Take a wirebrush to clean your molds.

[c_073r_01]For making blue varnish

Take the **blue of flowers of florey or of Flanders**^[c_073r_02] & **quicklime**, and put around four **fingers** of **water** over it, and let it soak one day / Take the **water** where the said **lime** has soaked, and put your **blue** with it, and lay it down on the **wood**.

For orange color

Take **water** in which **lime** has soaked and put *terroy merita*, one with the other, and then set on your **wood**.

For ridding bone or horn of grease

One needs to make them boil in **quicklime**, and let there always be **water**, and take a very clean **pan**. And when they are washed, boil them in the **ash of vine shoots**, and put them into the hottest **pot** you can, and put into the **pot** **GOLDSMITH'S water**, **verdigris**, and leave for the space of some time, and you will see a very beautiful green color.

For making gray wood

Take alum with river water, make them boil together, then take river water with bran, submerge the bran and beat it together. Take iron filings & sulfur & verdigris and grindings^[c_073r_03] [gap], and make it all boil together, and pound maplewood which will have been soaked in alum water and well water, & put it to boil together. All of this will be done better in a hollow *grais*.

For making bronze in gold color

Take one ounce of sal ammoniac and grind it in an iron mortar. Once well ground, take one ounce of sulfur, and

l_____.^[c_073r_04]

^[c_073v_02]grind it separately. When it is well-ground, take the sal ammoniac & grind it together again. Then take one ounce of soft tin & one ounce of quicksilver, then melt your tin & put your quicksilver drop by drop into your tin while melting, & stir strongly until it is powder.

For coating it

Take some glue of Partenay or parchment and apply it with the white of one egg, then take a little saffron and vinegar and the milk of the fig tree, and do another coat. Then take the bronze and apply it on top.

Varnish

Take two ounces of spike lavender oil & one ounce of sandarac. Take a clean pot, & warm it, & then take it from the fire, and next put the drugs inside, and next put them into a vial, & apply it on the wood.

Another recipe for making varnish

Take one ounce of verinse Venice turpentine & one quarter ounce of oil of perolle petrolle & one ounce of sandarac & one of spike lavender oil.

Color of burnished copper

Take one ounce of **sal ammoniac** with one ounce of *brouillamini* and half of **copper filings** with one ounce of **sulfur** & a half-septier of **vinegar**. Push it all into a small tile oven and make a small **charcoal** fire around it, and put your **pot** into the said **oven** for the whole day.

[c_073v_02]For **bronzing white**

Take **looking-glass tin** & put it to soak in **gum water** & pestle it in a mortar. And next, you will put it on **marble**.

For making **vermilion**

Take two pounds of **sulfur**, & melt it, & put it into two pounds of *mereuse* **mercury**. And if this substance ignites, cover it quite gently, so the air does not pass into the pot, then put the whole for some time after into a **leaded** pot, onto the fire for the space of twenty-four hours. You will have **good vermilion**.

For making **varnish**

Take one pound of **linseed oil**, and then you will put it in a **earthen** pot, mixed with a **crust of bread** and three **onions**, and put it on top of a **charcoal** fire, and you will cook it on a little fire, so that it boils for the space of five hours. You will take half an ounce of **flour glue**, & you will make it boil just as before and stir with a **spoon**. And then, after, you will put in two ounces of **well-pestled sandarac** & will do as above. And then after, you will take **mastic & arabeic**,[c_074r_03] **two ounces each, which will both be well ground**, and you will put everything together, & will make it boil while stirring continuously, for the space of five hours. And then you will put *d'araueq* **rock alum**, two ounces, & then you will make it boil. And if you add two ounces of *l'arable* **arabic** to it, if you see that they are not cooked enough, have it cook more on a low

[c_073v_02] fire until it is cooked enough. And pour it into a **cloth** that should be rather tight. And when you have poured it, let it to cool a little. And if you see that it is too thick so that you cannot pour it, you will put a little of the said **oil** & you will make it better.

For making red varnish

Take **vermillion** and make it soak in **quite clear gum water**, like the other, and ~~s~~ make two or three ground layers as above.

For making yellow varnish

Take some **gum arabic** & ~~it~~^[c_074v_02] soak it with **water**, then take some **well beaten saffron**, & temper the said **gum**, and make it quite clear, then make your ground layer on that which you want to varnish, & let it dry, & when it is dry give another ground layer of the same, & let it dry as before until it is dry enough. Then take **varnish** from an **APOTHECARY**, dash by blows, one quite far from the other. Then wash your **hands** quite well & with your **palm** spread your **varnish**.

Recipe for white gum

Take **white wax** & **ceruse** & a small amount of **fine pitch** very well **pestled** together, & put it in a small new **pot** & make it melt. And when it will be melted you will make a **spatula** of **wood** ~~of~~^[c_074v_01] burnish what you want.

Green gum

Take **green wax** with a small amount of **verdigris** and make it melt as above.

^[c_073v_02]Red gum

Take **red wax**, **vermillion**, & a small amount of ~~resins~~ **resin pitch**, as above.

Bronze of copper

Take ~~da~~ some **verdet** & **clear glue**, & grind it together. Then make a layer on your **wood**, and take **pin filings**, and grind it on **marble** with **water**, then pour it on the **wood** & polish it with **copper**.

Bronze like tin

Take looking-glass tin, two ounces of quicksilver, & melt the looking-glass tin into a new pot. And *diffiant* as soon as it is all melted, put in the quick^[c_075r_02] *aiant* silver, & remove it from the fire, & let the said glue dry. Then take a piece of tin & burnish it on marble with clear water, and then coat it on the wood, and polish it with a piece of tin.

For making aquafortis

Take a half-septier of vinegar with one ounce of verdigris, & one ounce of copperas & one ounce of *solle*, then put them together in a glass vial.

Or moulu

Take fine gold & put it on a quite clean *but* marble & put aquafortis & start crushing. Then take saltpeter & sal ammoniac, and put it into a shell which should be large & washed, for safekeeping.

^[c_073v_02]For making gray wood

One needs to take three half-septiers of iron filings, xviii s deniers'-worth of glass alum,^[c_075v_03] & as much green copperas, six deniers'-worth of verdigris, *am*^[c_075v_05] pitch, & a quart of *curry* CURRIER'S water, and if you cannot find it, you will put more rainwater *[gap]* of small degree.

For gilding on wood

First one needs to put down a layer of very clear glue, and once dry, you will put down a layer of yellow gold. And when it is done, you will take fig tree wood, & put it to soak some space of time, & wash the places you want to gild, and cut your gold with a knife to the price that you will lay. And one must lay the said gold with cotton *ie.*^[c_075v_04] And if you can find a fig tree, take the the white of one egg & stir it vigorously.

If your gold does not have beautiful enough color, you will take a partridge feather, & make it burn in a chafing-dish, and make the smoke go against what you have gilded.

For gilding with *or moleu*

One needs to take a shell of gold^[c_075v_02] and, before you want to work with it, you will put it to soak with gum water and lay it down with a paintbrush, & polish it with a wolf's skin tooth when it is dry.

Recipe for putting all woods in color

For making it black, one needs to soak it in olive oil, and similarly for horn, as the case may be, four or five days, & then boil it where it has soaked for the space of one hour, & take it out of the oil, and take some natural sulfur or another

^[c_073v_02]if you cannot find it, and cover the said wood with this powder, until it is cool, & you will make it boil again, & boiling it, one will see if it is black enough or not. If it is not enough, you take the said powder & put it on the said wood while boiling.

For making wood green

One needs to take one quart of white vinegar & one ounce of green & one ounce of glass alum, all mixed together, and you will put your substances into a leaded pot over the fire without taking air, & then put the pot in a dung heap for fifteen days, and once it is out, you will boil your substances for the space of three hours.

For making wood red

Take one quart of old urine and three ounces of madder & one ounce of glass alum, and you will put all in your pot, & do as with green.

For making it blue

Take one quart of urine as above and one ounce of alum & two drams of sal ammoniac & half an ounce of pastel woad flowers, the whole made into powder, and do as with green.

For making it violet

Take one quart of **urine** & one ounce of **alum** & two drams of **sal ammoniac** & one of **lake**, & do as above.

For making it yellow

Take **urine** as above and two ounces of **guesdre woad** & one ounce of **fustet** and two ~~ounces~~ drams of **sal ammoniac**, & do as above.

[\[c_073v_02\]](#) For making very beautiful color of gold & of little expense

First take very yellow **orange peel**, & clean them well of the white that is inside, & pulverize them very well ~~and~~ in a very clean **mortar**. And take as much of **sulfur**, & grind all together, and put everything in a **glass vial**, & keep them **in the cellar** or **other humid place** for the space of eight or ten **days**. Then when you want to use it, one needs to warm it and use it where you want, & you will see a very beautiful color.

For making black ***goumiche***

Take some **glue**, & temper it with **vinegar**, & melt it, and it should be very clear. And take **lampblack** or another black & mix them together, then put it on **wood**.

For the white

One needs to take **white wax** with **ceruse**, and melt it all together, & lay it on **wood**[\[c_076v_01\]](#) or another thing.

For gilding on iron or tin

First one needs to wash that which one wants to gild in wine lees, and then wash it again with white wine, and take three ounces *terra merita* & a chopin of white wine, and boil the substances the space of half an hour, & put down your colors on your iron or tin, or other, and then let it dry on a piece of paper, & not put the hand in your materials.

[c_077r_02] Against redness of the face

Make a small lead cap & wear it overnight. Excellent secret. Try a lead mask.

Medicine of the orientals against all maladies

[Figure: fig_p077r_1]

Dry rosemary in the month of May, then fill this bowl with powder of it, and put a lit charcoal on top. And, receive the smoke by a quite tightened mouth, and a part will come out by your nose. But if you want to purge the head also pinch the nose. Against colds, rheums, and other maladies.

Fatty earth

FOUNDERS, to make the handles of their bells, use it. And before it is used, they beat it very well, then leave it to dry in the shade, little by little & for a long time, and mold with it very neatly. But it must not be sandy &, but rather well chosen & soft.

[c_077r_01] Recipe for making bronze and varnish of many sorts

For making excellent varnish with clear water which you will use with a paintbrush and immediately dry, for putting on paper, a tablet, or another piece.

First, you will take five ounces of eau-de-vie and one ounce of benzoin pestled between two pieces of paper or card or in a mortar,

^[c_077v_04]but it should not be too small, then take *fillegible* a glass vial not too big and put into it a half of these two, namely two & a half ounces. Next take the said benzoin just as coarsely pestled, and put it to use with the said water and let it rest for the space of one & half days, & then take the said water & put it into another glass vial & mix it very well. And on the rest of the said benzoin that remains at the bottom of the said first vial, put the rest of the water over this, and do as before when you see that the case is going well, and mix the first water with the second. By means of this you will be able to use it for something more noble.

Another approved varnish

Take two ounces of linseed oil & two ounces of petrolle oil and two ounces of mastic, the whitest you can find, and of glass alum,^[c_075v_03] & grind it, and take a little bit of white copperas, and put all these drugs together into an earthen pot that should be new, and lay it on hot ashes for a bit, and you will see a beautiful varnish.

Another varnish

Take petrolle oil & spike lavender oil, as much of one as the other, & mix it together with copperas, & make them melt over hot ashes, according to the quantity that you want to make. To lay down this varnish, put three coats on the work that you want to varnish.

Another varnish

Take one ounce of spike lavender oil & of sang de raiey^[c_077v_02] da Rac^[c_077v_03] & make

^[c_077v_04]these drugs melt in a new earthen pot, & when it will be melted, you will pass it in a clean cloth & you will see a beautiful varnish.

Another varnish

Take one ounce of spike lavender oil & heat it over charcoals, & then take a half ounce of sang dea^[c_017r_01] Raiec^[c_078r_01]^[c_077v_03] & grind it coarsely, and then put it into the spike lavender oil, & then mix it with a stick until you see that it is melted, and then put it in a glass vial. And when you want to use it, heat it little by little over the charcoals. And before putting it down, put down a coat of very clear glue, & then put it down with a paintbrush.

For making red varnish

Take **vermilion** & temper it with **gum water** as well as with other **water**, and make it like the other **varnish**, & mix this other **water** like the other **varnish**, and then lay it down as before ~~for making three green~~.

For making ~~tr~~**wood**^[c_078r_03] **green**^[c_078r_02]

Take **very strong vinegar**, **salt**, & **rainwater**, and one needs to put it all together with **verdigris**, and put it in a new **earthen** vessel with your **wood**, & put it in some very warm **horse dung** for the space of eight or nine **days**.

^[c_077v_04]For making **bronze** in the color of steel

Take **glass alum**^[c_075v_03] & **antimony**, but one needs twice as much **glass alum** as **antimony**, and pestle the whole together in an **iron** mortar, & then mix with **gum water** while grinding it on **marble**, & then one needs to use it with a **paintbrush**, & next let it dry, and then polish it with a tooth of a **wolf** or **dog**.

For making **bronze** in the color of gold

Take **copper filings** & **ocher** & **gum** & **alum**, & grind it all together in a **stone** mortar, and when it is well ground, you will lay it on the work with a **paintbrush**, then polish it with a tooth of a **wolf** or **dog**.

For making **bone** or **horn** green

Take **verdigris** & temper it with **strong vinegar**, then soak your **bone** or **horn** an **hour**, & then put it to use.

For making **bronze**

Take **pin filings** & other of **latten**, & put it together, & grind it on **marble**, grind it well with **water** little by little, until they are distilled, then put them into some new vessel. And

^[c_077v_04]when you want to use some of it, mix it with **very clear glue**, & then you will layer it on what you want two or three times, & then let it dry. But before layering it, lay down on it one layer of **very clear glue**, & let it dry, & rub the said **bronze** with a tooth of a **wolf** or **dog**.

For making **wood** gray

Take some **grais powder**, _____, ^[c_079r_01] **iron filings**, **ironware**, **alum**, **CURRIER's' black**, **copperas**, & **glass alum**.^[c_075v_03]

For making **water for disease of the eyes**

Take **white copperas**, & heat it a little on the fire, then put it as a powder on a **white cloth** stretched over a **very clean glass**, & the powder on top, then take **fountain water** & pass it through the said **cloth**, while stirring the said powder with the **finger** until it has all gone through. Then wash your **eyes** *at any hour* you wish & with the help of **God**,^[c_079r_02] **you will find yourself very well from it**.

For making **bronze** in the color of gold

Take six ounces of **calcined tin** & as much of **natural sulfur** & six ounces of **sal ammoniac**, and put the **tin** to melt in a **spoon**. When it is melted, put in **quicksilver**, and cast it in a line, then **pestle** all these **drugs** together in a **mortar**, &

^[c_079v_03]and put it into an **earthen** pot, & it should have many hot **ashes** underneath, & little by little you will make the fire underneath bigger and bigger, & one ought not to move it, & when it is cooked, & it needs to be for six **hours**, **mind that the fumes do not harm you for they are bad**.

For making **varnish**

Take some **mastic**, **sang** ~~daRage~~ **darac**^[c_077v_03], **gum arabic** & **spike lavender oil**, as much of one as the other, & make them melt all together, & before coating it, lay a coat of **glue quite clear**, & let it dry.

[c_079v_02]Antidote against the fumes of metals

In the morning, take a piece of toast with butter, & neither antimony nor any other vapor will be able to harm you. Or put half a pig's bladder in front of the face.

Tin for casting

They use common tin, which is the one that PEWTERERS use to make plate, which is composed of 9 or ~~ten~~ ten lb of fine lead for one quintal of tin.

Some find that there is nothing better than fine tin.

Mixture for PRINTERS

Make a layer of pulverized antimony, & a layer of latten & old scrapings or thin plates of iron or ~~ele~~ iron nail heads, and continue in this way until the crucible is full. And melt inside a *four à vent*, & then mix a little tin & fill up the crucible with lead ~~until it causes it~~. And increase the fire & mix to make the substances alloy well. The mixture for large letters is harder.

Petard[c_008r_04]

They make them of fine substance & fine copper, which is capable of fifty lb of powder, in the shape of a reinforced firkin, and having made a hole even of with the ground at the foot of a wall with gimlets, [c_080r_01] they set the said loaded petard in that hole, with the muzzle pointing up, which makes a large breach.

Very hard white stucco

White wax, Venice turpentine, eggshell & ceruse.

Fountains

[Figure: fig_p08or_2]

If you wish to make **water** rise higher than its source, make a **pipe** descend as in A to B. in order to give it push ~~to the~~ **water**, then from B to C make the **pipe** ascend again, which should not quite attain the height of the source, which is represented to you by this horizontal line, then make the **pipe** descend again from C to D, then raise it again, higher than the line showing the height of the source. And do this successively until you have reached the desired height, heeding nonetheless that the length of the descending **pipe** should be twice as long as the ascending **pipe**. This **cornet** folded back on itself also shows you a perpetual fountain which you can fit into some rock, pulling the **water** with which it is filled by the tip marked E, by sucking & breathing in. You can also make a watering pipe in this manner, such that the trussed-up length is as long as its straight pipe, & nevertheless does not descend as far down.

[Figure: fig_p08or_1]

[Figure: fig_p08or_3]

FOUNDERS OF SMALL WORKS

OF TIN

Make sure the pegs of your frame enter easily so that ~~n~~ in opening the frame will easily open without shifting anything, and that your frames fit well together, & that the table is quite even.

They usually cast with solder, even the things that should not come out empty, for the latter require fine & soft tin, which however would not release, & would not come out empty if it was mixed or had some looking-glass tin ~~mix~~ in it, just like they put in a little of it in soft tin. They engrave their works on stones of which are made the sharpening stones or files of BARBERS, which are found in great flakes near the mountains, & resemble slate. They are of three colors: reddish, which is not as perfect as the others because it does not last as long in the fire & as, one ~~dard~~ of the color of dark slate, the other whitish. When they have some relief, first they imprint it on carton as thick as one finger, to serve as a pattern, then with a little compass & little matching iron fittings, they engrave their figures, having first flattened their stones & worn down one against the other, they make their ~~p~~ molds of three or four pieces, to make a circle or a square which joins perfectly, because the stones render themselves even. Before casting, they rub the mold with tallow, which has quickly absorbed it because it is hot. Then, taking fine powder of quicklime in a linen, they pounce the mold while beating with the linen on top, then blow a little on top to prevent it from becoming porous. The main thing is to make vents, if the work is largish. They make them in this manner, as you see represented here. They pierce a hole in some place on the medal that is least visible. And then with a borer they pierce the mold on the side of the medal. And if they want their work to stay pierced in any place, they drive in a bit of cork at this place in the mold. And the lead or tin

[Figure: fig_p080v_1]

will not attach to it.

Try to engrave ^[c_004v_02] with distilled vinegar.

Try calcined oyster shells. They are said to be excellent for molding.

Sand

One can find an excellent one [on the little hill](#) of [Puy David](#)^[c_081r_01] near [Thoulouse](#) for [lead](#), [tin](#) & [copper](#). It does not want to be too much reheated because, drying out all at once, it loses its bond & burns at the first arrival of [metal](#), which makes the work lumpy & not neat. It is better to reheat from a distance, rather than with a [straw](#) flame, which generates [some](#) some [filth](#). Before filling in the [frame](#), you can put in the [finest sand you have](#) in a very fine [linen](#), & dry pounce the medal and then the [moistened sand](#) that you put on top, which has more body, will grip it.

[Tallow](#) makes it porous.

[Fixed mercury](#) mixed in when one wants to cast, makes [metal](#) [lead](#) run. But if it is pure, one ought to cast very hot so that it runs. And vents.

Earth for molding

[TANNER's earth](#), or the one with which [POTTERS](#) make a [whitening on pots](#) to make [lead](#) run better on them & to prevent the [lead](#) from being absorbed into them, is very good for molding the hollow forms of things you want make in relief. It releases better than [plaster](#) or [sulfur](#) which become hard once they have set. For the [earth](#) being ready, one ought to beat it hard so that it does not crack. If the piece is very large you can mold it in several parts. If you reheat it, it is necessary that it be over a closed fire. One finds this [earth](#) at [Fosseret](#)^[c_081r_02] & in another place called [Ox](#).^[c_081r_03]

Plaster

It is necessary that it be well cooked, which you will recognize when cooking it in an [iron](#) or [metal](#)^[c_016v_05] pot, you mix it with an [iron](#) rod, & if it attaches to the [iron](#), it is not cooked enough, if not, it is good. The [water](#) with which you temper it should be a little warm & the [mold](#) made with the aforesaid [earth](#) also a little hot. The work of [plaster](#) does not last & the faces & delicate things break if one does not give a coat of [glue](#).

Carton

One ought to take paper from Florence, which is the finest, & pestle it & soak it several times & change the water every day, so that it does not smell bad, & when you have molded it in the hollow form, put a linen over it, & from the back, rub it with a tooth, as if you wanted to burnish it, and it will mold very neatly. Then glue the cloth on the back with strong glue.

Sand

Only brick, very finely sifted, & worn down one against another, is good for all castings of lead and copper, mixed with urine. This needs to be of that whitish brick.

Making copper and latten run

Put in at the end, when it is very hot & when you want to cast, sal ammoniac & saltpeter, which removes filth & heats it. Mix some ardides with the latten. Guard against the metal^[c_016v_05] touching the iron or the latten of the frame, but cover it with sand or lute. Do the casting very evenly.

Sand

Calcined black pebbles from the river are good for lead, but they dullen metal.

There is only *illegible* clay earth with which one makes tiles, reheated & reddened & passed through a sleeve finely mixed with glair.

Willow charcoal is excellent^[c_081v_02] for sand for *b* lead.

Latten runs better.

Frame casting

It is good to make it with **boxwood**. Turn it in order to make it even, as this is important for the casting. Lute also, or cover the mouth of the frame with **sand** in order that the melted **metal**, or **lead**, or **copper** does not touch the frame's **iron** or **latten**, because it makes it brittle, & makes it porous. Also make sure that the cast is always higher than the **mold**. Also guard against the cast being too wide or too deep because the narrower, the better. For when it is big, the weight of the substance that runs breaks & shakes loose the **mold** & makes it porous. When you have cast, gently tap the frame, in order that the substance spreads better. **Black lead of saulmon**^[c_028v_04] from the first melting makes a very neat one.

Heat of copper

It is hot enough when you see it neat & even on top, without **filth**.

Frame

Iron & **copper** make it porous if the **metal**^[c_016v_05] touches it, & the **wood** warps. Thus, make a mold of **wood**, & have frames of **bricks** made inside this mold of whatever thickness that you want.

Glair of eggs

Glair of eggs gives strength to **sand** to make several casts.

CLOCKMAKERS

To divide the teeth of their cogwheels proportionately, they do not use a compass, for there is none so fine that it can compass distances as small as those of the small cogwheels. But they make a platform (as they call it) of latten make divided into several circles, & each circle is divided into ^[c_o82r_o2] equal distances marked by a point, and each circle has a certain number of them, for example one 30, another 36, another 40, &c. Then, on the pierced center of the platform, they set the small cogwheel there, and on the center of the cogwheel a flat line or alidade which is moved to the circle with the number that you want to mark on your cogwheel. Then they mark a line on the cogwheel with a sharp point, then move the alidade to the following point, & continue to mark thus. And to mark the points on the circles of their platform, they divide the circle into three & then divide this third part into as many distances as is necessary with regard to the total division of the circle, & make in this manner their division & distribution of the teeth as fine as they please.

[Figure: fig_p082r_1]

CLOCKMAKERS

In the past, they tempered their springs by dipping them into molten lead. But *today* they temper their springs straight, & bend them once tempered, which is a ~~pe~~ beautiful secret.

Casting lead in lead

There are some who make their hollow forms with thick lead, then cast lead in them.

Lead when not cast hot enough, is white, & blacker when cast well hot.

One can make a lead mold, & to cast in it, smoke it with candle black. But it is never that neat.

Never does lead come so neat as tin. ^[c_o82v_o1]

Sand

If it is too fatty, one ought to reheat it and sieve it again.

Method of casting in bronze

Latten of potin *eor*, which is the most brittle, molds more neatly, according to the opinion of many people, than **fine latten of pots**, just like all **fine latten** molds neater than **red copper**. If you want to cast something fine & thin, the entire secret is to cast as hot as possible so that the substance boils. You will recognize that it is hot enough when it **smokes** a lot and while stirring it throws sparks. To heat well, place your **crucible** as low as possible & at the very bottom of the **forge**, so that the **bellows** ~~fra~~ beat on the middle of the **crucible**, for in this way it is better than on the **grate** on which one usually puts the **crucible**, under which the **bellows** beat. It is true that the **crucible** risks more danger breaking, but you can **lute** it as you know **FOUNDERS** do. And also, one ought to maintain the **charcoal** between the **bellows** & the **crucible**. Also take heed to cast all at once & not in increments & drop by drop, which would stop & plug up the conduit of the substance. And if you were to make in the cast a trough to feed the medal, it would be even better. And in order that the substance heats well at the bottom, stir it, once melted, with a **stick**, for **iron** only makes it brittle. Turn.

Some put **wool stuffing** in order to heat it & make it run.

Put under your **crucible** a thick **iron slab**, which will redden & will maintain the heat under your **crucible**.

The **copper** substance is found to be good for casting, when once broken it makes the grain long & not short, for it demonstrates that it is soft. It is half **fine latten** & half **red copper**. This long grain is called long stalk.

Sand for lead

R^[c_083r_04] **grey soot from the furnace of the SILVERSMITHS**, **quick lime**, and **flour** ana,^[c_083r_03] moistened according to the art, being the finest possible.

The **grey soot of LOCKSMITHS**, which is held in the **forge**, is very fine once ground, molds very neatly, & releases very well.

Sand for copper medals

R ~~hat felt burnt~~ on a covered fire, ~~dross of iron~~, & ~~burnt bone~~, all of which ground very finely & pestled & watered with ~~saltwater~~; & make a paste of it & mold it, & wipe it over a ~~straw~~ fire. These three ~~sands~~, pulverized and very finely ground on ~~porphyry~~, mold well, and I think that separately each of them is very good. ~~Burnt hat felt~~ molds very neatly and releases very neatly.

~~Plaster~~ molds very neatly but it becomes porous. ~~Bone~~ has scarcely any body unless it has ~~iron dross~~. ~~Felt~~ makes it release.

Another sand

Charcoal of ~~vine shoots~~ & ~~clay earth~~, ~~well-cooked~~ & well sieved, as much of one as the other, & join them together with ~~well beaten glair of eggs~~, then calcine in the furnace, & to use it, temper it with ~~vinegar~~.

Another for lead

R ~~finely pestled slate~~ & ~~calcined~~ ~~pumice stone~~, mixed together. Calcine them in a well covered pot, & thrice stoppered over a good fire, & each time temper them with ~~varnish~~.

Another

R ~~p~~ a little-cooked tile, ground & tempered in ~~white wine~~ with ~~burnt black tracing paper~~, & if you add ~~burnt horse dung~~, it will be all the better. Moisten with ~~glair of egg~~.

~~Tracing paper burnt~~ over a closed fire is reduced just as ~~charcoal~~ & very soft black, molds neatly & makes it release well mixed with the others.

Excellent sand

Alabaster calcined in a *crucible* over charcoal fire, so that, touching it, it turns into powder. Once cold, pulverize it finely & pass it through a double sieve & render it as if impalpable. And ~~d~~ with one lb of alabaster, one needs one $\frac{1}{3}$ of sal ammoniac. Mix well & incorporate everything together, then put them in a ~~cellar~~ cellar or a humid place. And with this paste, mold what you will need, & next dry the mold in the fire, & cast whichever metal you wish, while the sand is hot; & you will cast as neatly as the principal, ^[c_137r_03] & the sand can still be used by placing it in a humid place & drying it in the fire.

A way for molding excellently with water

Dissolve in humid place some sandiver, and then place this water on what you want to mold, having encircled it, and place it to coagulate on the hot ashes. Do the same with vitriol & copperas, which, once well calcined, reduce in water.

Molding in relief on one part and hollow on the other

It is necessary to cast two pieces of **copper**, **latten** or similar **metal**, very neatly, and then when you have molded the hollow form in the **sand**, leave the figure of **metal** that you ~~s~~ have molded in the **frame**, without moving it from its place. And cast, & if there is not enough thickness press a little & push the figure down in the **frame**.

It is good to mold always the faces not on the side of the cast, but with the head on the bottom, because the force of the substance is at the entry of the medal, & there, where the force is, the **filth** & **grime** accumulate. And, in this way, if you were mold the face toward the cast, some **grime** could be found there, & it is better that is found on the clothing, which is easier to repair.

Vinegar is better for moistening than **wine**. It is necessary that the **frame** be quite smooth and even otherwise, ~~And that the cast be~~ as you press on one side, the other one lifts.

This is why the **press** is better, for it tightens evenly, & more than your **hands**, and makes the **coarse sand**, which is humid, communicate its humidity to the **soft & fine sand**, which is sprinkled & pounced dry on the medal.

When you mold, always leave your medal in ~~the one~~ some^[c_012v_01] **frames**, ~~Is~~ without stirring it because, if your hollow form is not molded very neatly, you can put it back in the right place by means of **pegs**, which will prevent it from shifting. But, at first, pounce your medal with very fine **willow charcoal**, & ~~se~~ next clean it, for this degreases it, & makes it easier to release afterward.

Do not knock it when molding because this will shake loose the **frame** & the **sand**.

Bellows

To melt with **bellows**, & hasten your melt, & also cast hotter **pø**, do not place your **bellows** at the bottom near the foot of the **furnace**, for fear that some **charcoal** might ~~you~~ enter it, put them almost under the **grate**. It is good that your *four à vent* be in an **aerated place** so that the **wind** might make it heat better, & that it be well dry, & reheat. One ought to plug the doors of the **furnace** & that there is only the entry of the **blast-pipe** of the **bellows**. And by the end, you need to give it force, as at the beginning you will blow gently.

Impromptu mask

Mold some **paper** & put it on the face of somebody who is making an ugly grimace. Let it dry & take your pattern to paint from it.

^{#[c_084r_02]} & swellings. It is necessary that it not be too humid for the aforesaid reasons. Reheat little by little. And if, after molding it, you leave it to dry slowly, in some **dry place** & not over a big fire, it would be better, for when one exposes it all at once to intense heat, it warps. I believe that reheating it at the mouth of the *oven*, *after the bread has been taken out*, would be very proper. One ought not to complain about the difficulty of preparing it, for it withstands as many castings as you wish, because it renders itself as hard as **marble**, & you can polish it, & the **mold** cannot be spoiled. Once used, **pestle & sieve** it again, yet without being scrupulous to render it so fine, ~~for~~ for having been passed only through a **common sieve**, it has more force ~~than~~ and releases better, than when it is so fine.

Eau magistra

Dissolve **rock salt** or ~~salt~~ finely pulverized **sandiver** & put on **marble** in a **cellar**, & it will dry out by reheating the **mold**, & will give it a bond to withstand several castings. *Try to moisten it with tartar oil.*

Flour

Ground during *Advent*,^[c_084r_05] keeps for the *whole year*.

Sand from a mine of Thoulouse

The sand from Thoulouse, which is taken from the depths of the earth, from the small hill of Puy David, is excellent in itself, but to make it withstand several castings, I mix it with pulverized sandiver & moistened, which hardens it, & takes body & bond with it, & makes it withstand ~~more than five~~ as many castings as you wish. *Try to moisten the pestled glass* and other ^[c_084r_01] sands with the waters of the aforesaid salts. It wants to be, like all natural sand, well reheated before putting it to use. One pulverizes it, because it is in lumps, then one reheats it in a copper kettle or similar thing, until^[c_084r_04] it no longer smokes.^[c_084r_03]

It is necessary to reheat it before using it. It is rendered better for casting because it is reheated, but when it has been used a lot, one ought to refresh it with new sand.

Sand

I tried the bone of oxen feet, thoroughly burned & pulverized & ground on porphyry, until it is not felt between your fingers. It molds on its own very neatly. But because on its own it is very arid & lean, it wants to be well wetted & moistened with wine boiled with elm root.

Iron dross, well burned bone of oxen feet, felt also well burned over a closed fire, and all three very well ground on porphyry mold very neatly in lead, without needing to be reheated a lot, & casting it in a hot or cold frame.

Felt alone molds very neatly once moistened & releases well, and also makes the other two release.

These sands only withstand one casting.

A fatty sand which is rendered very smooth, makes it porous.

A fatty metal needs lean sand.

Eau magistra

Some people think that salt water is not good, because the salt cracks in fire, & consequently should make it porous. There is only the wine boiled with elm root.

Charcoal for pouncing makes for a good release, but one finds that the one of willow makes it porous. The one of oak or beech does ~~make it porous~~ well without making it porous.

Try burnt oysters.

Lead

For casting, there is only soft lead that wants to be cast very ~~g~~ hot, and soft tin.

Sand for lead, the most excellent of all, for high and low reliefs

X^[c_084v_02] I took ceruse and crushed it dry on porphyry to make it very fine, then I moistened so much with well-beaten glair of egg that it was like a paste, smoothing it perfectly with the dull side of a knife. I left it a little

One ought to mix it well with a knife.

to rest on a very clean & smooth table, & since it is desiccative, I knew it would dry out ~~for~~, which I let it do in order to reduce it to powder & to mold it with sand, broken up with my fingers & the sharp edge of a knife. I oiled my medal, because oil cleans it without spoiling it. ~~And~~ And having dried it & cleaned it with a linen cloth & very small hog bristle brushes, I once again lightly anointed it with clear walnut oil & gently passed a linen cloth over it so that it does not remain too anointed, and I noted that, by this means, it would come out better in release, because the ceruse, once moistened with water of glair of egg, would not attach to the oil. This worked very well and I molded a medal of high relief very neatly, without any sticking, which a lot of good sands, such as felt, burnt bone & iron dross, had failed to do on the first try. I reheated it & my mold became hard like marble, and by this I knew that sands for molding high relief should be well moistened with some water, which gives them body & compactness, such as glair, gummed water, ~~ea~~ wine boiled with elm root, &c; and lightly oil the medal, it withstands as many castings as you wish, for it is as hard as glass. But even soft lead & brittle tin ~~v~~ want to be cast very hot.

Since then I have realized that this sand, even though it is excellent & endures many castings & molds very neatly, nevertheless is fatty and makes things porous. Thus, soft lead ~~and the~~ does not come out so well. But try to mix it with a lean sand, such as pumice, scales & similar things to give them body & so that they release better. For lean sands barely release well and yet they receive metal well.

Try to mix ceruse or minium with other sands.

X

Oil & anoint with aspic oil, which will go away when reheating, for the oil makes it porous.

One ought to moisten with glair, then mix it well. And once in the frame, beat on top with a pestle, or other appropriate thing, for this makes it mold better and release better.

It would be good to fill the frame all at once, for the mixture that is made of several sands with that of the mine, with which you fill the frame, corrupts it.

Green varnish for medals of copper

Having cast them very neatly, cover them with sel de verre that we use for sand & moisten it, & in three or 4 days it will be green. Next, oil them & keep them under the dung.

Glue

The **Flemish** reglue their **earthen** pots with gold color, that is to say **minium**, **massicot** & **varnish**.

FOUNDER

They mix **beaten glair of egg** with **earth** with which they make the first layer of the cope of pieces, & bells, & all other pieces, saying that the said **glair** makes it come out *d* neatly, & lays down & settles the substance. *En noyau* for a small work, **glair** is also good.

Rosette, to come out neatly, wants the **mold** to be a little hot, & **lead** which has also been mixed with the **rosette**, especially for small pieces.

Mortars

It *s* is necessary that they be of the finest substance possible, such as **copper for cauldrons**, which is better than **rosette**, in order that it withstands the blow better.

Also the **mortars** for **pestling** are stronger & less in danger of breaking if they are of **fine copper**. And for a **private home**, they do not *ring* so much & do not carry as much *noise* as those of **metal**.^[c_016v_05] It is true that those that are of **metal** have more of a *ring* for the
APOTHECARIES.

Grenades must be of **fine metal**.

Sand from the mine

It wants to be well reheated for **great metals**. Some burn it in the **furnace** until it is very black and grind it finely on **porphyry**. Others burn it with **aspalte**, but when it is too burnt, it does not mold so neatly, because it does not have body and is too lean. You can give it body with **tripoli** or **burnt felt**.

Experimented sands

X^[c_084v_02] I have experimented with sand from Thoulouse, & after reheating it well twice, in a skillet, I passed it through a fine sieve, like the APOTHECARIES' double, without finely grinding it further on the porphyry, as I have done previously. I moistened it with wine boiled with elm root and molded with it a large piece of a portrait of Jesus.^[c_085v_01] I found it easy to release, without having it to knock on it, *Jen* & molded neatly with one side in relief & on the other in hollow, & of the thickness of a coin of forty sous. I cast very hot

Sand from the mine, well chosen & well reheated, is the most excellent of all, without looking for any other mixtures, because it receives all metals. It does not want to be used hot, because it makes things porous. The most finely ground for big works is not the best, because it does have enough body to sustain.

with the material of a skillet mixed with a knob that is potin. And before that, I had so reheated my molded frame, now with the flame of my furnace, now putting lit charcoals on top of it, that it became as if red. I let it cool and cast. It came out very neatly in relief on one side & in hollow on the other, as well for the figure as the letters. It is true that the material was whitish, almost like metalline, but this was because of the potin. I made another cast with only the material of a skillet in the same sand, but not so reheated; it did not come out well.

Since then I have molded the **bone of oxen feet, burned, pulverized** & sieved through a double sieve & ~~hum~~ very moistened with **glair of egg** or **wine boiled with elm root**. I knocked on it moderately while molding. Having ~~undone the~~ opened the frame, I found that the figures had not released neatly & left the molds floury & crumbling. I ~~them~~ moistened the **bone sand** further, so that it gave a good hold ~~in the~~ between the **fingers**, and in this way, I molded neatly with a good release. And even though it seemed to me that the **pulverized bone** was coarse, if there is some **material of a skillet** thrown in, my figures came out very neatly. It is true that I had very very reheated my frame; it withstood only one cast. *I find that* when a **sand** is so finely ground that it renders itself dense as **ceruse** & even, ~~like~~ without knowing it to be arid, rarefied, sandy & rather spongy, that it molds very neatly, but it does not receive **metal** so well as if it were porous to absorb the substance. But rather, once fatty & even, it becomes porous & does not receive fine features. *I believe that the secret* to cast well lies in finding a **sand** that receives the **metal** well, one for **lead**, the other for another, for each one has its particular one. Let it be molded slowly & carefully, and leave it for a few days to become compact by itself, if you have the time for this. And next, reheat it very well, not all at once nor with a large fire, but little by little, otherwise it crumbles & always has some fault. Finally, you ought to cast **copper** or **latten** or other **great metals** very hot &, if it is possible, in large quantities of substance, which contain more heat than small quantities. It is necessary that the frame be cold, & that you cast all at once. Always lute the entrance of your frame, for the **metal**, touching **iron** or **metal**,^[c_016v_05]

This **bone** wants to be well pestled in a mortar and does not want be reheated because it crumbles.

becomes porous. Most importantly, make it so that the cast is always higher than the molded thing, because usually the **sand**, being reheated, swells & ~~if the~~ ~~by this~~ in the middle, & in this way, the molded thing remaining higher than the cast, the **metal** cannot run into it easily or enter at all. Also, make sure that the mold & the cast are well reheated. Cast also all at once & **out of the wind**. And if your medal is really thin, put a **card** or two or three thicknesses of **paper** underneath, when you want to mold it. In this way the mold will be lower than the cast. Cast also at the place where your medal will be ~~more~~ ~~es~~ the least thick & where there will be less relief.

Excellent sand for lead, tin, and copper

D^[c_o86v_o1]

Since then, I have molded with **burnt bone**, **iron dross** & **burned felt**, thoroughly pulverized & ground finely on **marble** and well mixed together. I moistened them very well with **beaten glair of egg**. And having covered the medal with it, as in the others, then filled the **frame** with **sand from the mine**, I knocked moderately. I found it to be of very good release & molded very neatly. I let it sit an entire *night*. The *next morning*, I reheated it little by little, over the course of seven or eight *hours* (*for if possible, no humidity ought to remain in the frame*). I cast twice in **copper** alloyed with **¢**, as **old K**.^[c_o86v_o3] The substance turned out very beautiful, shiny & *sonorous*, & without a crust, and my **sand** was not corrupted at all. Since then, I have cast with it several casts of **soft lead** & **tin** that came out better & more neatly than any other that I have ever found.

When you mold, make certain lines around your **mold**, in the **frame**, in order to attract the substance to all sides, in this way.

[Figure: fig_po86v_1]

Potin of syringe & other **ee** works runs even better than **fine latten**. But I think that it is better half **copper** & half **latten**, which have been used & have been in very thin works, such as skillets & other similar things. I have seen this mixture of half come out well.

To mold well, one ought to cast in a big *frame* several medals together, for when there is a lot of substance & the *crucible* is almost full, it heats more, & then, if one medal does not come out well, the other will be good.

It is better to melt in a *bellows furnace* than in a *four à vent*, because it gives a more vigorous heat. It is true that *latten* melts well in the *four à vent*, because it is easier to melt than *copper*, being more brittle.

Some *FOUNDERS* have this superstition, that only *three days a week* are good for melting, namely *Tuesdays*, *Wednesdays* *Thursdays*, and *Saturdays*. The others, for them, are unlucky.

When you mold, do not knock excessively on the medal, which is in the *sand*, because it prevents it from releasing very neatly & shakes loose the *mold*.

Take heed also that the *sand* does not surpass the edges of the *frame*, for it makes the molded medal higher than the cast, & in this way, *metal* will never enter the mold. Therefore, always make sure that the surface of your cast object surpasses the *mold* in a straight line, and to do this, if it seems good to you, put a piece of *carton* of whatever thickness you please.

FOUNDERS, in order to prevent their large cast works from becoming porous, are careful to reheat their *molds* very well. And to know if they have been reheated sufficiently, they knock against it with their *finger*, & if they start to *ring* like a pot, then they are sufficiently reheated.

To cast their *cannons* neatly, they mix their *earth* with some *fine casting sand*, if they can find any.

Sand from Thoulouse

The usual *be* good one is *the one which is found in a vineyard near Puy David*, but the one which is most excellent is *the one from the Touch, near Saint Michel & toward Blagnac, in a vineyard that is quite high up*. The latter is finer & a little fatter than the other, & better for small works. It does not want to be reheated too much.

Sand, slate, and burned earth

Thoroughly burnt sand loses its bond. Slate is reheated & molds neatly. Next, it is true that it often becomes porous, as burned earth also does, as fatty sand also does.

I find that one ought not to knock on very finely ground sands, for it shakes them loose & makes prevents them from releasing neatly. But one ought to press hard and moisten them sufficiently.

Magistra

FOUNDERS take the roots of a young elm when it is in sap & boil it in wine, or better yet vinegar, and keep it *all year long* in a barrel.

Sand from the mine of Thoulouse

Casting sand coming from the mine, once passed through a double sieve, next put in with melted resin, burns & inflames & becomes all red & inflamed like iron. Once cold, it is completely black and can be ground very finely on porphyry. Having prepared it thus & rendered it without asperity on the fingernail, I moistened it with beaten glair of egg & beat it well, until it was not pasty but rather powdery. I found it of very good release, & molded with it in lead & tin very neatly, but it wants to be well reheated & at ease.

Others beat it well in a mortar, in small amounts at a time, & thus it is *pressed together* and rendered very fine. Then they reheat it moderately, only to dry it. Next, they grind it dry on porphyry. And thus it becomes as if impalpable and not too dried out, it and it retains the body & the bond of the earth to which it is kin and is better than when it is so burnt. Once moistened with glair of egg passed through a sponge, it releases ~~very neatly~~ *M* very neatly in low relief, but not for figures in high relief. Therefore, since then, I have experimented *lexper* with moistening it only with very strong vinegar. It released a figure which I could not release previously. And I believe that, moistening the finest in a fashion as with glair, & the coarsest, for filling, with gushes of salt water or wine, that they do not join so well. But as they are of one nature & are moistened the same, they embrace each other & hold together one with the other.

For molding well, after having prepared your sands, mold *in a day*. Slowly reheat them *the next day*, then cast them on another.

One ought to choose the one which is as in clods & lumps, well deep in the earth, for usually the one that is found higher up is too much a kin of the earth, and the lower is a kin of the rock.^[c_087v_01]

I have molded it from pure lead cast very neatly hot, & I had as an example the very neat principal,^[c_137r_03] but the vinegar hardly gives it any bond, & thus it sustained only one cast.

Osier

It can be planted, like the bramble, on both sides, & those who plant the large feet against a slope say that it makes a larger stump. But it only has a point at the top, for it grows higher.

Mortars

Fine copper mortars do not throw fire, as long as the iron pestle is not tempered. The metal^[c_016v_05] mortar does the same, because it is sour. One makes, for this purpose, the bottom of large mortars from fine copper.

Varnish

Turpentine oil, turpentine & good eau-de-vie to render it desiccative. Heat it without mixing on the chafing dish, so that it mixes *pu* by itself when melting. Next, test on a very clean knife, & you will know then if it has enough body & if it does not run too much.

Grafting

One finds by experience that the graft that *is* has its entrance into the incision on the sunny side takes very rarely when it is also bent.

BAKER

Dust keeps wheat from *becoming infested with weevils*. And to clean it well when it is stained & as if rusty, pass ashes through the sieve & mix them with the wheat, then bould the whole with a boulding cloth of rough cloth or canvas. The ashes will pass through & your wheat will stay yellow, clean & very beautiful.

Looking-glass tin

It makes the substance whiter.

Sand from pulverized rock salt and sand from the mine finely ground on marble

The one and the other, once very finely ground on **marble**, after having thoroughly pestled them dry & beaten in the **mortar**, I mixed as much of one as the other, and having reworked them together on **porphyry** & passed them through a **double sieve** or through the sleeve of a shirt to mix-^[c_088v_01] them even better, I put them in **paper** & put them on a **marble** in a **cellar**. In one **night**, they had been wet enough by themselves without moistening them further, because **rock salt**, like all other **salts**, dissolves **in the humidity**. I molded very neatly with it, because both were very finely ground. They want to be *f* humid enough to release well.

^[c_158r_01]Mineral sand

It does not matter if the color is white or yellow. Above all it must be in one piece & as if taken from a **quarry** or **rock formation**, & the deeper one takes it from, the better. The signs of its goodness are that it is thus amassed, and that when removing itself in the form of **rock**, it comes out in lumps & *qu* bricks, which demonstrate its bond & that it is not too lean.

However, it should *break apart between your hands* & have very small *men* & delicate grains & of the same nature. If it is not delicate enough, you can pass & grind it finely, either through **water** or through a sieve & ~~when it~~ or on the **porphyry**, & in this way, from *sil* lean they become fatty & well bound. You can mold with it in *sa* frame or *en noyau* without **cloth waste**, & try it with **lead**, for if with this it does not become porous & casts neatly, it will also behave well with **copper**. Some say that the **fatty sands** do not want the **metal** to be cast too hot. **ARTISANS WHO WORK IN LARGE WORKS** &, who for profit, do not need to grind & seek the curiosities of **artificial sands**, benefit more from seeking some that is ready-made by **nature**, which has the finest grain possible, & for small works, they only pass it through a **sieve**. But those who work in small works, finely grind it & grind it impalpable, because they do not need a lot of it.

Orberé grain makes a tawny powder, very delicate & very soft, which, once mixed, could *mix* mold very neatly. Try **wheat flour** burned over a closed fire.

Sand of burnt ox bones and rock salt

I have pulverized them separately & finely ground them on **porphyry**, as much as I could. Then I mixed as much of one as the other & reworked them on **porphyry**. Next, I moistened it in **paper**, folded in a wet **napkin**, which is previously made in the *serain of the night* or in the *moisture of the cellar*. And I have not found anything else which releases more neatly than this one. It wants to be rather humid. And if you want to cast very thin, make sure it is very hot. It came out very neatly in **soft tin**, like the principal, ^[c_137r_03] and withstood several casts. For **tin**, I believe that it is not necessary to seek a better one, nor for **fine lead** either, which comes out almost as neatly as **tin**. ~~For~~ The **bone of the foot of oxen** is always so lean on its own that, without being mixed with one or two parts of some **fatty sand** & one that has bond, such as **tripoli**, **salts**, **felt**, **ashes** & similar things, it would not release & would not mold neatly, for it crumbles.

Reheating or drying a molded frame

Always put the most delicate part, such as the face, above, so that nothing falls in it that could hinder your fusion.

Natural sand

It does not want to be reheated for **lead** and **tin**, ~~and~~ and is better very new & fresh. ^[c_070v_01]

Sal ammoniac and alabaster

Sal ammoniac, well pulverized *mœu* & ground dry on marble, molds very neatly & is of a very beautiful release, & once mixed with alabaster, pulverized similarly, ii 3 per lb of alabaster makes it release well. It suffices to moisten it in a cave or in the *serain* or, to be done more quickly, in a piece of paper between a wet napkin. Take heed that it does not stay for too long, for it would become so wet that it would not be good for molding in a frame, but rather *en noyau*, in which you will be able to use it well as long as it dries well at ease & far from the fire. Otherwise the heat makes it swell & pushes the salt onto the surface, which renders it lumpy. You can ~~in~~ anoint the medal with spike lavender oil, molding *en noyau*. It is better to put in 4 3 of sal ammoniac per lb, and moisten it in a humid place for two or three days, & so that when you take *fistfuls*, it holds together, without, however, attaching itself & being pasted to your hand. You will mold very neatly with it. But let it dry & reheat very thoroughly, leaving the mold inside so that it acquires strength by reheating, for it becomes hard as stone &, in this way, is more certain to release well. Otherwise if you release before having reheated it, there would be danger of it crumbling in some ^[c_089v_01]

^[c_089v_02]place because of its delicateness & fineness, even if the medal has a high relief. Once you have molded with it, pulverize it as before and put it back in the humidity.

All sand that releases well has body & gives a good hold. Ammoniac is fatty and ~~a-va~~ is nevertheless sandy, which makes it release well. There is no better bond than salts appropriate for metals, for once mixed in powder, they get moistened together & dry & reheat together.

GLASSMAKERS' white sand from the mine, mixed with sal ammoniac

There is found in Cominge, near the town of Aurignac, a sand white *māi* like salt and lean, that GLASSMAKERS & POTTERS use, which becomes impalpable ground on porphyry & is easy to grind. And once ground, it resembles calcined alabaster. It molds very neatly, and I have not found any that molds as delicately as this one for low^[c_089v_03] relief. It is excellent to mold *en noyau* without a frame, having ground it impalpable with gummed or pure water on porphyry, then placing it, thick as mustard or a little more, on the medal, anointed lightly with oil either of olive, walnut, or even better spike lavender. But to do it better *mθ*, let it dry by itself, without fire, for one or two days. Although, if you are in a hurry, you can heat it well, & it will not crack if it is not put on too lightly. It is true, being thus suddenly exposed to heat all at once, it makes some holes & pustules, which it does not do when dried in the cold or at ease rather than being reheated. Once dry, reheat it & it will withstand several casts.

Sal ammoniac and iron dross

I have pulverized sal ammoniac, dried well in the fire & in a hot bronze mortar, and passed it through the double sieve; it became very fine. But to render it even more delicate, I have ground it dry on porphyry. Then, I mixed it with pulverized & finely ground iron dross, in the same way, and both mold very neatly things in low relief without being moistened in the *serain*, or in the cellar, or otherwise with the napkin, & it releases very neatly.

Sand

MOLDERS from Foix who cast their *tt*^[c_090r_01] medals crosswise,^[c_090r_02] use *crocum ferri* and calcined slate. It is for very flat things.^[c_069r_04]

That any sand can be rendered good

ARTISANS WHO WORK IN LARGE WORKS & who need to further their profit by seeking things already prepared in nature, because she does not sell her wares to her children, and to also save the time they would use for grinding finely & for artificially preparing sands, seek the one of the mines, which is not too fatty, the one that is a kin of earth, not too lean & consequently without bond, but rather that which is pulled from the depths of the sand-bed in bricks & clods that show its natural compaction, which is quite difficult to break & which has a very small & delicate grain, & which is found *soft when handling it between the fingers*. And because the latter is only found near the rocks in mountainous areas or lean territories, & akin to the *arene*, it cannot be found in the surroundings of all the *bonnes villes*^[c_028v_02] where ARTISANS willingly gather. And thus, if they do not have it close to their house, they prefer to have it come from afar, like from Lyon, Venice, Paris near the Saint Chappelle & similar places, rather than prepare it. However, you can be certain that in all places you can render the sand from a mine

good & proper for molding. For if it is coarse, pass it through a sieve, and if it is not yet fine enough, wash it, & when the water has rested a little, empty that which is still troubled in some separate vessel. The coarse will promptly fall down to the bottom of the first vessel, but the one which will have come from the troubled water, set apart, having settled, will be very fine. And then, if it does not have enough bond, grind it quite dry on porphyry, & you will render it impalpable, & which will have bond like chalk. Then, if it seems right to you, you will reheat it & again will grind it & mix it with salts, or linen, or burnt felt, or ashes of paper & similarly washed things.

Terre fondue of POTTERS

Grind it in a mortar mustard mill with some water & render it impalpable, dry it & next moisten it with salt water, which gives strength to all sands to withstand several casts.

Orange trees

In *Italy*, those who are in the colder regions, like *Lombardy*, make square wooden cases, a little larger at the bottom than at the top, and affix buckles on its sides for transporting them with straps, as one carries gout sufferers, because the wheels with which one could make them roll spoil the pathways of the *gardens*. And every two years, they do not forget to open the sides of the cases for trimming & dexterously cutting, with the soil, the ends of the *orange tree's* roots, because otherwise, as they find the wood, they contract & fold back on themselves & dry at the tips & would make the tree die. But as they are trimmed, it preserves for them new space *eēs* for expanding, without finding resistance from the wood that hinders them. And know that, for this effect, it would be better to join the sides of the cases with screws & not with nails, in order to not shake the *soil* when one opens them.

Grafting

With any tree that has coarser marrow, the graft is awkward to *be cut well*, because there is a danger of wounding the marrow, & if it is wounded at the point of juncture, it takes uneasily, like from the *vine*, from all *peaches* & *apricots*.

Apricot trees have a very thin bark, & thus one needs to graft them onto young trees which do not yet have thick bark, like on shoots of *prune trees* & *almond trees*.

The grafts scarcely *[illegible]* take if the cut of the tree is wet. One needs then to graft in *serain* & mild weather, & not too cold & windy.

Old wood that one leaves to the graft is necessary if one grafts on a tree that is already made & of good size, because being such, it tightens the graft more, & if it is from young wood, it is so compressed that it cannot profit. But old wood resists the compression of old wood *than the young* better, because it is harder than the young. *[c_091r_02]* But if the graft is all of old wood, it will never hold beautifully, but turns fragile & short & slow to grow.

Molding with cuttlefish bone

Guard against keeping them in a humid place, for they are very prone to getting moist. If your medal is small, cut the bone in two, then even it out with a knife. And on a hooked roof tile, quite dry & quite smoothed & covered with pulverized willow charcoal, rub & smooth the two halves of the bones. Thus they imbibe this willow charcoal, which makes them release well & guards against removing anything. Then, on a counter bone, that is to say a piece of brick evened to the size of your bone, place your medal, & then on this one, place the bone, & press well with some other piece of the same size on the top. And for the second time, mold it, but before, pounce on top with willow charcoal & blow lightly, then press as before, and it will come out neatly. If it is for a spoon handle, one needs two whole bones. All cast work is brittle & subject to breaking, because the metal expands when cast, & retracts & condenses under the hammer. That is why one ought to retrace the cast thing with a chisel, & in this way the metal retracts. Let it thus *escrouir*. If the piece for molding is of high relief, first trace the mold & hollow it with a penknife to make way for the medal, & then mold. And if the medal has two sides

Before casting, heat the bones in order to make them lose only the coldness & moisture.

When the lead gets too hot, it calcines.

since the two **bones** are joined, ~~ee~~ cut them evenly all around, & make notches *e* around it in different places which cross over the join of the two **bones**, in order to recognize well the place of the first join. Or else, with little shards of **wood**, pierce them, or ~~ma~~ coat the joins with some **clay**, & dry. Press, ~~between them~~ your **hands** joined between your **two** knees & not with a press, because the **bones** would crack. Mold also at your leisure & two or three times, until you see that it is pressed quite tightly together & well imprinted. And each time before replacing the piece, pounce with some **willow charcoal**, for it makes it release well. When you have cast, rub the medal with **oil** & with **willow charcoal powder** & with a brush, to make it dull. Take care that your medal is not too greasy or **oily** when you mold in **cuttlefish bone**. When you have cast, leave it to cool before taking the medal out, for when one takes it out hot, it brings with it some **bone**. And cast moderately hot, which you will know when the **bone** is about to change its ~~good~~ whiteness. But when it is too hot, it turns the **bone** very red. The proportion of **lead** & **tin** is as much of one as of the other. If the piece is difficult to come out & of several pieces, make the gate forked with three or four grooves, ~~and make~~ & direct these grooves to the place of the thicker parts. Also make these grooves around the medal, like straight on the heads, for this attracts the **metal** & feeds the figure better. Shake your frame a little when you have cast, and thus you will make very neatly several casts. **Tin** that is too hot ~~p~~burns^[c_091v_01] the **bone**, which is corrupted. Also, once taken out ~~from the m~~ hot from the mold, it risks breaking.

[Figure: fig_p091v_1]

Sand Mixture easy to melt

One ~~3~~ of part **soft tin**, one part **fine lead**, one part **looking-glass tin** & one part **fixed quicksilver** makes an alloy & a **solder** so easy to melt that it can easily be melted in a dish of **fine tin**.

Molding hollow on one side and in relief on the other

And for this effect, one casts a medal of **fine tin**, which is harder to melt. And since it is neat, one molds with it. And one leaves it in one half of the **frame** & presses it a little so that it holds better. And next, you will cast in your **frame** some **solder** described above, or another more meltable than **fine tin**. And thus, the second medal will melt & mold itself on the first one without spoiling it. But to make sure this is done right, mix some **lamp black** with **water** &, with a **paintbrush**, give a light coat of this to the medal, which remains in the **frame**, & leave to dry. Thus it will not melt.

But if you have a medal of **copper** or **silver**, you can leave it in the cast if you want to cast with **lead** or **tin**. But it is necessary that it be a little hot, for the cold would make the **tin** contract.

Tin wants to be cast quite hot to come out neat.

Soft tin, which is the best for the cast, is the one that, once cast in *grille*,^[c_028v_05] is **burnished** & shiny & polished like a mirror, & appears to have been burnished. And does not have holes like the one that is brittle & that is not shiny as if burnished.

Potin

Potin, being cast hot, runs & flows like **tin**. But the medal becomes whitish from this, and immediately casts out the *verd*,^[c_092r_03] which a good material does not do.

Molding statues

Half **founder's earth** which **FOUNDERS use** & half **clay earth** *g* renders very neatly.

Sand from **river tellins** and **mussels**

The long **shells** that one finds in **fresh water rivers**, once calcined, make an **impalpable white sand**, which molds very neatly.^[c_069r_04]

Congeaing mercury

It congeals, just as I tried, by boiling it one or two hours in a rather large iron pot, putting in, for an 3 of ȝ, ii 3 of verdet of and vitriol of saltpeter ana, ^[c_083r_03] with sufficient quantity of old water from FARRIERS.

Or else, melt 4 3 of tin, & as it cools, purify it of its filth, which is on top, then, make a hole in it & put in this i 3 of ȝ & it will come out like tin if you remelt it, but it will be breakable. And if you want to assay if it is tin or ȝ, redden a shovel & put a small piece of your ingot on top. If it is tin, it will melt & stay, but if it is ȝ, will quickly melt, then, crackling quite strongly, it will take flight. One ought to congeal it in a spoon or in a hollow crucible & make a moderately sized hole.

It can also be congealed, as I assayed, in aquafortis which beforehand will have eaten a little silver. This one, mixed, makes tin & lead run.

Mixture

Fine tin, congealed mercury with the smell of tin, looking-glass tin, fine lead, as much of one as the other, makes a substance that melts very promptly but is breakable & white. I think that it would be good for solder. A long time to cool.

Olives

They are spoiled if once a month one does not refresh their salt water, which one ought not to touch with the hands, for this makes them spoil.

Observation from RUSTICS

That when it freezes on Palm Sunday, ^[c_093r_01] it freezes all the months of the year.

That when the first flowers fall the sun & are lost from the frost, the others are usually lost also.

Grafts

[c_093r_02]

It is necessary that the graft be not from old wood, for it is never a beautiful tree.

One needs to leave only two shoots at maximum on the graft, for when it has more, its strength is weakened. The **wind** torments it, & it does not have enough strength to bud.

Trees which have coarse marrow, like **peach trees** & all their kind & **plum trees**, do not want grafts **in freezing weather** because the cold damages their marrow, which one also needs to protect from wounding by cutting the foot of the graft.

All grafts must not be made earlier than their tree is sapping, for the **humor** grows them quickly. Otherwise ~~at~~ they dry before the **humor** of the sap pushes them.

Sand

The **white ash of all woods**, which still sticks to the **wood** that burns, and which has not fallen into the ~~be~~ hearth, molds very neatly.

Sand

Well **pulverized ash tallow** molds & releases very neatly. The one from the **kitchens**, which is fatty & shiny, from the **big kitchens**, is better.

Finely pulverized quicklime works. The same for broken-up **flint**, which works better in the cavity.

Face in distemper

Because colors in **distemper** dry promptly & one would not have leisure to perfect the shadows & touches on the face, one wets the reverse of the face which is on **canvas** with a wet sponge. Then, with a small **paintbrush**, one makes the shadows, which do not come undone. Next, one lays the flesh color, which does not prevent the already painted shadows from appearing. And again with a more lively flesh color, one touches the more prominent areas. And with another **paintbrush**, one redoes the shadows by hatching. The shadow strokes do not come undone because they are made of **bistre**, which stains the **canvas** like **rust**. The said **bistre** is good **with** for making shadows in **distemper mix**, for in **oil** it has no body & would not dry but with great difficulty. One mixes in the said **bistre**, for shadow, **ocre de ru** & a little **sap green**. The best **bistre** is the greasy & shiny kind from the **fireplaces of large kitchens**. It is difficult to grind & *screeches* on the **marble**.

Azure

Azur d'esmail always wants to be cleaned, because the **filth** that can be perceived in the **wash water** makes it die. One needs to layer it two times, & the first very thick, moving the **paintbrush** by layering it first lengthwise then across.

[Figure: fig_p093v_1]

It is better used on **canvas**, where it is imbibed immediately, than on **wood**. **Varnish** returns it to its vigor, because being imbibed, it becomes dark. To assay it, **PAINTERS** bring their **palette** to the **GROCERS**, & temper & alloy it with a little white ground in **oil**, for in this way, the beautiful shows its *turquine* vivacity, but the bad is lavender grey. The most delicate is the best for working. It is made finer **working** by washing it.

Violet and lake

It is made of **azure** & **lake**, which is also assayed on the **palette** with white. The one is deemed beautiful that, on a **polished knife** or on **glass**, gives^[c_093v_01] a clear **red** color of red rose, tending a little toward violet. The one that is ~~not~~ dark red is not as pleasant.

FURBISHER

The parts of a sword are the rivet, the tail of the sword, what comes next is the ricasso, the rest is the ^[c_094r_02] blade. The sides are the edge & the point. Some blades have a sharp ridge^r, ^[c_094r_03] which has one single elevated ridge in the middle & along the whole length, and are easy to break. ^[c_094r_05] The other blades are called of three edges or three slopes, which do have a rise in the middle, but it is flat as if it were a sharp ridge, but flattened, ^[c_094r_06] and s these ones are the safest. The others ~~are~~ are called fluted, which are notched in the middle, ^[c_094r_07] & when it is along the whole length, they are just as easy to break as those with sharp ridges & are more troublesome to furbish because the *fustée* cannot get in. But one makes one in particular which is narrow.

Of the **guard**^[c_094r_08] of the **sword** are the pommel, the branches of the **guard** & the *pontet*,^[c_094r_11] which is this **iron** strip which closes off the branch which is at the end of the ricasso to stop thrusts from sliding into the **guard**. The rings^[c_094r_10] are these two branches in half-round which start from the eye^[c_094r_11] of the **guard** up to the branch of the *pontet*. The branch that crosses the **guard** is called the body. And this quillon block,^[c_018v_02] by which the **sword** tail^[c_094r_13] enters and to which all the branches return & are held, is called the eye of the **guard**.

Then follows the **wood** of the grip, which one **glues**, or according to the most competent, with **gummed wax**,^[c_094r_04] which is of **wax** & **pitch**, because **rosin** would be too hard. They heat it lightly, then rub the **wood** of the grip with it in order that the tang or the **thread** takes hold there. Otherwise, if a **thread** were to come loose, it would all **de** break immediately. On **iron wire** or **dog skin**,^[c_094r_14] one also puts **glue** on it. The garnishment **of** which is put on the **wood** **of**, which is of **silk** or **thread**, is called the cord, which is made from two ~~two~~ or three **threads** ~~turned~~ twisted on the spinning wheel, or 4 if the **silk** is thin. The slightly thicker cord holds better. The binding, which is also made of **silk** at both ends of the handle, are called the buttons.^[c_094r_15]

Some grips are made of **silk**, **dogfish skin**, **annealed iron wire**, **threads of gold** & of **fine & false silver** & of **velvet**. **Iron wire** has a lower price & is the most durable. Next is the grip of **silk**, if one does not have the convenience of being close to the **sea** to procure some **dog skin**, which is quite convenient. ~~Pou~~ The beautiful **skin** costs fifty or lx **sous** & 4 or five dozen grips are made from it. This kind gives a good grip even if the **hand** is **sweating**. To work it, if it is too hard, one soaks it for one or two **hours** in **not quite lukewarm aquafortis**, for if it were too hot, it would cook & spoil the **skin**. It is sewn with **black thread**.

[Figure: fig_p094r_1]

[c_094r_09]

The gold grips are made by putting underneath thin yellow canvas or a different canvas yellowed with chalk. And this canvas is set with glue or the aforesaid gum, this is in order that the thread holds better on it. These are made of cords like the silk ones, & between two cords one sets one or two threads to make it show up better. The silver kind is made similarly, and there is not as much trouble as with silk, and even less because it takes more to twist silk, because one needs to twist it twice. A grip of fine gold is worth 18 or 20 sous.

The best sword point is the sage leaf form.

scabbard bench

[Figure: fig_p094v_1]

This long plank on which the sword is attached & laid down to furbish it is called the *chameau*, it is commonly of rowan,^[c_094v_05] which is hard & even.

The lower stick, which is folded like a bow, is called the *arson*.

The upper is called the stick of the *fustée*.

And this small square piece, which is put^[illegible] ^[c_094v_04] on the sword to burnish it, is called the *fustée*.

There are two horns: one is called the oil horn and the other the emery horn.^[c_094v_06]

There is an iron which is made like a halberd point, square, & of very even steel, & well filed, which is called the *grateau*,^[c_094v_07] which serves to to smooth the traces of the file on sword guards & to give an edge to swords after they have been ground, which is better than with a stone or a sharpening stone, which quite often makes scratches.

[Figure: fig_p094v_2]

[Figure: fig_p094v_8]

a

[Figure: fig_p094v_4]

b

[Figure: fig_p094v_5]

[Figure: fig_p094v_6]

c

the *flin* or thunder
stone

[Figure: fig_p094v_7]

D

the *baston*

a *felinder*

To make ~~coup~~ *swords* cut better, one gives them the edge by pulling upward from the point.

THOSE WHO CREATE SWORD GUARDS are ARTISANS separate from the FURBISHER.

A is the *bruisson*^[c_094v_08]

B is the *bloodstone*^[c_094v_09]

The *fustée* is a square piece of wood three *fingers* in thickness, of *boxwood*, which is fitted in the middle of the stick of the *fustée* to furbish.

The *fresil* stick is of *willow wood*, which is to clean the rust off weapons with *fresil*, which is the *iron scale* falling at the FARRIERS' forge.

The FURBISHER buys his blades by the dozen, which are not fully drawn by the tang because he does this himself to adjust them well to the *l* pommel & guards.

Spanish ones are deemed better for being of better steel & iron, but they are not as well-forged as swords from Vienne in *pro* Dauphiné. The Spanish ones are not as well ground coming from the forge, because they grind them with the foot,^[c_095r_05] & this is what makes them wavy.

Blades from Vienne commonly cost xviii or 19 lb a dozen.

The first thing the FURBISHER does when he gets his new blades is to draw out their tang, which he does himself or has done by LOCKSMITHS or FARRIERS, giving him some liard for his charcoal. Next, they pass it over a grindstone to make it cut,^[c_095r_07] then lay it down on the *chameau*, and with some pulverized emery, fine & soft as flour, & mixed with oil to make it hold, they furbish the sword with the stick used to remove the traces of the grindstone, and then ~~the~~ clean the sword *powell*^[c_095r_03] with the emery and give it a drop or two of oil, which they spread with the finger to give it luster. Having put the oil, they furbish the sword again on the *chameau* with the *felin*, which is a thunderstone mounted in the middle of a stick like the *fustée*, and this stick is called the *baton à felinder*. Next, having passed it on the *felin*, they furbish it with chalk & the oil which is on the sword. Next, they wipe it & go over it again, & furbish with dry chalk. And at the end, when they are ready mounted, one gives them the edge with the *gratteau*.^[c_094v_07] *At*

Once furbished, one mounts it on the guards which one presents to know if they are quite suitable. And taking hold of a blade such that the whole ricasso is held in the hand, one conjectures that it will be just as heavy once mounted.

One puts the blade in a *visse* between two pieces of wood, then with a file, they enlarge the opening of the guard^[c_095r_09] if it is necessary. Then, to rivet it, one places on the rivet^[c_095r_12] a piece of & the pommel a piece of wood, & with a hammer, one beats on it to align & secure the pommel well. Then, with the hammer, one finishes the rivet when the pommel is well secured & does not wobble. The wood is put there so as not to spoil the pommel. Next, one finishes the rivet with a file or chisel. And some make ~~the~~ the rivet in a square diamond-shape,^[c_095r_11] but it is not as good as the round one, for, when faceted, the rivet breaks.

The end^[c_095v_03] is bought ready-made by the dozen, which costs six **sous** for the small ones, but for the the big ones 2 **carolus**. The end ~~this~~ is put either with **nails**, which are put on the sides of the cutting edge, but this only spoils the **sword** & destroys the scabbard because the **water** enters through the joint of the **nail**. It is best to apply some **rosin** or **glue** on it, but **rosin** is better. And it is best when the end is well adjusted & set so hot that the **pulverized rosin** melts on the end. In this way, it does not fall and cannot be undone unless it is put in the fire.

Guards are of several kinds:

Worked^[c_095v_04]

Guttered, which is with round moldings

Pearled

Scarfed, when the bands are crosswise

Onioned, which is with a flat head^[c_095v_05]

In the **KING**'s manner, which are plain

The **FURBISHERS** buy them by dozens, the dozen of plain ones commonly costs x **lb**. The worked piece, 30 **sous** or depending on its fashion.

The first thing the **APPRENTICE** does is to furbish as said.

And next, to garnish the **sword** & make a scabbard, which is the height of the art.

They buy the **wood** pieces of **beech wood** for scabbards which are ready made, a hundred for xv or xx or 30 **sous**, depending on the distance from the place where they are made.

These **wood** pieces are thus called *estelles*,^[c_095v_06] and have to be very neat & without any knots & are one **finger**'s thickness across.

Then the **FURBISHER** puts them on a small bench, called a scabbard bench, and with a ^[c_095v_01]~~e~~ **plane** small **iron** tool similar to that of the joiners' bench, they make it hold firmly. Then, with a ~~plane~~ plane which is like a knife with two handles,^[c_095v_07] one works the **wood** roughly from the top, next one passes the **JOINER**'s plane on it the better to even it. Next, one scours it on the inside with a

round plane, also mounted with two handles, then with a small narrow plane, one hollows & scrapes it half a foot toward the end of the *talan*,^[c_096r_02] and the shorter the better. Without this scraping, the sword would always cut the scabbard.

The opening of the scabbard is called the mouth, & on top is the shape of the blade.^[c_096r_03]

The stop, which is a leather rim set on the edge of the blade shape,^[c_096r_04] is made to stop the hangers.

When the *estelles* are well levelled, one lays the sword on top, & with a black stone, one marks the width of the blade & the length, & then with a chisel, one cuts the excess. And one passes a joiner's plane to even it well, according to the mark.

Next, one glues the two *estoilles* edge to edge and all around, only as far as the shape of the blade extends & not elsewhere. And this is to make the leather or velvet of the scabbard hold.

Then one puts the sword into the *estelles*. And precisely thus, they set it in the scabbard, which is all sewn, and rub what is glued along the shape of the blade^[c_096r_04] with tallow to make it run into the scabbard.

The scabbard is made of calf or sheep leather, the calf ones are all in one piece, but not the sheep ones. But, when the swords are long, one makes them in pieces which are sewn between leather & flesh, & then they rub the stitching thoroughly with a piece of boxwood to cover & even it. From a good calf skin, viii or 9 or x scabbards can be taken.^[c_096r_01] A WORKMAN can easily make vi a day. If they are too thick, one thins them a little with a plane. If the skin is hard, one wets it in lightly lukewarm water, and one does not leave it there for long. Next, the same WORKER WHO MADE THE WOOD PIECE has to adjust the scabbard to be well made. It is true that for COMMON PEOPLE, one may well get ones which are ready made, but they are never carried as well. When the scabbard is made & sewn with black thread, one rubs it with a piece of boxwood or with a cloth, having daubed it a little in oil. The scabbard of a good cow is better than any and also costs more, except the velvet kind. Under the velvet, one commonly puts plain canvas or a sheep scabbard or a parchment cover. But the best scabbard of all is a waxed scabbard, of either velvet or calf. It is because one covers the wood with thin canvas, which one next waxes, then one covers it in velvet or calf. A waxed scabbard is worth at least xxx sous, a cow one xx sous.

From a sheep skin, v or vi.

Grey guards

Once they are white, one only needs to clean *bi* them well, then put them in the fire, & make them pass to blue. And one needs to take good care that they do not pass too far beyond blue, for neither gold nor silver nor any color would take on it. To do this, which is called making them pass,^[c_096v_01] one takes a cauldron full of *ashes*, which one covers with thoroughly lit charcoal, & thus one heats them quite strongly for an *hour* or two, and when the *ashes* are very hot, one pulls the charcoal to one side & one puts the *guard* where the charcoal was, & one covers it completely with *ashes*. And when the body of the *guard*, which is the main thing, is completely passed, one rotates the *guard* onto the other side, and in this manner, the grey cannot pass too much, unless some *hot charcoal* touches it. The grey can be done well in the *œ*^[c_096v_02] ordinary fire *in the fireplace*, but there is a danger that it may pass too much & produce *filth*, which will prevent it from taking color. Blue is obtained as soon as the *ash* has heated the *guards* a little, but it is still grey in some places. After blue comes grey.

Color of water

For^[c_012v_01] the color of water, one passes a *soft file* on the *guards* to whiten them, then the *burnisher*. Next, one makes them pass to blue until they turn grey. Next, when they are still moderately hot, one passes the *bloodstone* over them, and when they cool, one turns them to reheat them, for the color of water is made only in several passes. And if the *guards* were not warm, the *bloodstone* would scrape & undo the color. One needs to take heed that the *guards* do not pass too far beyond grey, for they would throw off *filth* that would prevent the color from taking. One needs almost one *day* for preparing, smoothing & setting in the color of water, but as they pass a little beyond blue, it is enough for grey & another color. Grey is the lesser color after *varnish*, which is of two colors, either yellow or black.

Yellow varnish

One whitens very strongly & one cleans the *guards* well. Next, one applies *walnut olive oil* all over them with a *feather* while they are cold, and next turns them over a good *charcoal* fire that is on the *FURBISHERS'* furnace, without them touching the *charcoal* or the *ash*. And when they do not *smoke* anymore, it is done.

Black varnish

It is said, at the beginning of the book^[c_097r_02] where you can see it, that it is made with galipot.

Gilding^[c_097r_03]

One prepares the guards thoroughly with a soft, very soft, file such that there is nothing black^[c_097r_04] left on any of the guards, and next heats them, & passes them as is said.^[c_097r_05] But to gild & gild with silver, they ought not to pass more than a little beyond blue. Then, while the guards are hot, one attaches them to a vise, & with some tweezers, one layers the gold, & one sets it with bloodstone that is quite clean & rubbed with putty. And when the guards are cold, one reheats them, then one layers the gold as above. And first, one gives of two layers, until the entire guard is well-garnished. And next, one reheats as at the beginning, & one gives the third covering of gold. Then, one burnishes very thoroughly & with great force with a large bloodstone. ~~And~~ But note that for burnishing well, the guard always needs to be warm. And to know this, *one smells it & brings it close to the nose*. For one ought not to touch it with the fingers, but one ~~holds it on~~ lifts it from on top of the warm ashes with a small iron rod, which has been purposely made to go into the eye of the guard. And when it is completely well-burnished, one rubs it very well with a white linen cloth, and the gold needs to be thicker & stronger than for PAINTERS. A quarter on is worth fifty or lx sous.

Gilding with silver

One needs to prepare the guards & whiten them with a ~~li~~^{li}~~illegible~~ file, a little coarser ~~for~~ than for gold. And one makes them pass beyond grey, as for gilding. And when they are hot, one needs to double the silver foil, then separate it with a knife; next, apply it to the guard with a small tweezers & a small burnisher. And then, reheat & apply until they are all gilt with silver. Next, one needs to cover them for the third time with the doubled foil, as has been said, then burnish them very well & with force, not with the bloodstone but with a strong burnisher. Just as the burnisher ought not to burnish gold.

Mastic varnish dry in a half hour

Some take 2 $\frac{1}{3}$ of mastic, a half $\frac{1}{3}$ of turpentine, & a half $\frac{1}{3}$ of turpentine oil, & eau-de-vie, a little at your discretion because it evaporates when heated & nonetheless makes the varnish more desiccative. But I made it thus: I take turpentine oil at discretion & put in a good bit of turpentine, because it remains always humid & attaches itself if one puts in too much, & eau-de-vie, & heat in a varnished bowl the said oil, & when it begins to be very hot, I put in some subtly ground mastic & passed through a sieve, ^[c_110v_04] around one-third of the oil, and let reheat until it is melted, which will be soon on hot ashes. Once all melted, try it on the knife, and if you see that it has too much body, add in a little turpentine oil, and if it does not have enough, add in mastic, and thus it will be done. And keep it well covered so that no filth gets in. When you want to make it, be careful to sort & choose the mastic that is white & purified of any dirt & dust & black dross. And when you wash it & dry it to render it very white & clean, it will be even better. For if you do not purge it well, these straws & marks, pulverized into it, will remain within the varnish, & when you set it on white or flesh color, it will seem that they are fleas & blemishes. Once well chosen, pulverize it in a mortar and pass it through a very fine sieve, and next mix it in oil, as is said. But if you want to make it more carefully, extract a tear of mastic, as you know, pulverize, pass, & mix, and you will have something very singular for small works. Take heed when varnishing not to breathe on it, for this will make the varnish whiten & take body.

It almost dries when working.

One knows that this varnish does not have body enough when it does not take well on a panel in oil, for it is like water. Therefore, add in pulverized mastic & heat until it is good. This varnish is very white & beautiful, & does not go to your head like that of spike lavender.

For some, instead of ~~tour~~ turpentine oil, put spike lavender oil, which is not as good.

This varnish is laid down cold on the panel with a very clean fingertip, & one needs to spread it vigorously.

The Italians scarcely varnish their paintings because they layer their paintings very thick, & they are a long time drying on the inside, though on top they make a dry skin & crust.

One lays the varnish with a finger so as make a lean layer, because when thick, it yellows.

Working on glass

It is a strange thing that the **WORKERS** of this art^[c_097v_01] cannot work well if they do not have good **breath**, for if they have a bad one, their work will break in the fire in reheating.

Varnish for lutes

They take a little **turpentine**, & **oil of turpentine or of spike lavender**, & **amber pulverized** & passed very subtly, & make like that of **mastic**, & add in a little **dragon's blood** to color it and make it reddish, and others some *terra merita* for yellow.

Borders of a garden

One needs to work the earth, then make it thinner with the **rake**. And next, if it is dry, one needs to moisten it. Then, stretch the **cord** very close, and hit on the entire length of the **cord** ~~as~~ with the back of a **pruning knife**, in order that the **cord** marks a straight line, the length of which you will make ~~a border~~ holes with an **iron stake** where you will plant your **rosemary**. Behead & cut to measure, and prune from the bottom up.

LOCKSMITH

To **tin** nails well, and other work, they **file** their work very neatly. Then to clean it well & rid it of grease, they make it boil in **vinegar**, then they wipe it well with a **linen** cloth. Next, they heat it & pass some **rosin** over the top, which coats it with a shiny skin like **varnish**. This done, they melt some **pure & fine tin** in their *estamiere*, which is a little square **iron** box. And when the **tin** is well melted & moderately warm, they throw in **rosin** to burn the **filth**, & then they let the head of a nail or something similar soak a little, & having remained there for seven or eight **pauses**, they take it out and shake it, hitting the top with an **iron** to make the **tin** that is superfluous fall off, & clean it with a small stick wrapped in **tow**. And if it is not well **tinned**, you will rub it hot with a piece of **rosin** & do as before & let it cool. When the work cools, it becomes yellow, which is a sign that the **tin** is the right temperature. But it becomes blue if the **tin** is too hot. Things ~~†~~ thus **tinned** are durable & are not undone like **tinning done in leaf**, thus at the end of a *year*, they can be clarified & renewed by heating & rubbing them.

LEADSMITHS say that making a **lizard** die in the melted **tin** ~~it des~~ makes the **tinning** become very golden. Or else putting in **sal ammoniac**.

Small dogs

Small **dogs** who should be **water-dogs**^[c_098v_04] are recognized by this, that they have a larger muzzle than others.

Salted artichokes

One puts them whole & not too ripe in a **firkin** that one fills with **brine**. Then, one serves them **all year** among salads, raw with **oil** & **vinegar**, for being thus prepared, they take long to cook. But take heed to test your **brine** with an **egg**, for if it is good & strong enough, the **egg** will float on top. If not, it is not strong enough and would not preserve the **fruits**.

Trees

Which bear fruits quickly are aged and scarcely last.

Birds

Which have been fed by the **rod** do not whistle among the company of others if they are not in a separate cage. For teaching them to whistle well, one needs to take them from the nest before they can see & cover them with **down** or a **hare skin**. Thus, having not seen their father and known his voice, they better learn the whistle that one teaches them.

Founding

The **putty** is made of **burnt earth** which has served in the founding; this is **earth bourre bolvene**, in *[illegible]* which one has founded. One grinds it on a big **stone**, & with this one makes the ~~cope~~ first coat of the cope of bells, where there are letters & works, & ~~le~~ only needs to be reheated in the flame of **straw**, and molds very neatly.

The **earth** which molds *en noyau* is subject to making it porous, if you do not rub well with a **brush** or your **finger** the piece to be molded, which should be well **oiled**. And do it coat by coat, & not all at once.

Earth or sand moistened or ground with water wants to be reheated more than sand.

Latten from a candlestick is not pure, for one mixes in it iron filings & potin.

Latten wants to be cast hotter than copper, *quod non credo*.^[c_099r_03]

To cast carefully, one ought not to take metals already alloyed, but take them pure & mix them.

Iron hardly agrees with being cast in a mixture of copper or latten.

It is better to mold all with one sand, be it in a frame or *noyau*, rather than in various mixed ones.

One ought to reheat for one or two hours ~~and p~~, in a fire ~~that~~^[c_099r_01] of charcoal which lights by itself, a *crucible* with the substance inside, and then blow & cover the *crucible* with large charcoals & the mouth of the furnace with bricks, and let it consume two or three feedings of charcoal, which *se* fill the furnace above the *crucible*. At the end, stoke it to a violent fire, & when the flame is very white & the substance is in a liquid bath like water & casting off pale blue flames, cast. The secret is to cast very hot & in one go.

Lean white sand without bond renders quite proper for casting, & having body, if you grind it very finely on porphyry or calcine it, reddening it several times in the fire, & spread it in vinegar or finely grind it with water, as you know. It also molds very neatly *en noyau*, as I have experimented. But do not moisten it with salt water if you want to promptly reheat it, for salt boils on the fire & makes pustules, being pressed by the fire. I believe that the *noyaulx*, gently reheated, would not do this. I molded very neatly *en noyau* the substance of skillets. White sand smells like sulfur when reheated, and I believe it would melt. And since the substance has been cast in it, it acquires in the mold ~~as~~ a luster as if it were leaded or vitrified. I believe that GLASSMAKERS could use it.

^[c_099r_02]One needs very little sal ammoniac dissolved in water.

Bell handles

They can be put back on without remaking the bell, which one ought to put back in the pit & mold it there. But should you solder a *ref* cracked bell, it is considered impossible to give it its first voice.

Quince trees

They want to be pruned often, otherwise they die & do not bear such beautiful fruit.

Cannons

They are very difficult to bore when they are of *metal*^[c_016v_05] because the substance is brittle & frangible. But one *z* ought not to push the borer with too great a force nor continue all in one push, but pull it out often. In that case, one makes the ~~touch-hole~~ muzzle of the *cannon* bigger than the ball in order to avoid the necessity of boring, because the substance is cast & expands & pushes the mold. If the borer, which should be neither like a swallow tail nor a point but be cut in the round like a wimble,^[c_168r_01] if it breaks, one ought not to leave it there to rust +^[c_112r_02]

+^[c_112r_03]

but immediately take it out of the touch-hole. This you will do by pouring a little *oil* on it; then, *t* turn the place of the touch-hole downward & strike the opposite side of the piece, & it will fall down. One needs to bore gently & at ease when the piece is of *metal*.

Bells

One does not make them in the pit if they do not fit.^[c_069r_04]

Gilding ~~your~~ moldings for panels without *gold*

Some take *orpiment in leaf form* & pulverize it & make moresque leaves & burnish it, and it is this *orpiment* which is shiny like *gold*. However, *ground metals* or *ground cristallin* or *touchstone* are better.

Orange from *orpiment*

One sublimates it & one grinds it, & some put in a little *arsenic* to make it melt instead.

Varnish

Some make the one of **mastic** with two ounces of **mastic** and one of **clear & white turpentine oil** & **eau-de-vie** as above. Heat it on **ashes** until it is melted, then let it rest & put it in another vessel to purge it of dregs.

Gold color

To quickly make a layer of **or** ~~on~~ **mat** on **canvas** or other **oil panel**, one makes fatty **walnut oil** **in the sun** or **on the fire**, as said above, for it thickens by itself in this way, although there is neither **lead** nor **ceruse**. And with this, grind **massicot**, **minium** & other desiccatives, not **verdet** nor **orpiment**, for they cause the **gold** to die. It will be dry soon. However, if the *weather is not serain & dry*, do not smooth it, for if the *weather is musty & humid*, it would turn black.

Portraying from nature

One needs to carefully *observe* the eyes, the nose & the beard, for these three things make strong resemblance.

Gemstones

You need to pestle your materials in a mortar of **thick glass** & encased & stuck with **mastic** into another mortar of **wood**, in order that it does not break. This can serve for **PERFUMERS**. & ~~the~~ the pestle, also of **glass**.

*Mortar of **glass** and slab of **glass** for grinding*

Vitrified **saltpeter**

Being melted with **pebbles**, it makes the **glass** very white. But before, one needs to calcine it on a **hot tile** or shovel. And that which will remain from the vapor, mix it with as much of the **white calcined pebbles**. It is true that, in the **little furnace**, it does not clarify well. But for **large panes of glass**, it makes the **glass** very clear & white & clean.

Windows that the sun will not pass

Take the aforesaid **calcined saltpeter** & expose it to a **humid air or place**, and it will convert itself into a liquor which, if rubbed on both sides of the windows, the **sun** will not pass through; rather, it will give **shade**. One needs to put the **saltpeter** on some clean thing place & ~~it~~ put glowing charcoals on it, and continue all over until it no longer burns.

It also serves for melting & for adding to **alkali salt** for cleaning **hands**.

Gemstones

Take **white pebbles** that are found by the **rivers** & among the **sand bank** & **paths**, which are **somewhat transparent**, & if they are perfectly transparent it will be better. If not, use the best & whitest that you can. Calcine them three or 4 times in your *four à vent*, & extinguish them in **water** or **vinegar**. Next, take a $\frac{3}{4}$ of them and **pestle** them in a totally pure **copper** mortar & with a **pestle** of pure **copper**, and grind them until they become very fine & soft powder, and this is a sign that they have taken the substance of **copper**, enough for giving them greenness. At that time, on your $\frac{3}{4}$ of **pebbles**, put in three $\frac{3}{4}$ of **good minium**, **not adulterated by brick** & anything else, and grind everything together again very well in a **bronze** mortar. And on all of this, put in a gros ~~for $\frac{3}{4}$~~ of **sel de verre**; & some & the **COMMON PEOPLE** put in e^[c_07or_03] **sandiver** that they find at the **GLASSMAKERS'** or **APOTHECARIES'**. But **alkali salt**, as you know, is better. In this way, the **COMMON PEOPLE** make **emeralds** & cast in **sand**. If you do not have a **bronze** mortar, grind ~~with a mort~~ in a kettle of pure **copper**.

One needs to reheat **crucibles** before putting in materials, and put them in the *fornaise* or *four à vent* before making & increasing the fire.

[Figure: fig_p100v_1]

They are made in an **hour** & a **half**.

A gros of **salt** on the four $\frac{3}{4}$ of **pebbles** & **minium**. When one says, for $\frac{3}{4}$, this is to be understood: on one $\frac{3}{4}$ of the body, & not

Emerald^[c_100v_01]

of the **salts** & the **minium**.

For ruby take gold leaf

Raise your furnace by two tiles all around, because one needs more heat for making rubies than for emeralds. And take one ⅓ of white calcined pebbles and put it in a mortar of glass, & having ground it coarsely with the pestle of the same, mix in ~~a grain~~ the weight of a grain of gold leaf of what the PAINTERS gild, & grind

Some say that, mixing the gold with the pebbles and the saltpeter, it makes the color of a peach tree

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Others say that it is necessary that the gold be cemented several times, then beaten into leaf.

again very well, then add in iii ⅓ of minium, & pestle well again all together, & put it in the crucible, which you will cover with an appropriate tile, a bit thick, in order that heat reverberates better there. Then, set it on the grate of your furnace, having put under a few thick rounded squares. Next, fill your furnace to the opening with charcoal, so that it will be heaped, and let it kindle, and always maintain the heat evenly without letting the charcoal decrease. And for this effect, always make it so that the furnace is heaped & full of charcoal, and maintain it thus for one day. The first experience that I made of it, it only returned a yellow mass, as is vitrified minium alone, & some grains of gold in a mass at the bottom. Try cemented gold and accompanied with antimony.

If you need greater heat, ~~put~~ put, on the edge of the opening of the glowing furnace, tiles, one against the other, for making the heat reverberate.

[Figure: fig_p101r_1]

Topaz

The same dose is observed for all **gemstones**, namely one weight of **calcined pebbles** on three of **minium**, pestling all separately in a **copper** mortar for **emerald** & in an **iron** mortar for making **topaz** or **amber** color, with pestles identical to the mortars. The **emerald** & the **topaz** are of the same heat, & for an **hour** & a **half** on the fire, for they could burn. The **ruby** ~~en~~ wants more time & more fire & colored with **gold leaf**. I believe that **pumice stone** or **firestone** for the **ruby** would be better. See the **enamels**. Try also mixing, in place of **pebbles**, pieces of **colored glass** or **enamels**. If the mass is not colored enough, pestle it more in the **iron** mortar.

Slightly burnt tartar mixed among this makes beautiful yellow, but one hardly needs any. The **arene** also makes it more yellow.

Salt for melting

Mix **saltpeter** & **common salt**, and melt them together, & cast on **melted copper** or **eh** in a bath, & it purifies & makes it run marvellously. First, one ought to decrepitate the **common salt**, that is to say holding it over a good fire until it no longer crackles or, to melt it better, in a *four à vent*. And cast it neatly on **marble**, then pestle it & grind it very finely, then put it in a **crucible** on as much **saltpeter** & let it boil, & mix them together until

It cleans & purifies **metal** well.

the **crucible** will be red. Next, cast it on **marble**, and you will have a substance white, hard & even, like **alabaster**, with which you will be able to cast medals which will resemble **marble**, but keep them out of the humidity.

Jacinth

Is made like **ruby**, with **gold**, but one does not need such a great fire. The **ruby** wants fire for a whole **day**, and if it does not have enough fire, it will only have red veins.

Always heat up your **crucibles**.

One holds that **rubified antimony** makes **jacinth**.

Topaz

I melted one part of pumice stone, calcined & pulverized, & ~~tr~~ with three parts of minium, and the stone pulverized in a steel ~~verf~~ mortar. It returned me a very beautiful yellow without any grains, more yellow than any others. It is true that it was well saturated with color. I believe it would be better to pulverize ~~it~~ the pumice in a glass mortar, because it & the minium make enough yellow by themselves. It returned to me a mass, the top a beautiful yellow, as was said, the bottom like firestone, without transparency. With which, by mixing *d'aultre*^[c_101v_02]

Varnish

The Germans make minium boil well in linseed oil, & to give it the body of varnish, they mix in thoroughly pulverized yellow amber.

Gum ammoniac

One puts it in small pieces into a little good vinegar, & one heats, then one passes it through a cloth strainer. All medicinal gums dissolve in vinegar.

Provisions for the work of Colchis

7 retorts

2 lb of *[illegible]*^[c_102r_01] ☞

One measure of coarse salt

6 *terrines* without lead

2 large unleaded pots for calcining

2 alembics for distilling vinegar

4 pots of good vinegar

3 or 4 lamps

2 lb of cotton

One pair of small scissors

For the furnace

A coffer with a stone ten square thumbs in size and one foot thick, pierced in the middle

2 earthenware boxes or pots with a lid

2 small pipes of *fer blanc* to evacuate the smoke from the furnace

Rapeseed oil for the lamps to heat the furnace

A fire-steel

Ciment royal^[c_102r_02]

One lb & a half of vitriol

As much saltpeter

As much rock alum

Glass vessels

The glass vessel must be made like a pear or round pyramid, of the thickness of a small knife back, round on the bottom without bending like vials, its opening of such a size that a Dutch quill can just about fit in, & with a lip at the end. Thus of a height of seven fingers' width.

[Figure: fig_p102r_1]

Painting on crystal or glass

They paint in oil without lines, except for the faces where they trace the nose & the mouth with black in small work, then they make strokes & highlights in white, next they coat all with flesh color. And as for the ground, they make it with *azur d'Acre* for more beauty, or with lake for a quickly-done red, or with dragon's blood for the most beauty. But one needs to layer it little by little so that it appears even & of one color, & thus for other colors. Next, they put underneath it a foil backing for topaz, or one of gold or silver.

Infusion of anthos or rosemary^[c_102v_05]

In the month of August, the flower is better cooked & more suitable for making oil. Take of it whatever quantity you like, and put it into a bottle well stoppered afterward, & leave to wilt in there in the shade for a day. Then put in it the first substance of wine,^[c_102v_06] & leave it to rest three or four days, and next express the whole into e another vessel, & into this very same substance of wine, put in seven or eight infusions of new flowers. Next, leave the last infusion in the sun for a month. Next, distil it through an alembic, *Ap* and take ii 3 of this water in two or three spoonfuls of white wine, but this is for the ELDERLY. Paul III^[c_102v_03] used it.

Cast

Tin comes out better being thin & fine rather than thick, because being thick & in great heat, it retracts. Therefore, if you want to mold a thick piece in tin, mold it only on one side & with a cavity on one side, if it is possible, in that way you will have it more neat, and then you will be able to solder two halves together. But if you must mold it thick, æ^[c_102v_01] make it in the form, & mold a lot of feeders

[Figure: fig_p102v_1]

around the figure, in this way.

Against burns, excellent

Heat **linseed oil** on a gentle fire without letting it boil & simmer, but once it is hot, put in a quarter as much of the **newest wax** you can. Once melted, let it cool, & once they begin to curdle, stir continuously with a **new wooden spatula** ~~†~~ for as long as it takes you to say ~~one~~ 9 paternoster,^[c_114r_05] and as you say them, wash this composition with **holy water**, stirring all the while. Having said the ~~s~~ first 9 paternoster, pour out the **first water** & put in new one, & wash & stir the composition for the time it takes you to say 8 paternoster, and the 3rd time for as long as 7, & thus you will consecutively ~~until~~ add **new water**, doing the same as above, until the last & single paternoster of nine. Then you shall have a **soft & white ointment**, with which you shall anoint the burn for the space of 9 days. But **do not apply it any longer than this, for it would cause** ~~a~~^[c_065v_05] **your flesh to grow excessively**. You ~~p~~^[c_103r_01] shall bandage yourself ~~twice~~ a day, & each time you shall wash your **face** with **water** & **wine** mixed together, a little tepid, not rubbing, but as if pressing with a wet linen cloth, and you shall wipe it similarly ~~aff~~ with a fine linen cloth, & next put the **ointment**, over which you can put **ivy leaves**. This **causes hair to regrow & leaves no scar**. A **GUNPOWDER MAKER** who had almost completely burnt himself ~~me~~ & showed no sign of the burn, taught me this.

Against dogs' mange

The **English**, who caress their **dogs** a lot for taking care of their livestock, have **GROOMS** for them, who ~~not~~ particularly hold this office. And melting **pitch** in **water** & leaving it to soak, they rub the **dogs** with that **water**, or else with **water of sublimate**.

Enema

In order that the tube does not harm, for example children, or those who ~~se~~ have **protruding or swollen hemorrhoidal veins**, one covers the end of the tube with a piece of **chicken gut**, & one folds it back over the end, & in this way, one gives the **enema**.

Cast

Tin retracts when it is thick, thus it is best to cast it thin & to make two pieces out of one, then **solder** them if need be. One uses a strong piece of **taffeta** to sieve the **fine sand** with which one first covers the medal to the thickness of a **teston**.

For making colors run

Mix **vinegar** ~~with~~ a little with **bile** & put it ~~p~~ into a **glass** bottle, & if you want to keep it for a *long time*, add some **salt** to it; & of this, mix some of it among your colors, & that will make them run.

Earwax

If you take enough with the tip of an **ear** picker & you pass it through the **foam of urine**, which is readily made by those who have a **headache**, all the **foam** will dissipate.

Enamels

For recognizing well their difference and their true color by **candlelight**, you need to put your candle behind a **crystal** mirror or a **glass** globe or jar full of **water**, because this light is like **sunlight**.

For eating away and dissolving entirely pure **gold**

R^[c_083r_04] put **common salt** into **aquafortis** in a **matrass**, and let it rest two **hours** without putting it on the fire. Put in the very thin **gold**, and draw it out as if it had been parted from **silver**.

For engraving^[c_004v_02] on iron

One ʒ of **verdet**, ii ʒ of **coarse salt** & a little **sublimate**, or else grind **massicot** with **linseed oil**, and ~~it~~ cover ~~this~~ the **quite clean & polished blade or iron** with it, & let dry **in the fire** or **in the sun**, and draw on it what you please. Then, to engrave it & make the **water**, take a **liard**'s worth of **verdet**, & put in twice as much **coarse salt**, & about four grains of **sal ammoniac**, & six grains of **sublimate**, & the **water** ought not to be hot.

Good mixture to color gold

Sulfur & small **gravel**, as much of one as of the other, & the third part of ~~soufr~~ **salt**, & as much **terra merita** as **sulfur**.

For gilding with **silver** on **copper** and **latten**

Soften the **silver** like the **gold**, & apply it as if you wanted to **gild**. And do not let it heat, so the **silver** does not tarnish. And after it is well applied, boil it in **walnut oil**, & next heat it a little, & thrust it in **sweet boutteure**.^[c_104r_01]

Enameling a **cornaline**

Soak some **wheat flower** in **white wine**, then besmear & cover the whole **cornaline** with it. And bring the violet kind to heat again, next put it to temper in **white wine** for one or two **hours**, then scratch it & leave the part you want to save on it, then reload it a little more on top.

Against **dogs' mange**

Half an ʒ of **stavesacre** for **common dogs**, & one ʒ for big ones, as fine powder beaten with two **egg of oil whites** & one quarteron of **oil**. Make them drink on an empty stomach, having kept them locked up *at night* without eating. Approved.

For casting

If you have some piece which will not release & is big, mold it with **wax**, either in hollow or in relief, because it is malleable once soft & obeys, and thus separates itself from the piece without leaving anything. But take heed that the **melted wax** be neither too hot nor too cold. Some mold with **wax** heated in **hot water**, but in pressing, the **mold** becomes clumsy & makes itself false. When you have the hollow **wax** form, you can cast in some **very soft clay** & thoroughly moistened & clear, & let it dry at ease. Then you will make a hollow form on it ~~ave~~ of **lead** or **tin**, in ~~you~~ which what you will form will be of good release.

GOLDSMITH

Know what it is to do spangling work: it is **scales of pure silver & of gilt silver** with which one makes the **ARCHERS'** haquetons.^[c_104v_04]

Spinet playing by itself

[Figure: fig_p104v_1]

Make an axle surrounded with wheels pierced all around the edge, and attach **quills** as for a **cittern** or a **spinet**, & arrange them according to the song you want to be said, leaving ~~such~~ a suitable distance between. And, turning the axle either by yourself or by a **clock spring**, your invention will be effected.

Turtles

The males have the shell overturned at the end near the tail, and have the shell under the belly notched all its length from the tail to the ~~que~~ head. And the females have neither the overturned shell near the tail nor the notches.

Drying colors

Soot black & others would not dry in **oil** if one did not put **verdigris** with it.

PAINTER

Colors laid down twice are thicker in and of themselves, if they are not managed. Otherwise, one paints on **wood**, otherwise on **canvas**, otherwise on walls.

Gardening

For shield grafting, one needs to take the new issue that the tree that you want to graft has made *in that year*, & there cut a branch on which you see that next to ~~raei~~ the sprouting of leaves there are little buttons that one calls *œillets*, which are the beginnings of sprouts. One needs to nimbly, with a very sharp penknife, cut in the shape of a shield a little bit of the skin ~~with~~ which contains an *œillet* or sprout with the leaf, thus marked B. ^[c_105r_01] ~~But plusto~~ Then, carefully make on the tender wood, ~~s~~ which is in sap, on which you want to graft, two lines thus ~~de~~ cut

[Figure: fig_p105r_3]

, then make in the middle a cleft thus

[Figure: fig_p105r_2]

. Next, separate, with the point of the penknife, the bark & open it from the cleft in the middle, and having neatly lodged your shield so that nothing comes out but the sprout, bind it well & wrap it entirely with a **slip of linen** or **very soft thread**, so that there is nothing uncovered but the leaf, which in three or 4 ~~days~~ will give you an indication whether the shield should take, accordingly it will be green. Leave your graft seven or eight ~~days~~ thus, then unbind it & join it well to the bark, especially at the sprout, & then rebind all gently but not as strongly as before; & if there is any output or growth, leave it space to go out, & do thus three or 4 times.

[Figure: fig_p105r_1]

Next, when it is well *b* taken, cut the top of the tree that exceeds your tree, *ne* three or 4 *fingers* above the shield for the first time, and *ap* then, at the closest point, in order that it closes. But heed well that when you make your shield no small hole remains at the back of the sprout, for this would signify to you that its root would be broken, & your graft would never take; but make it so that the back is intact. This type of grafting is practiced from mid-May, so that the trees have already budded & made new

issue, until the beginning of August, and so that the trees are in sap. *Almond trees*, which by their nature are drier, lose their sap earlier, therefore those who want to graft onto them *mericotons*, *apricots* & grafts of trees with pitted fruit, which are the best there, they are grafted in the month of January. Generally trees with pitted fruit, like *mericoton peaches*, are grafted in clefts. One says that trees *de* grafted *en piolet*^[c_105v_06] or by shield are later in bearing fruit than those by cleft.

Nightingale

It is necessary that the *iron* wire of its cage be of the thickest, in order that, thinking of leaving, it will not be hurt. Cover, from the moment that it is taken, its cage with canvas.

One needs to feed it the first day, giving *uy*^[p120r_3] taking it out from its cage into the *hand* & opening its beak, & with a small *wooden* pin, put it in its throat & make it

Nightingale

It needs to have a cage made like a *barn*, like those for *calendras*, doubled with green cloth, because it fears the *cold*. And for making it accustomed to eating when first it is put in the cage, one needs to give it *ants with soil* at the bottom of the cage, to make it accustomed to pecking ~~then it~~, and give it *chopped sheep's heart* & immediately some *eggs* & *mealworms*.

Gardening

It would not be very careful to cultivate *oraches*^[c_105v_05] in one's *garden*, because when soup & broth is kept a little bit cold because of it, it engenders *worms* in it.

swallow. And continue thus until
it is no longer opinionated. This is done
for sustaining
it,
for
if it
were to
become thin,
it would die.

FOUNTAIN MAKER

As you will see below in the discussion of the **MOLDER**, reheated plaster promptly mixed into water & put on the joints of the conduits of fountains & resists as much as any stucco.

Catching **nightingales** See the 15th folio after this^[c_105v_04]

For trapping them, one needs to observe their nature, the food that they like the best, & the *season of their pleasure*. The **nightingale**, as long as it sings, maintains a territory for itself alone. Approach, therefore, making as if searching the ground for something. And taking some **worms** which come from old meal or from beneath kneading troughs or mills, which it is fond of, put some on your hat attached with a pin or otherwise, in order that it wiggles. And at five or six paces from the hedge where it sings, make a hole in the ground & put in some **worms** and your device of little crossed sticks. It will be anxious for you to leave so it can go see what you have done, and seeing **worms**, it will enter.

Some sell them on trees.

The **coolness of the evening and the morning, near fountains & shaded places**, are more appropriate for taking them.

For casting

Aspalte^[c_106r_03] is which is found in Germany is the most excellent sand one can find for molding in a frame, because it is appropriate for silver & for gold, & the more you use it and the older it is, the better it is. One molds in it very thinly & finely.

Making gold run for casting

Because gold cools down very quickly, one ought to give it a mixture when ~~melted-q~~ it is well melted which maintains the heat. Sublimate softens^[c_015r_01] it nicely. But, because it goes up in smoke, it does not continue to help. Therefore, mix this composition when you want to cast: sal ammoniac, the best verdet that you can find, a little borax & saltpeter ~~which ti~~. And this, by keeping it warm, it will come out neatly. Saltpeter clarifies it & ~~p~~ heats it. But the most important thing in this mixture is the verdet, which has to be good. This mixture softens the gold ~~qui~~ so much that it becomes tractable like lead, even fine gold.

For sand for molding flowers & leaves & delicate things, mix in ground raw plaster, brick & feather alum.

To moisten sands, eau-de-vie is excellent, for it grinds the sand finely & goes in exhalation ~~que~~ when one reheats the frames.

Sal ammoniac water is very good, is excellent, for moistening sands, but for lots of water, one only needs a little sal ammoniac.

A loop^[c_106r_02] of iron, for lack of *crocum ferri*, is ~~exee~~ good for gold.

The snakes or lizards you want to mold should not be kept for a long time, for if they are alive, they get thin, and if they are ~~dry-ii~~ dead, they wither.

Plaster of Paris is as firm as stone & very good. When you want to choose some for your sand, take it raw, the hardest possible & which does not make any powder. The transparent one and the one that thus makes powder retracts, ~~Which~~ which is not good for this work. A sign of the one that is close to perfection is that it is hard & made of lustrous grains nearing the shape of sugar. Finally, to mix some into the sand to cast gold, it is necessary that it endures the fire twice & is reheated twice.

^[c_106r_01]

When gold is very fine, it is so dry that it can hardly endure a hammer, but this mixture softens it like lead.

Casting in gold

To cast in gold, *it f crocum ferri* is necessary, & more feather alum than in the following mixture. The feather alum mixture cannot corrupt anything. The mold needs to be red, & one needs to press it promptly with iron presses.

The shell of crabs & crayfish are awkward to burn, & there is a proper fashion of molding them.

Rats & birds can be molded, and the feet are awkward to extract when burnt because they are small & delicate. The bodies are extracted more easily from the mold. The feet are cast in many times pieces.

Plaster^[c_106v_07]

When you have it as a stone, choose the hardest bits and those which do not easily crumble away with your nail, and clean it well from powder & filth before pestling it.

Plaster alone does not withstand fire but breaks up into pieces.

Tiles

Those of the houses that are not sandy seem to withstand fire better.

Tiles with which one covers houses, the hardest & firmest, and purged of stones & coarse gravel, are used to p mix in with the sand And for molding. But, before, it is necessary to heat them until they have been quite red for one or two hours, & pestle them & pass them finely through a sieve.

The little turtles, having just come out of the egg, are very nice to mold.^[c_106v_02]

Reheated **plaster** *se-ga* as is said here, keeps well one or two months, well pressed, in a dry place, if it is not *rainy weather*. But when fresh, it is excellent for exquisite work.

It must withstand the fire & turn red like a lit **charcoal**.

If the **plaster** is mixed with some **dust** or is not the hard kind, it bursts in the fire & causes flashing.

The hardest **plaster**, as was said, is the best when it is from **stone**, therefore take it raw of this kind. Pestle it well as finely as possible, and pass it through the finest sieve or sleeve that you can. ^[c_106v_01] Being thus ^[c_091v_01] fine, put it in a good amount in a cauldron or skillet over an open flame, & as it begins to heat up, stir it continuously, and heavy & coarse as it is, it will become so light & so handleable that it will seem to you not to have any resistance to handling stirring, as if it were **water**. Keep stirring it continuously until it returns once again to being heavy & dense, and that is the sign that it is cooked. But do not reheat it until your **brick** and ~~feather~~ **feather alum** are reheated & the **clay** circles are made. For it needs to be the last one reheated & when all the rest is ready, for the less **plaster** ^[c_112r_02]



Feather alum is the one that gives good binding to **sand**.

Crocum ferri is appropriate for **gold**. It is that one which, being mixed among the **sand**, receives it & holds it within its warmth.

^[c_106v_03]

remains reheated, & ~~more~~
the more quickly it is
put to use, the better
it is, for it sets
more quickly. One ought not
to reheat it until
you want to
mold. And to
reheat it, put it,
as finely ground raw powder,
in a

cauldron on ~~ash~~ a clear flame, & do not make it either too strong nor too violent. Always stir with a long stick to **avoid the vapor**, turning it around the cauldron & in the middle, in a figure

8. At the beginning, you will find it heavy ~~diffieult~~ to stir, because it is full of moisture. As it heats up, it will start to throw off some bubbles at the edge of the ~~cauldron~~. And finally, it will become like liquid & as it were, mealy & like bran & boiling in the middle. Continue to stir continuously until you recognize that it has once again become heavy   [c_106v_06]

  [c_106v_02]

as heavy as before, and like a moderately thick paste, & that it is not so easy to handle as when it is liquid. It is a sign that it is cooked enough, which you will know when it also throws off big bubbles or exhalations, in the middle & around, as long as a ~~finger~~. Seeing it in this state, remove it from the fire, for it is heated enough, because if you were to reheat more, it would be too much & would not set as well. For when it becomes red & overheats, it loses its strength & spoils the ~~sand~~. Leave it to cool before mixing it with the other ~~sands~~. And when it is cold, mix and mold, for the sooner after its cooking you use it, the sooner it will set.

Catching lizards and snakes

Take a stick and attach a string at the end which has a ~~knot~~ eyelet slip eyelet at the end. And there being two or three to distract the lizard by whistling, approach the eyelet toward its neck, and when its head ~~l~~ is inside, pull. The lizard is more tedious to catch by hand than the snake & bites without letting go & grips like pincers.

Snakes can be caught by hand, provided that it is covered by a thick woollen cloth, for the teeth of the snake stay in the cloth & cannot pierce like they would with a linen. The dangerous ones are recognized by their blue & asses aseures^[c_107r_03] azure eyes. They hardly ever bite in water, which CRAYFISH CATCHERS experience.

The sand mixture is of two parts of plaster, pulverized & reheated as said, & of one part of tile, reddened ~~and p pre~~ in a good fire after the first cooking & then finely pulverized, and of feather alum, half as much as of the brick, namely two full crucibles of plaster, one of brick & a half of feather alum. There can never be too much feather alum, for ~~s~~ this is what gives bond to the sand, and because it does not burn, it makes sand withstand the fire without cracking & bursting. Otherwise, without it, the sand would not withstand it. This sand, thus composed, is proper for all metals, but if you want to use it for gold, one needs more feather alum & than the aforesaid composition, and mix in some *crocum ferri*. For it is this one that attracts gold.

It is necessary that all sand with which you want to cast well, withstands the fire well, that is to say that it withstands ~~abon e~~ a great firing without getting spoiled.

Feather alum is awkward to pestle, and it does not pass through the sieve. Thus, one needs to grind it finely on marble. And the white one ~~that v~~ in powder that APOTHECARIES sell is good. It is ground better ~~su~~ in the mortar by pestling & dragging the pestle,^[c_107r_06] thus you will render it very fine.

Crocum ferri must be set ablaze in a GLASSMAKER'S founaise for four days.

Molds can only be used once because for delicate things, like wormwood & others, one needs to break them, but before one ~~them~~ needs to dip them well into water in which the twice reheated things dissolve easily. Otherwise, you would not be able ~~f~~ to release your work without danger of spoiling it.

Good feather alum is white and has a luster as of white e silk. It is in pieces long as a finger, & is very breakable & wooly as down. The one made of stone is harder & not so good. H The best of the aforesaid quality is fetched in France, near Rouan. The feather alum for our sand is pestled in a mortar and is further ground on marble, especially since one cannot think of passing it finely through the sieve, for it is so fat & wooly that it would not pass through it. It is this, with its small soft which & thin filaments, which gives binding to the sand in a much more excellent fashion than cloth shearings in the founder's earth of the FOUNDERS OF GREAT WORKS, because these cloth shearings & cloth waste burn and feather alum not resists the fire.

To enclose the molds, when you em throw onto the things to mold your liquid sand, make your a circle & surround with well beaten fatty earth.^[c_107v_03]

*Archanum omnibus fere reconditum est in re fusoria,
ut uidelicet^[c_107v_05] res exprimenda formis, sive herba sit sive animal
ut lucerta, in af inting^[c_107v_06] inmergatur primum in vini spiritum
apprime rectificatum, deinde pulvere composito aspergatur
sive illinatur (si pulvis in formam pultis redactus sit, ut
assolet).^[c_107v_11]*

When you want to mold hollow, it is necessary that the core be of the same material. And if the snake or the animal is curved or folded, one ought to make the core of several pieces.

Test whether distilled vinegar is appropriate for eating away & dissolving what will be in the animal molded hollow.

If you know that your plaster is not strong enough to withstand the fire without cracking, do not be so scrupulous an observer of the mixture put here that sometimes you meeties would not diminish the quantity of feather alum ^[c_107v_12] a little bit, for it softens the molds with its softness. Once reheated, do not pulverize it on this occasion as fine as said, but leave it as the APOTHECARIES have ground it, for it does not hinder the neatness of the cast & gives more binding. When the sand mold, being having set, retains the color of brick and is reddish, it is firmer.

To hold the cores, some use **wire of the same metal** that they cast because it reduces ~~with~~ & melts with its counterpart, but because when melting or folding, the core changes, some find it better to ~~use~~ **iron wire**, sharpened at the ends, because it holds firmer & having delicate ends, it appears as no more than a point of a needle. And one can apply **gold** or **silver** before using it for a work. If it makes a hole, one covers it with a small **chisel**.

Eau-de-vie prevents the **sand** from becoming porous & does not make little holes on the edges of the **mold** if the thing to mold is well moistened with it. The holes & blisters & bubbles are not made on the side of the **mold**, which is thick, but at the edges, which are thinner.

One casts with **common silver**, with which **GOLDSMITHS** commonly work, which alloys ~~And qua~~ indifferently. And when one were to cast with **solder**, it would run even better.

Spat^[c_108r_02] is a **whitish stone** which can be found in **Germany**, & mainly in **Augsburg**, which one uses for **the most excellent sand that can be found for lead, tin, copper, silver & gold**. And the more it is used, the better it is. It is appropriate for casting flat things in a frame. For round things, it is not as fitting nor does it hold in the fire as well as the aforesaid one made with **plaster**.

The shreds of ~~ewi~~ thick, **greasy leather** are ~~p~~good^[c_108r_01] to cast in the **molten copper and latten**, for it cleans it & removes from it all its **filth**.

Spalt^[c_108r_02]

Spalt is white like **cooked plaster** and can be found in mounds and **stones** formed in long scales & long veins. It is very soft, such that with a **fingernail** one can scrape it, & makes a powder like our **chalk from Champagne**. And because everything which comes from ~~s~~ the **earth** is mixed with some other substance, to purify it, one grinds it, coming from the **quarry**, quite coarsely, then one mixes it with **sal ammoniac water**. ~~M~~^[c_108r_03] By putting in a piece the size of a **walnut** in a large **bottle of water**, and

thus one mixes it & reduces it into ^[c_091v_01] ~~p~~ small stones, purging it of its impurities. Then, one puts it to cook neatly in a ~~pōt~~ earthen vessel^[c_108v_02] in the *fornaise* of THOSE WHO MAKE POTS, and one leaves it there until the pots are cooked. Next, one mixes it again with sal ammoniac water & one grinds it very well, and one empties the muddy & clean water into a separate vessel. Again, one puts the same water on top & one grinds, & again one puts the muddy water with the other. And one does thus, until it has passed everything. In this way, one purges & cleanses it, & one renders it very fine & handleable. Having taken away the water by tilting it or with a sponge, one takes the residue and one dries it. Then, moistening it with the aforesaid water, like one does with the other water sand, one uses it in a frame, where, if it retracts, it is a sign that it has not reheated enough & that one needs to reheat it further. This one is appropriate for molding all metals, and especially gold & silver, and the more it is used, the better it is. One needs to set aside the one in which you cast lead or tin, for it would sour the gold you would cast in it.

Feather alum should be reheated in a ~~cauldron~~ crucible covered with a tile in a strong flame fire of charcoals, in order that the impurity which could be there burns with the feather alum, which does not burn. This is done either in the GOLDSMITH's forge, surrounded with bricks, or in a *fourneau à vent* with fusion fire, so that the ~~sand remains long enough~~ crucible for a quarter of an hour remains red. This is done more to cleanse it than for anything else. It becomes reddish on the surface & on the inside it remains white & better dried out. ^[c_112r_02] #

^[c_112r_03] #

After your feather alum is cooled, pestle it in a mortar, then grind it on marble, and it will be rendered into very fine wooly filaments which give bond to the sand without getting burned as other things do, which is a beautiful invention. Pestle it in the mortar by dragging the pestle, for the flying dust could enter your throat or land on your face, which will give you *reason to scratch yourself well*. Put it in the mortar a little at a time to avoid the flying dust. It is better

to grind it thus, in the mortar, dragging the pestle, than on marble, ~~for~~ where e it spreads, & in the mortar, it collects on all sides. Render it very fine & *soft to the touch*.

Clay to make circles around molds should be very fatty & handleable, and serves only to make the surrounding of the molds. Thus, one ought only to choose the quite fatty kind, and beat very well, & moisten it moderately with some water, & keep it in a pit or in a *terraine*, and make numerous holes with a stick in it, which fill with water, in order to keep it always fresh & soft, so that it is always ready to use when you need it.

Modeling in wax

When wax is too hard, one mixes in turpentine or a little butter, which ~~are pl~~ renders the wax more amiable and more appropriate than the tallow that the Italians put in, because one often has to put the tools in the mouth, which are better in boxwood or bone of hart.

Wax for molding -

As the wax is melted, they have sulfur that is melted in a spoon or crucible, & they pour some in the melted wax. And going to the bottom or remaining on top, the sulfur leaves & mixes only its substance amongst the wax & renders it more meltable when warming it, such that having molded, it melts in the mold gently like butter, without leaving any pustule or bubble in it. Also be advised not to give it too strong a fire.

If

Molding wax

In order that your mold grips without repelling in any place on a shape or image of wax, you need to anoint it with oil and moisten your sand with lukewarm water, for the cold water would repel the oil more & would not have a good seating on it.

Anoint well, very lightly, with oil, so little that it hardly appears. Then, rub with some eau-de-vie. Next, moisten your sand with lukewarm water so that it does not repel the oil.

Bellows of the forge

It is better that they should be fixed through the blast-pipe in some piece of thick plank, *q* for they are more secure for it; next, you can lightly secure them from above. It is necessary that blast-pipes be 4 fingers above the sole^[c_109r_01] of the forge.

Snakes for molding

When you take them for molding, if it is possible, do not remove their teeth if you want to keep them. For, having had their teeth removed, they get sore gums & mouth, & can no longer eat. You can keep them in a barrel full of bran or even better of earth, in a cool place, or in a glass bottle. And give them any live frog or other little live animal, for they do not eat anything dead. Also, I have noticed that

when they want to bite or eat something, they do not bite with a direct attack but with sinuous turns & from the side, as do Satan^[c_109v_02] & his DISCIPLES. It has a small head but a very long body. The entryway to sin seems small & inconsequential, but the consequences of it are very great. It abstains from eating seven or eight days, once it has devoured some frog. It can swallow three or four of them, one after the other, and what it devoured is neither corrupted nor consumed in one go in its stomach, but *p* some part little by little, that is to say bones and everything. And the remains are found as fresh as when it had devoured them, such that sometimes, when one presses & torments it, it renders up what it has engulfed, parts of which are found totally consumed & others as fresh as if it were alive. It can keep a frog engulfed for two to three hours & renders it up completely alive.

Toad

^[c_109v_01]When it is big, one needs to mold it hollow, & if you want to make it have an open mouth, put some cotton inside, & then on the cotton some melted wax.

If by chance you want to mold this vile animal, & if it were to piss in your hand, it would burn your hand & itch, as if you had handled nettles. But the most powerful remedy for this is to put your hand into fresh earth & to cover it as if you wanted to bury it. A frog is not so beautiful molded because it has lively skin, & the other has a lumpy one.

You can mold it hollow, and leaving under its belly an open notch, you will make it jump with the twisted cord of the saw. Or else, if it is small, put it on a magnet of its size, cut thinly, then put it in good vinegar.

Killing **snakes** for molding

Some put a drop of **aquafortis** in the mouth, which stuns them well, such that the head & the part behind seem to be dead but the mouth remains alive, and when you pierce it with a **needle** to fit it to the **mold**, it moves & spoils & undoes everything. Therefore, to put them to death entirely, put it in a **bottle** of **good vinegar** & some **eau-de-vie**. And do thus with **lizards** & other similar beasts.

If you want to keep them, you can put them in a **pipe** full of **earth in a garden outdoors**. But your **pipe** must be covered with **archal wire**, for otherwise it would climb & go up very high.

Molding

You could **mold** the thing and animal already cast, but it never comes out as well as the one from nature, with which you can make four or five **molds**.

Rock & **grotto**

One needs to **pestle** **white & yellow marcasites** & diverse kinds of **minerals**, & then wash them well, in order that the earthy & powdery part is cleaned & there remains only the lustrous grain of the **mineral**, with which you will sprinkle your **rock** previously covered with **strong glue**, if your ~~fatty~~ **grotto** is ~~r~~ not for a fountain & for touching **water**, and you will have a nice work.

Snakes

When they feel taken, they hardly bite & do not have the power to harm, unless they are really big **snakes**. The main thing is to keep from being bitten before catching them, and having put your **foot** on top of it, as close to the neck as one can, one needs to grab it closest to the head, for it cannot bite if it does not have the means to stretch its neck & make a sinuous & oblique turn, & it cannot ~~s~~ harm with a direct attack, since he cannot move forward in a direct line, but writhes in the shape of an S. I saw that **THE ONE WHO TAUGHT ME TO MOLD THEM** did not take this into account, & assured me that there was no trick to it, other than, when taking it, he would pull it, a little pressed & held tightly by the neck, & passing it under a shoe, he would flatten it in such a way that it would render ~~under~~ from its bottom, which is five to six ~~t~~ **fingers** from the end of its tail, all nasty and venomous things that it had in its belly, and that after this, it does not have the strength to bite, and if by chance it should bite or expel through its bottom some **filth**, he would only dig the **earth** with a **knife**, & bury his **hand** in **fresh & humid earth**, which, when applied fresh ~~en~~ on the **infected part**, pulls out all the venom and nothing else. It is the same with **toad**'s venom, which I have seen experimented.

In three, ^[c_110r_03] it is almost as thin as it will be afterward if it does not eat. **Molding** it very soon after it is caught is best, before it becomes thin. One ought to put it to death only a **quarter of an hour** before you want to **mold**.

When it has eaten something, by tormenting it, it renders it up. And if, after having eaten something, it is thus pressed **underfoot**, this pains it greatly & hurts it. If it is wounded, it will not eat willingly.

Molds

There is nothing better for opening them up than to anoint them with **olive oil**, & nothing else. And next, when you want to unjoin them, soak them in **cold water**, which is the secret. **L** And ^[c_110v_04] you will see that the **oil**, although it seems to be imbued, will detach itself, like grease. **Molds** become stronger in **cold water**. And **hot water** would dissolve them awkwardly, although once reheated, they are more handleable & easier to dissolve in the **water**.

Wheat oil

Is made on a blade of iron reddened in the fire. And the oil drips off, which is appropriate for anointing the hair of a butterfly or similar thing, for this oil is instantly dry & makes the remainder dry out. It is necessary that the hair or down of any animal that you want to mold be flat, for being upright, it would elevate the sand & become porous.

#

If you want to mold something delicate, like a pansy, some, to give it a little thickness, more than what is natural, some rub it with butter. But it is best to anoint it with wheat oil, for it has no body, & does not obstruct the small lineaments as much, and makes the flower firm.

Cast of lead and tin

Because tin wants to be cast very thinly, if your medal, plant, or other thing for molding is *espe* thin & fine, do it so that there is more tin, much more than lead, namely less than the fourth part lead for three parts tin. And still, one puts lead only to form an alloy. On the contrary, if you want to mold something strong & thick, put^[c_110v_03] a lot more lead in than tin. And in one & the other you can put a little looking-glass tin, but only a little, with a little rosin, when you want to cast. Since then, when molding with fine and new lead, I put into one lb two ounces of fine tin. And when molding with fine tin, I put in two 3 of fine lead for one lb. I made plants & snakes just like nature.

S[illegible]

I cast tin almost red, and lead the same, which, however, had not remained in the fire for too long, for it becomes brittle and calcines.

Reheating molds

The frames readily dry out & do not reheat. For reheating is actually ~~for the second time~~ to redden & inflame the molds in the fire, and drying out is to let the molds dry themselves or to make their humidity evaporate by placing them in front of a flaming fire or a charcoal one. *Noyau* molds readily reheat & frame molds dry out.

Latten smoke

It is good to reheat in it the molds for casting latten, for this yellow filth *gc*, which appears nevertheless to refill the molds, casts very neatly, being of the same nature.

For red copper

When it is melted, it is good to throw in a little fine tin, for this makes it run.

Clay earth

This one, moistened & well beaten & kneaded as you know, is necessary for you to make the contour for containing your molds. But take heed that it is not too soft, but rather as if half dry, that it ^[c_111r_01] does *not attach to your hands*, because otherwise it would attach to your work. Always keep it in a humid place, and make holes in it, and fill them with water to keep it fresh.

The gray one is best, which does not crack at all.

It is more appropriate than a blade of lead.

Iron wire

You also need to have provision of different sizes, according to the molds that you want to make; thick like cord, smaller [illegible], & thin *p*, like the thick strings of a spinet, for the small works. Once ~~de~~ reheated, you make clamps from it to close the molds, & points, like needles of different lengths, according to your need, to pierce the animal to be molded & keep it held down. Needles would not be good for this because their points have to be empty & of the same thickness throughout, except at the point. And then, one must make them as long as you have need of. Iron wire is firmer than that of latten.

[Figure: fig_p111r_1]

Sal ammoniac water

The size of two chestnuts of pulverized sal ammoniac suffices in a pot of water, and to the tongue, you find the water moderately salty, for too much is not good. [c_111v_04]

Sanguine

To clean the various colors of lead & tin, one pulverizes sanguine, & with some small bristle brushes, one rubs the molded e work. [c_111v_02]

Crab and crayfish

These are the hardest to mold, & whoever molds them well will mold many other very delicate things.

Lizards

When one takes them with two fingers from the sides of the head, at the level of the ears, one makes them open their g mouth, then one takes the a [c_033r_01] end of its lower mandible with the end of the fingernail, & next, with the upper mandible, he bites the nail, but he cannot pass through, but he clenches very strongly. And if he were to bite living flesh it would ~~at~~ not let go, & there would be no better remedy than to promptly cut off his head. In the spring, as they have changed skin, they are more beautiful.

The small lizards that one takes in the summer, the size of small female lizards, grey on the back & green on the belly, are very appropriate to cast in silver & gold, or other metal, because they have rougher scales than the female lizards & show better.

like pincers

Composition of sand

Once everything is reheated as said above, take four full crucibles of plaster, two of brick, & one of feather alum. Do not pass through the sieve to mix ~~may~~ because the alum would not pass. Mix with your hands until neither one nor the other, neither white nor red, can be discerned among the other. If your plaster^[c_111v_03] were not strong, do not mix in at all so much feather alum, because it softens the molds. Take heed also that your sand is not hot (since it has immediately been reheated) & when you will want to mix it with water, for this ~~them~~ makes molds too soft & breakable.

^[c_111v_01]You may sometimes diminish the quantity of plaster if you do not find it strong enough to withstand fire & if it cracks, &^[c_111v_05] in order that the part of pestled tiles holds up, with the feather alum, which you can also increase so that it creates a better bond.

For tempering sand

You need to have a big basin full of water to & soak the molds to open them, a flagon full of common water, a lead bowl for tempering your sand, a small wooden spoon to collect the wetted sand in the bowl. ~~The big basin is for tr~~

To make handles for your large oil paintbrushes, if you do not have large enough feather quills, take two of them, & slit them, & join them together.

[Figure: fig_p112r_1]

Decoction of sands

Already mentioned.^[c_112r_01]

For molding *en noyau*. Mixture of sand

Having reheated your sand, namely the plaster, the feather alum & the brick, & having passed them finely through the sieve, #, [c_112r_02] mix them this way: take four parts of plaster, two of brick, & one of feather alum. Mix them all together with your hands ~~that it~~ in such a way that one cannot discern one from the other. With your sand ready, you need to put to death the animal that you want to mold ~~de~~, [c_112r_04] in this manner.

[c_112r_03]

except for the feather alum, which should be ground in a mortar

Putting to death the animal for molding

You need to be careful not to wound it in taking it. And, having put it in a glass bottle ~~d~~ [c_112r_05] with bran, or in a barrel full half full of fresh & humid earth, if you want to store them or keep them a long time, give them live frogs & not dead ones to eat. For if you keep them without feeding them, they wither & grow thin & have long wrinkled ~~autx~~ [c_112r_06] skins. Thus the best would be to mold it as soon as after possible ~~apre~~ after it has been taken. But before, put it to death in this way. Place it in a clean bottle or vessel so that it would collect no dust. And put inside such a quantity of good vinegar & urine that it can be covered. And shake it & torment it therein until it is dead, which will be in an hour or a half. But if you are in a hurry

To know if it is quite dead, take it out of the vinegar and take it by the tail. If it moves it, do not mold it for it still has feeling, & when piercing it, it would draw back & spoil the mold.

Water snakes hardly bite.

to cast, make him take through the mouth some good **eau-de-vie** or else mix a little with the **vinegar**. And soon it will be dead, without any lesion which deforms it. For large animals, for whom one would need a lot of **eau-de-vie**, one uses **vinegar** and **urine**. But for small ones, only **eau-de-vie**, which is done sooner. When your animal is dead, take it out & clean it carefully of its old skin, if it sheds, or of the **filth**, or of the **lice**, like **lizards** have, and then arrange it thus.

Now, put enough in a **glass**, & soak & continually keep in it the head of the animal, or the whole of it, if it is not big.

Take heed, before it dies, to keep the eyes open ^{es^[c_112v_04]} by blocking the eyelids with a little bit of **wax** or something else.

Molding Making the arrangement and disposition of the animal

Having made provision of fatty earth called clay, that should be grey because that commonly is the best, or another which has good binding & which should be well prepared & beaten, such that it is handleable without attaching to the hands nor the work, make a lasagna or like a cake of this earth equally flattened with a round stick which PASTRY MAKERS use, which should be a little thicker than a thumb. And on this cake, arrange your animal, ~~aya~~ imitating in that its nature & ~~fa~~ the fashion in which it commonly turns itself. And first, with a good needle, pierce it from underneath in the middle of the throat & up to ~~u[illegible]~~ the top bone of the head. Retract the needle, & in its place & its hole, put the point of an iron wire of such a length that it suffices to hold the head of the animal as ^[c_112v_05] high as it must be, & if the skin moves into the inside & when you put in the point

[Figure: fig_p112v_2]

, ^[c_112v_01] pull it out with ~~a~~ ^[c_033r_01] point the edge of your small pincers, & arrange it as it was. Push the other end of the point in the cake of clay. Thus, the head will be held high, which will have better grace, & being secured, next, arrange the gesture of the body & the feet & the entanglement as you think will look best. And so that it is secure & does not move at all when you cast in the sand, ~~put~~ secure the legs & ~~the corp~~ with little points of iron wire, having already made the first hole with a very sharp needle. Do the same on the body parts that you will deem necessary, ~~arranging~~ making sure that the points passing through the animal are fixed in the cake of earth and not so far in front that they jut out beyond the body of the animal by a

Take a fine needle of steel, & which is the sharpest possible, in order that, making with it the first hole to place the points of iron, it passes without forcing anything, & by its roughness does not push in or pull out the skin. Next, put in a thickish point of iron in thick places & thin ones in thin places. But heed as a secret to not plant, in the first go, the point passed through the animal in the slab of earth, ~~for~~ but having planted it, take it out of the earth & not out of the animal, & ~~do-ains~~ next, fix it. This is done because, by fixing it the first time, it pushes in the skin of the snake, and by taking the point out, it replaces the skin in its original state.

^[c_112v_02] When you put again the points you have already used, clean them well of rust so that they do not take away some skin.

The principal disposition of your arrangement is to ~~di~~ place the head raised & looking sideways. For this effect, pierce the head on a solid plank or table ~~& illegible~~, making the point pass through the bottom of the throat, ~~s'arrestan~~ entering into the top of the head,

[Figure: fig_p112v_1]

[\[c_112v_03\]](#)

bit, ~~qua~~ so that ^[c_113r_01] you can take it out if you need to. And take heed that it is necessary that these points be of the most delicate iron wire possible which can support the size of the animal. For the more delicate it is, the smaller the hole that it leaves appears. However, one needs different thicknesses of these, because ^[c_128r_02] ~~it~~ the points which are put in the body & in thicker places, like under the throat, ought to be longer & stronger than the ones of the legs & thin parts, where the needles ought to be subtle & delicate, almost like the thickest strings of spinets. And it is better that they be of iron wire, which is firmer than the one of latten. And if the end of the tail, or the end of a nail or a leg, ought to be joined to the body, do not put the point there, not to corrupt it. But place wax, as much as a grain of millet, between the body & ^[c_113r_04] ~~ee~~ which the end of the tail, then with a bit of flattened & hot iron wire, touch this wax & join by lightly pressing. Thus having placed your animal on the cake shaped like a mandore, place all around a circle of the same

[Figure: fig_p113r_2]

earth, in this way,

[Figure: fig_p113r_3]

b & join everything well together in a circle, then, with a big knife, with which you have cut your cake to the right size, trim the outside which exceeds it, & place there a piece to close it as you see in b. ^[c_113r_02] Then, with a small curved instrument, mark on the inside of the circle the thickness you want to give to the mold, which will be for a common snake as thick as two thumbs, in order that when you cast in your wetted sand, you will see when it is thick enough. All of this carefully arranged, moisten well everywhere with good eau-de-vie, with a paintbrush, the body of the animal which is uncovered. For there is the secret, ~~of the most~~ kept well hidden, because everything that will be ^[c_113r_05] ~~it~~ touched by eau-de-vie will undoubtedly come out very neatly & without porosity any small eyes or holes that one calls porosity, which usually come not at the back & in the thick sides of the mold, but on the edges. And as soon as you have thus moistened everything with eau-de-vie, cast in your wetted sand without letting the eau-de-vie dry, which evaporates promptly. And wet it thus.

[Figure: fig_p113r_1]

[c_113r_03]

and make sure that the **point** is longish, depending on how much you want to elevate the head, and that it be pointed on both ends. Once placed thus, plant your **snake** on the slab of **earth**, & arrange the head first and then the rest.

If, after you have placed your animal on your **clay cake**, you are distracted with other occupations, rub your animal with **eau-de-vie**, & under the belly, so that it does not dry & attach itself to the **earth**.

[Figure: fig_p113r_4]

If, when you pierce your animal, it renders **water** from the bottom of the side of the belly on the slab of **earth**, clean it well with **cotton** for the **sand** that

Eau-de-vie in three goes.

would touch it would be lumpy. If it is on top of the animal, clean it very carefully and touch it & moisten well with **eau-de-vie**.

Tempering the **sand** and molding the first cast

Take a **bowl** of **leaded earth** of such size that it can hold the **tempered sand** which will be needed ~~of~~ to fill your **mold** in one go, which is *mei* better than in two goes, because if you do not cast the second wet batch promptly, there is a risk that while you are preparing it, the first one will set & become solid,

such that, while reheating, the two casts will unjoin. ~~And for pl~~ Therefore, for this effect, take several bowls of different size which have a lip, to cast better. In these, pour some common fountain water, & mix into it as much sal ammoniac water as can be held in an egg, #^[c_112r_02] composed as mentioned. If you want to cast in lead or tin, because one would need more for casting gold & silver, the water being in your bowl, mix put in it your sand in it & not the water in the sand, & add it ~~a dista dista~~ with such discretion that, ^[c_113v_03] while stirring & mixing it promptly with a wooden spoon, it does not become thicker than clear mustard. And thus, cast the first into your mold the lighter part, ~~which es~~ as is always at the surface, with a shaking motion, & ~~da~~ from a little height. And doing so, when the animal is nearly covered, blow strongly everywhere in order to dissipate the small and big bubbles that the wetted sand makes & continue without delay to put all the rest which is at the bottom, & a little thicker than at the top, until everything is filled, up to the mark for thickness that you made.

[Figure: fig_p113v_4]

^[c_112r_02] And do not forget to shake the mold in order while casting, in order that the wetted sand runs & enters well everywhere. Also, tip your mold up on the side of the head, which is higher than the body, and thus your mold will have the same thickness, & you will spare sand.

All of this being carefully done *fai*, let it set, which will take a quarter of an hour. Then, release the clay circle, which can be used another time. And leave it to dry a little, & separate your mold from the cake of earth, which also ~~de~~^[c_113v_04] will be appropriate for molding right away, and trim the excess with a big knife, giving ||^[c_113v_01] to it the long shape of a mandore. *Rasehe*

If you can, fill your half mold in one go, & with the ~~pre~~ a tempered batch, it is the best.

#^[c_112r_03]

or two eggs, because there is no risk if there will be more. ~~And the water~~ If you cast in two goes, it is enough to put sal ammoniac water at the first bowlful.

Make it clear like a pureed broth, or like starch water that women use to make their starch. For there is no risk in it being very clear, because sand always settles at the bottom & water separates & remains on top. The sand that one scrapes as well *[illegible]* mme too weak & soft. And it will not^[c_113v_02] let itself set quickly, for all things calcined dry out promptly from mixed water.

[Figure: fig_p113v_3]

[c_112r_03]

If you do not fill in one go your mold tempered with **tempered sand**, take heed to stir your second cast with the e[c_017r_01] p surface of the first, p by mixing with your spoon or spatula with which you temper it.

Second cast

Scrape & cut also away the back of the mold, which is always the weakest, and adapt it cleanly thus. And do not forget to make notches around, in order that the second cast anchors itself there & binds better

[Figure: fig_p113v_5]

without changing.

Sal ammoniac water is not necessary to small molds, which require neither a big nor long fire to be reheated; however, when you put some in, it will only be better.

Second cast

When you have well molded the first part of the animal, that is the back, the backbone, and the entire top part, and the ~~len~~ half-mold where it is enclosed has set and is hard enough,

[Figure: fig_p114r_2]

+^[c_114r_03] uncover the whole bottom part & side of the belly,

[Figure: fig_p114r_3]

now with a knife & ~~tant~~ at the thickest places, & then with a penknife, where the most delicate parts are enclosed, such as the legs, the tail, & similar things, and because the head is higher, you will also need to look for it & uncover deeper, and make a deeper notch there which ought to release easily. That is to say, widening on the outside, in order that the second mold that you will cast on it can come out well, which even the animal can help with, which is malleable and obedient, being natural. However, ~~ad~~ be more careful when uncovering the throat of the lizard than with the snake, for the lizard has large jaws & large bones that are not malleable and has hollow ears, where, if the wet sand has entered, it is not ~~aff~~ easy to release. But you will avoid all of this, if you uncover half of the head and those things that you know do not release well. Once everything is uncovered well, blow on top & wipe each part, by wiping with tiny hog bristle brushes, slightly moistened by the end with a little saliva, or with clear water, as you uncover it, in order that ~~your~~ the uncovered lower part of your animal will be very neat.

^[c_114r_03] With this done, dip ~~the rev~~ your mold, for the length of a paternoster, ^[c_114r_05] your mold in water, not ~~from the~~ the uncovered side but opposite & the reverse of the uncovered thing. And this is in order that, by sucking the water inside, the oil with which you next anoint the other side ~~to avoid~~, is not imbibed at all, but remains on the surface & prevents the second cast that you will cast on it from attaching to it. Having therefore thus dipped the reverse of your mold in the water, take a paintbrush especially dedicated to this & ~~anoint it~~ with it, anoint with oil the whole surface of the mold, except the animal, which must in no way touch the oil, & take heed to retrace well & to anoint with the point of a paintbrush between the parts & through all the delicate parts. And if by chance the oil is imbibed, dip the ~~mo~~ reverse of the mold, as mentioned, in water, & you will see the oil return to the surface in little drops.

Mold small animals like big ones, except that you need to make delicate points of *fil of eist* *cittern strings*, both long & short.

[c_114r_04]

[Figure: fig_p114r_1]

remove with your small flat pincers, all the points.

[Figure: fig_p114r_4]

And then + ~~now with~~

[Figure: fig_p114r_7]

However, leave the *point* of the throat, so that it serves as a clue to find the head, which is deeper down than any other part, because when making the arrangement you disposed it higher. It is also at the level of the head that you should make the biggest notch, & start with this one to uncover, and follow the rest through the trace of the *points*.

[c_114r_04]#

And if some bit of nail from a leg, or from a tail, or from another should separate from the mold, put ~~there~~ between the two a small grain of *wax*, & with the *point* of a hot *iron wire*, join it, then adapt your mold with a *knife*, & make notches on its sides so that the other half binds to it. ♂

[Figure: fig_p114r_6]

This thus prepared, place your *de* first half-mold on the *cake* of *earth clay*, & put the circle also around, & make the mark for the thickness similar to the first. Then, with another rather thickish *paintbrush*, moisten well everywhere the uncovered half ~~& the belly~~ of your animal ~~And~~ with *eau-de-vie*, without leaving anything, if it is possible, which is not moistened, for this is the secret which makes it come out neat. And next, as promptly as will be possible for you, before the *eau-de-vie* ~~not~~ evaporates, wet your *sand* and cast it in thrusts and by blowing & moving the *mold* as you did for the first one, making sure that the ~~first~~ beginning of that which you pour on the animal should be a little lighter than the next one so that it moistens everywhere & closely follows the more delicate parts. So, leave it for a *quarter of an hour* to set, then remove the circle & the *clay cake*. And, with a *knife*, arrange your two *molds* uniformly together in a long shape of a *mandore*, as mentioned, because of the cast. Then, dip a little the whole *mold* evenly, at the level of the joints, in *water*, for this is another secret to unjoin them, otherwise you will break everything. Separate them nimbly, therefore, by this means, and next, extract gently & with patience and method the half of the animal remaining in one of the *molds*, ~~for~~ pulling it sometimes from one side & sometimes from the other, to avoid breaking any of it, or also spoiling something from the *mold*. ~~And~~ The latter being empty, ~~extract~~ rejoin the two halves so that no dust enters it, & put them aside until you want to reheat them, make the gate & vents, & place the *clamps*. As for the animal, so that it does not dry & that you might be able to mold it four or five times, put it in *water*. And I think that it would keep even better in *eau-de-vie*. However, the best would be to mold in the same *day* the 4 or 5 *molds* that you can do, because these corrupt animals in themselves *stink* within one *day*. Having left your *molds* one or two *es days* to dry, for they stay humid for a good *month*, make the vents on one half

[Figure: fig_p114v_3]

[c_114v_01]

[Figure: fig_p114v_1]

+

Note that when you have made your second cast, were you to leave your *mold* for one *day* or a *night* without opening it, you would need to then dip it in *hot water* or else reheat it before opening it, as for *crabs*.

If, after both halves of the *noyau* have made a strong & hard set, you would not dip your mold in **water**, it would not unjoin at all. But as you dip the reverse of the mold in **water**, the imbibed **oil** collects at the top & at the level of the joints & makes it separate.

However, take heed your second mold is of good thickness & that it is hard enough because if it is lacking in this, after having dipped it in **water**, & you want to open it, there is a risk that it breaks. Take heed therefore to avoid this, and wanting to open it, dip all of it in **water** and rub it everywhere, where it will harden if it has set well. Then, take your two molds, joined with a rough **linen** cloth in order to have a better grip, and separate them with strength as if you wanted to tear apart a loaf of **bread**. But if it happens to break, join it & on the reverse, strengthen the joints with clamps.

[Figure: fig_p114v_4]

Next, you can repair the faults with small chisels.

~~Making the cast, reheating the molds, &c~~ **Note about everything above**

[Figure: fig_p115r_5]

[Figure: fig_p115r_1]

[\[c_115r_01\]](#)

if you want, which will be enough,
or else on the two halves.
But because one needs

to cast by the tail or from the back of the animal,
make it so that the vents come from
the head & the middle of the body to join
to the said tail,
where the
gate is done, which is the
end of the
mandore.

If your **snake** has been without eating for a *long time*, it happens that, when you want to put it to death in **urine** & **vinegar**, it fills with a lot of **water** & swells, and next it dries out as you fix & arrange it on the **clay cake**, and next it happens that when you have cast your **mold**^[c_115r_05] **tempered sand** on it, & it has set, it ends up coming out such that between the **snake** and animal there is a line of distance \mathcal{D} , in which enters the second batch of cast **tempered sand** \mathcal{M} . Avoid this, therefore, if you can. But if this cannot be, do not let this prevent your second cast, for the **sand** which will enter in this void will be so weak that it will easily be removed with a **small point** & will not have set with the first hardened one.

Note that one needs more **feather alum** for **molds** that should be reheated, like those for **gold** & **silver** & things that one needs to burn inside than for those which release well & that are only for casting **lead** & **tin**. However, do not put too much in either one.

N^[c_115r_03] And having done your cast, do not forget to make in it some holes and ~~fillegible~~notches^[c_115r_02] because the metal will run more neatly thus than if the cast were even, for it gets corrupted in its notches & holes, & does not go so much at once, & does not become as porous. This done, put join ~~th~~^[c_115r_04] the two halves of your mold & strengthen the joints, putting around these some small clamps of iron wire of this shape

[Figure: fig_p115r_2]

. They prevent
the molds from deforming & corrupting while reheating.

[Figure: fig_p115r_3]

[Figure: fig_p115r_4]

This is the shape of the clamps

Animal after release

If, by chance, you gave your snake such a curled shape that the place of the belly cannot easily come out, especially since the head & the tail, which are the two ends, are thinner, cut everything which is outside, & reheat the mold so well that what remained inside burns, then pass some quicksilver inside, & attracting ~~that which~~ the ashes & the burnt bones from the inside, it will also come out, because the conduit is big, & thus will not sour at all your material. You can pull really strongly the molded snake, because it is soft & malleable & obedient, & the mold, having set, is so firm that, because of this, the imprint will not be spoiled.

Reheating of Molds

After your molds have been reheated ~~le-p~~ & cleaned, casting soonest is best, because if you keep them, they get corrupted and moistened. Reheat the thickest part, where the body of the animal is, at the top, so that, if there is something inside to burn, it falls to the bottom.

Mark

the part

on top to

recognize it.

It can only be good to let the mold die down a little from the outside ~~so long as~~, being well reheated, so long as it remains red on the inside when you will cast.

Cast of tin

If the plant or flower that you want to cast ~~in tin~~ is delicate & fine, it is necessary that the tin exceeds the lead in the mixture, & on the contrary, if it is thick, it is necessary that the lead exceeds. Therefore, for the mixture fine thing, put in some fine tin, not at all the quarter part of lead. And make sure that your mold is *hottish, such that you can hold it in your hand* when you want to cast. As for the alloyed tin, the same as mentioned, it is necessary that it is very hot & almost red for casting, so that it penetrates. Otherwise, having to run the length of the fine branches of the plant, it will get cold before arriving there. And do not forget to mix in it a little looking-glass tin, which makes it run better & firms it up.

In the lead alloyed with tin, or tin alloyed with lead, you can put a little bit of *metalline*, & it will seem silver. But do not put too much, for this hardens the substance & sours it also, so that for a delicate thing like legs & similar things, it would not be appropriate.

For giving venting to the mold

In addition to your vents, if your ~~es~~ plant is very fine, you can pass a thread through the clay circle, rather than casting with a needle, & make sure it passes through the plant. And with the thread burning like the plant, a hole will remain which will give air & venting, to help clean.

Reheating the *noyau* molds

After your molds have their gate, vents & clamps, as is said, make at the end of the forge ~~in~~, or in some clean place, a surrounding of bricks, and fill it with large half-lit charcoals. And place your molds on top, and leave the charcoals thus to kindle by themselves for a half hour, so that they heat little by little and not all at once. Finally, as they will begin to become white, beat ~~little by little~~ the thus half-lit large charcoals on top & blow with your little bellows until they are warmed. And thus, little by little, invigorate the fire, without haste, until your molds are quite red on the outside & the inside. If it is for casting some plant or some animal which does not release well, & if, for this reason, one needs to burn it in the mold, & when you look through the gate, & through it, you see the molds are very red & inflamed inside, this will be your signal that they are reheated enough. But if you do not see this signal, increase & continue the fire until it is the case. If there is nothing in the mold that needs burning, it will be enough that they are dried well on the same fire, if it is for casting tin. They reheat better in a reverberatory furnace.

Do not pull out
your reheated molds
from the fire before they
have cooled
themselves, & take care
that the wind or the cold does not hit them while very hot, for this would make them burst.
One must not reheat them before they
are dry and firmed up, for they would
cast in a different way, and
it is necessary beforehand to make
gates & vents
& place clamps.

[Figure: fig_p115v_1]

Take care not to heat the fire in one go, for fear *f* that your molds crack inside.

They are reheated enough when the entire hole of the gate is red. When it is black, it is not enough.

For casting in **silver**, one must not reheat two times &, if there is nothing in the mold that needs **releasing** burning, simply because it does not release well. All the molds of flowers are reheated two times, first for

[Figure: fig_p115v_2]

[c_115v_01]

Molding bouquets, plants, and flowers

One needs to mold them as soon as they are picked because they ~~ont~~^[c_116r_05] wilt & dry out. Dip them, therefore, immediately in good **eau-de-vie** & then put them in your tempered **sand** mold, like **snakes**. For which one needs no release, for while the molds are being reheated ^[c_116r_01]s, the plant burns, which does not happen with animals that have bones & ~~q~~. It is necessary that for bouquets, the **sand** be not as thick as for **snakes** because, if it were thick, it would crush the flower.

[Figure: fig_p116r_1]

^[c_116r_03] burning the plants, flowers, and animal parts which are left inside. Next, one needs to clean them & remove the **ashes**. Second, reheat them & render them red for casting. At the beginning, reheat with some charcoals, gently lit, and put your *noyau* molds flat on the charcoals surrounded by **bricks**. Frame molds are reheated on a grate.

Molding ~~with~~ *en noyau*, with the same **sand**, **wax** images, or **lead** medals and suchlike

Check if they release well. If they do not, fill with **wax** what does not, and then anoint your images of **wax** or of **lead** with **olive oil**, very thinly & very lightly, such that the **oil** makes no thickness nor body on the medal. Then, heat a little **eau-de-vie**, ~~until~~ & when it is lukewarm, moisten the **oiled** medal with it, for if ~~it is~~ the **water** were cold, it would reject the **oil**, it would not sit well on it. Next, cast your **sand of plaster**, ~~br~~ **brick**, & **wet alum** on top, having arranged your image on the **clay mandore** & having made a circle around it ~~de~~ to give it the necessary thickness. These medals are **oiled** and rubbed thus with **eau-de-vie** because they are firm & hard & would not be malleable for taking out of the^[c_116r_02] the mold, which is tenacious, as are natural animals, which are soft & flexible.

When you have tempered your **sand**, do not cast it in the middle of the **mold** but on the sides, so that the **sand** descends gently and that the beginning is thin & afterward thick. If your **tempered sand** sounds like **water** falling in the **mold**, it is a sign that is too thin. Make it, therefore, of medium thickness.

Casting for **gold** and **silver**

It is necessary that the **molds** be fiery red & ablaze when you cast in **gold** & **silver**, or you burn flowers and bouquets. The gate should not be very thick at the entryway of the molded thing because the substance flows better when at ease and without shaking the **mold**, & does not become as porous.

A way to grind^[c_116r_04] **enamel** ~~gold~~ very delicate **gold** **rose** ^[c_116r_06] **e** leaves and others

After you have cast or beaten in **gold** the thin leaves of a **rose** or other things, if you want to **enamel** them, you need to **solder** or braze your delicate **gold** leaves onto **silver strips**, which ^[c_116r_07] will strengthen them to support the **enamel**. Next, once the thing has been **enameled**, put the work in **aquafortis** ~~d~~,^[c_116r_08] which will eat away the **silver** & leave all the **gold** with its **enamel**. For this, the **gold** needs to be passed with **ciment real**.

Molding snakes in all weather

~~Auleu~~ Because *in the winter* they hide in the earth, some feed them ~~des~~ in quantity in barrels filled with earth & covered with manure. Others make several molds *in summer*, because with one snake, you can make four or five. And others mold lengthwise a natural snake, without it being curled, with common plaster, reheated as said ~~pt~~, *en noyau* & in two half molds, as said, then they cast it in wax. In that way they have snakes that they can twist as they like, and then they cast them in metal, as is said.

If, in twisting the snake from wax, some feature becomes undone, you can repair it by removing the protrusions from the molded wax.

Mixture of tin and lead

For delicate plants & other flowers or thin foliage, the fine tin ought to exceed the lead more than three parts. And if it is a thick & coarse material, the lead ought to exceed by more than three parts. Heat the mostly tin mixture until it is almost red & very hot. And when you want to cast, in removing your crucible from the fire, throw in two or three grains of rosin, & for one lb & a half or two of lead or tin, put with the rosin as much looking-glass tin as the size of a hazelnut with its shell, & mix & cast. And make sure that there is more of the metal than is needed, in order that some is left. However, if there is not enough, finish casting, & it will take. But it will not be so neat. Next, dip your mold into water, & with a point, release it carefully so that nothing is spoiled. Make your cast a bit longer. If the material is very thin, one needs for it to be almost all tin.

If you ~~mold-de-ptu~~ want to cast in lead or tin *en noyau* in the aforesaid sand, reheat your mold once, only if there is nothing to burn inside. But if it is for plants, flowers, & animals to be burnt, one needs to reheat it two times, however not as much the second time for lead & tin as for silver & gold. For for these, they ought to be red when you cast, but for lead and tin, let it cool until you can hold the tip of your finger in the gate without burning yourself, but you find a lukewarm heat.

Cast for copper and latten

For red copper, one needs to put sal ammoniac, which cleans & purges it of all its crust when it is well melted. There are some who put in pieces of ~~old leather~~ thick new leather. Others, parings of the feet of field mice. Others, melted common salt alone, or melted with saltpeter. The principal is sal ammoniac & a little fine tin, as to what you want to cast. Red copper is more troublesome to melt ~~M~~ than latten. But when it is well melted, it runs better, especially if it is alloyed ~~with-a~~ with latten. Latten alloys with a quarter of copper, and one puts it^[c_116v_02] in like in copper. But particularly,^[c_116v_01] a little calamine makes it run well.

A means of molding flowers and plants

One needs to choose them in their full verdure & vivacity, & ~~them-mou~~ not pick them, if possible, until the time one will want to mold them, so that they do not wilt. Or, if you need to carry them from afar, soak their stems in a bottle of water or, better still, wine. Make, first, a wax stick pointed like a large peg, of a size appropriate to what you want to cast, as you see in the margin, marked A. Put & prick at the foot of this small peg a bit of rather thickish & strong iron wire. And at the point of this, you will fit your flower stem or your plant. This done, set it aside neatly. And arrange your ~~mold-of-t~~ circle & shape of clay, as you have done for the snakes, in the form of a mandore ~~in-such-a-way-that~~ according to the size of your plant. Then, take the one that you have prepared to be cast, as we have taught you, & wet & moisten it very carefully with good eau-de-vie with a paintbrush. Then pass the iron stem through the end of the earthen mandore, in order that the wax & peg, where the plant is fastened, joins to the end of the earthen mandore. And arrange thus your plant in such a way lying down that it remains in the middle of the said mandore, without touching on either side, so that a^[c_033r_01] the sand that you will pour in it will be of equal thickness as everywhere & exceed is everywhere by the height of two good fingers the top of the ~~such~~ plant. And having secured the iron stem well, promptly pour ~~wetted~~ your wetted sand, much thinner than the one for snakes, in the mandore. And the sooner the better, in order that the eau-de-vie does not dry. And take heed to put in a little more sal ammoniac water among the common^[c_117r_02] than you would do for the snakes. And when you will make sand especially for your bouquets, where you would mix in a little more feather alum, it can only be better. Thus, your mold will be in one piece and it will not be necessary to unjoin it, but rather ~~leave~~ separate it from the clay once it will have set, let it dry, and then reheat it again until the plants are burnt. ~~Then~~ And note that if the plant you want to cast has a strong stalk & stem, you can cast it lying down, as had been said. But if it is some weak & delicate flower, ~~east~~ plant it upright with the wax peg because the sand will always ~~east~~ lift it up, it being very thin. Do not forget to adapt two vent holes with two small sticks, starting at the foot of the cast, which is the pointed end of the wax peg.

If the plants are so delicate that they rise to the top when you pour the tempered sand, one can fix and contain them with a thread passed through the circle of the mold with a needle.

[Figure: fig_p117r_1]

[Figure: fig_p117r_2]

The more delicate the flower is, the thinner the **sand** must be.

[Figure: fig_p117r_3]

Mold *en noyau*

For making the **ashes** of flowers and plants leave molds

Some *meslen* put **quicksilver** inside it. But, if it is a small work or fine & delicate foliage that only has *p* a slender exit, they make two errors: the first, that **quicksilver** by its heaviness can break *f* some delicate feature inside when shaken, the other, that some grains will always linger inside that will make **metals** sour & hinder the perfection of the cast. It is true that if it is to empty the mold of some animal which is thickish & which has big conduits & passages by which the **quicksilver** can easily exit, like a **bird** or a **snake**, one can indeed put in it some **quicksilver** *pou* to break by shaking the **calcined bones of the animal**, because the said *ø* will come out & not remain.

The **asparagus** stalk is so hard that most often it remains as **charcoal**. Because of this, dry it out beforehand, or wet it with **oil of sulfur & turpentine**, or cast separately the little branches & **solder** them onto a thick stalk drawn through the *wire drawing plate*.

If the burnt thing has left some **filth** or **ash**, let it cool a little, & with an **iron wire** wrapped in **cotton** that can bend according to the cavities that you have to search out, clean & blow out this defect, or with a *soft brush* or a *cut paintbrush*.

Daisies

They can be cast well in **gold**. But if you want to **enamel** them, you have to make them by hand & **enamel** them & then attach them. Otherwise, the leaves would be so pressed together that the **enamel** would muddle together there.

Sand that was used

Do not cast it. But because it is mixed with **feather alum**, you can use it in the mixture of other sands, & it can serve in place of **brick**.

Molding *à noyau* figures of **wax** or medals of **lead**

Rub them with **oil** with a paintbrush, but let it be so lightly that your medal is almost rubbed dry & that it hardly appears to have been anointed. Next, ~~destr~~ rub it with **eau-de-vie** and heat the **water** with which you will temper your aforesaid **sand**, with **plaster**, **brick** & **alum**, in order that being *chau* as if lukewarm when you cast it, the **oil** will not refuse it, as it does with **cold water**, & do not forget when moistening your **sand** to always mix in it a little **sal ammoniac**.

Medals mold in such a way very neatly.

Blood of snakes

If you need to cut some **snake** inside the **mold** to burn it, cut it far from the entrance of the **mold** lest **blood** remains, for it would make a crust that afterward would not be taken away by the same **quicksilver** & would remove the impressions from your **mold**.

Snails

Those which are found in the **sea** & similarly those in which certain **small crabs** dwell are very beautiful for **grottos**, if they are stripped of the first crust of their shell with **aquafortis**, for they truly appear to be made of **mother of pearl**.

For removing flashing and barbs from things molded *à noyau*

If your **molds** are of **good plaster** which withstands well the fire, & they will not crack at all, especially if, with **presses**, they are squeezed well between two **boards** or in a **vessel** filled with **ashes** or **sand**, & in this way they will make no flashing. But if they do make some, you can remove it with a **burin** that one calls *chaple*, which has a tip like a small **chisel**.

For grottos

The old vine stocks

Stones made from water called *stuf*^[c_118r_01] charcoal, the compound of tin & fine latten, paper pestled & mixed with pestled glass, cork, heated parchment, white coral are appropriate for making grottos. But fantastical pieces of wood which are found in the forests, & mushrooms, and *potirons* of trees, once dry, are better than any other because they are light. One mixes in small pieces of looking-glass tin, which has a shiny luster. One finely pestles diverse sorts of *marcasites* which one washes to cleanse them of earth, & one sprinkles the work with it, which is very beautiful. If there is no fountain in the grotto, one glues all ~~at~~ of this with strong glue, ~~which~~ and it is soon done. Take specimens of all kinds of minerals. The sulfurous *marcasites*, which do not have a grain but are uniform like looking-glass tin, are very beautiful.

Rosette is found sometimes mixed with certain brittle lumps which are pulverized under the hammer, which are very beautiful pulverized on grottos.

Looking-glass tin

It whitens & renders firm fine tin if ~~in one~~ one puts in among one ounce of it, that is to say, i 3 of looking-glass tin in one lb of fine tin.

Sal ammoniac

† Sal ammoniac water is very natural for casting in gold & in silver.

Casting in frames

The same sand that was used in the cooked *noyaulx*, composed, as is said, of plaster, brick & feather alum, is excellent for casting in frames, and I have experienced it thus: I pestled the pieces which had come out of *noyau* molds in a mortar, dragging the pestle because this sand is very soft. I did not pass it through the sieve because the feather alum mixed throughout, which binds it, would not pass, but I ground finely upon marble what seemed to me too coarse. And having prepared it thus, I moistened it with sal ammoniac water, made of sal ammoniac, as much as two walnuts, in a bottle of common water, the same size as a bottle in which one boils tisane,^[c_118v_02] or in a good pot of water, so that you find ~~d~~ the water moderately salty.^[c_118v_01] I mixed throughout water of half a glass of sal ammoniac, ~~two ault~~ two ~~au-t~~ silver spoonfuls of eau-de-vie. ~~J'a~~^[c_118v_03] Having thus moistened the sand in such a fashion that it gives a good hold, nevertheless coming apart easily, I sprinkled my medal with charcoal pulverized with a file, to rid it of oil and all other grease, which are necessary to avoid, for they would make hinder a good release. I blew on my medal & molded it, and the female part of the frame once filled, I marked & made a line on the reverse of the & edge of the medal & on the nearby sand as well. In order that the second frame *s'em* take the imprint thereupon to denote the place for making the cast, ~~having filled the female part of the frame being filled~~ I uncovered the outline of the medal and pounced the whole side with pulverized charcoal, and then filled the male part with sand. ~~Once fai~~ I separated the frame and did not hit the corners of the ~~d~~ medal to make it release, because that knocks the sand & makes it *esp* crumble. Rather, I struck the back of the frame, retaining the obverse of the medal on the bottom, and it molded very neatly. If it had not released thus, I would have waited to remove it until the frames had been dried out over fire. I lit the a row of charcoals between two little trivets of iron in the form that you see, and put the back the & reverse of the frames thereupon & the imprint on top, because in this way, they dry out gently. And if, by chance, from being too moistened they should crack, it is on the back, which *pr* takes the harshest fire, & the imprint remains safe & whole.

For better, one needs to reheat the sand used for the *noyau* before using it in frame, until it no longer contracts.

Excellent sand

Take a little of the same sand, the finest that you can, to cover the medal with.

For medals & flat things, the true heat of lead & tin is when it is melted gently.

Note that I filled the **frame** before pressing it and did not hit it at all, but rather pressed it only with the strength of my **hands**, because hitting it makes it go awry. Secure your **frame** that it does not shift at all, & if you put some **wetted sand** under it, it will only hold in place more firmly.

Make the gate so that it is not too thick, so as not to overcharge the medal, but wide enough near the medal that it embraces a third part. Do not forget the vents.

[Figure: fig_p118v_1]

To dry **frames** is to rid them of humidity so that they no longer **smoke**, being nevertheless very hot.

Reheating is to redden the **frame**, which is done for **gold** and for **silver**.

As I saw that they did not **smoke** anymore & that, scratching the back & the front of the cast & having found that they are rough & firm & hard on one side and the other, which is a good sign of their being quite dry, I left them to cool. I took some **fine tin** ^f, one lb, & one ounce of **lead, fine & new**. I melted it in a **crucible** until it was, ~~a little~~ as it were, a little red. Being in this way quite hot ~~I smoked & not p~~ & being ready to cast, & not before, I **smoked** with the **smoke of a** tallow candle all sides of my **frames** & imprint & cast & everything. I set my **frame**, well joined, in the **press**. I drew my **crucible** from the fire. I left it a little so that the redness at the bottom of the **crucible** could pass die down. And wanting to cast, I threw in two or three grains of something like **pitch rosin**, & at the same time the size of a **bean** of **looking-glass tin**, & I mixed, & stirred the **crucible** a little, and I cast. And the medal came out as neat as the principal.^[c_137r_03] I **smoked** it with the **candle** & cleaned it with **small brushes**.

Always cast through the foot of the medal because the head, which is lower, will come out better & make the cast longish. And when you cast several medals in a **large frame**, they will come out better.

Advice about the above

Good tin is that which is hard as silver & soft nevertheless. If your work is thin, it must be almost all tin & alloyed as is said.

Looking-glass tin must not be smoked mixed until the instant that you want to cast.

Nor must the forms be smoked until then.

If the sand shrinks in the frame, this means that it must be reheated & reddened on the fire.

Good sand, when moistened, does not stick at all to the hand when pressed.

The perfect sand for the frame is asfalt, which is found in Germany, which is soft as flour & presq when wet, and almost all the others are lumpy.

Nota^[c_119r_01] that the cast must be thin & hardly thick in order that it does not overtax the material, and must not exceed the thickness of 𐆆^[c_024r_05] the width of a grain of wheat; likewise for tin, which wants to be cast very thinly. For lead, a little thicker. There is no need to make the vents very large & deep either.

For frames, the sand that you use for the noyau, of the aforesaid composition, is excellent. But in washing, crushing & reheating it several times, it must be corrupt from its nature & no longer fit to make a hold & to mold en noyau.

Fashion of preparing *aspalt*^[c_119v_04] *spat*^[c_108r_02]

It is found in earth in *Germany*, the color of *cooked plaster*, made of long filaments, very soft to handle. And because it is mixed with *earth* and *filth*, one pestles it coarsely & one makes little balls, having for this purpose soaked it in *sal ammoniac water* of such a composition that you were told above. One places these balls to reheat in the fire of the *fornaise* of the *POTTERS*, then one soaks it again in the same *water*. The *earth* and the coarseness and *filth* go to the bottom, and the *pure aspalte*, which is light & soft, and handleable as *wet flour*, adheres with the *water* and goes to the surface, clouding the *water*, which murkiness is emptied into a separate vase. When it has settled, one empties the *water* by tilting or by taking it away with a sponge, and the *pure aspalte* remains at the bottom. Dry it & employ it in a *frame* that has been moistened with *sal ammoniac water*. And try it in the *frame*, in which it shrinks when reheated or dried, that is to say that one needs to reheat it again on a good fire and redden it. Thus, for medals and flat things, you should use this one, because it is the most perfect of all for *gold*, *silver*, *copper*, *lead*, *latten*, & *tin*, for it withstands the fire & reddens whenever need be, without corrupting. The more it is used, the *b* better it is, & it does not spoil. At the beginning it is white, & being used, it becomes grey. However, make sure to put aside the one that served for casting *lead* & *tin* & *latten*, for *gold* would sour in it, & would not come out of it well. And to do this better, you could put it aside to be used for each *metal*.

See *Gesnerus*,^[c_119v_02] *De lapidibus*^[c_119v_03]

It endures ten or twelve castings without corrupting, it withstands the fire & reddens, it is suitable for all *metals*. It is so tenacious that should the *frame* be furrowed, it holds.

The *spat* almost does not set, even though it is reheated & is a kind of *plaster*. Raw, it breaks easily with the *fingers*.

Excellent secret for molding hollow and very delicately in **fine gold**

Cast with your aforesaid **sand** your animal and **lizard** or other thing with **billon silver**, & it will come out very neat. ~~E~~ But take heed to mold it hollow, or at least leave a small hole in its mouth~~[illegible]~~ or in another place. Next, **gild** it with **fine gold**, as uniform as it will be possible for you, three or four or five times, & until your **gold** has the thickness of a piece of **paper** or something similar, & all the scales will always show equally. Next, put it in good **aquafortis**, which, by this hole, will corrode the **billon**, & the **gold** will remain hollow & light & wonderful.

Stamped medals from **wax**

You can mold in **wax**, mixed with a bit of **rosin** so it will be harder & firmer, the relief of whatever you please, either an animal or a medal, & then, from it, make a hollow form of **latten** or **copper**. Or, ~~hammer it~~ mold it in relief and hammer it in a ~~sheet of~~ **tin**, ~~And put~~ and then fill with **lead** & heat it. Try **sheets of gemstone foils** molded in a hollow form for **lizards**, &c.

Sand for casting in gold

You could cast **gold** well in **common sand of** **GOLDSMITHS**, should you throw therein some substance that makes it run.

Take common sand of alum, of plaster & brick, according to the composition said above. Add to it some more feather alum. And mix in not quite the third part of *crocum ferri*. However, its quantity cannot be harmful, for it is that which receives the gold & thanks to which it comes out very neatly. But it were good that your *crocum* had previously been in the GLASSMAKER'S *fornaise*, 4^[c_120r_01] three of—4 days and three—days and three nights, in a flat box where it should not be very thick, so that it reheats better.

Before the invention of *crocum*, one would cast flowers in silver but not at all in gold. It has not been forty years that one knows this in Germany.

Sublimate is commonly employed by GOLDSMITHS for gold. Some add sulfur, but they & others are wrong, for sulfur sours, even as it heats. And the sublimate is agitated, boils, and bubbles. It is very good to clean gold because by its exhalations, it draws everything out as it goes up in smoke. But to warm gold & conserve its heat, there is only the *couleur*, which is verdet, sal ammoniac, saltpeter & borax. This makes it run, & you can throw in a branch of wormseed.

HNightingale -^[c_120r_03]

One needs for the cage, made like those for larks like a barn & lined with green fabric, to be made with a drawer underneath, to refresh its fresh earth *everyday*, for it takes much delight in this, & mix in it some ants. You can carry an anthill with its earth in a barrel full of earth, & keep them there & they will lay their eggs there, in order to always have some at hand when you want them, should you take pleasure in feeding nightingales. When you have taken it, it is fat & full, & thus, to keep it in its strength, one needs to, for the *first day*, take ~~uy~~^[c_120r_02] it in the hand & open its beak & put in its beak with a small pointed stick some mutton heart or other delicate flesh, chopped up not too finely, in order to fill its belly & keep it from diminishing & growing leaner, until it has gotten over its fancy. ~~The next day you will give him~~ And you will feed it in this way three or four times a day & will also make it drink. The *next morning*, you will give it in its cage some well-minced flesh with the yolk of a hard-boiled egg, and change it two or three times a day, for it will not eat it if it is hardened & if it is not fresh. And if it goes half a day without eating, one needs to feed it as before & do so until it

eats by itself. And to entice it better, you could add amongst the meat & the egg some live mealworms, for it is very fond of them.

Crocum ferri

It is excellent **plastered** on wounds to stop the **blood**. The best is made of **needle filings**.

Crocum ferri hardens **molds**, once reheated, & **feather alum**, the more there is, it renders them softer & sweeter.

Anatomy

One needs to skin the animal & boil it, or else skin it & put it into **good quicklime**.

Making silver run

^[c_120v_08] If it is for a large work, **arsenic** & **tartar**, pulverized & thrown on the **melted silver**, makes it run ~~If it is pou~~ and suffices. But for fine work, one needs some *æs ustum*, **filings of latten of thin copper**, ^u^[c_120v_01] **antimony**, sublimate, finely pulverized. ~~This~~ From this gets made a mass that does not sour. If the *s* **plaster** is good, one ought not to add *crocum* for **silver**, but one puts more **feather alum**. ^[c_120v_02] It needs also some melted **common salt** & some **saltpeter** with the aforesaid drugs: **arsenic**, **tartar**, *æs ustum*, **copper filings**, **antimony** &c.

See the second leaf following.^[c_120v_04]

Sciscitatio dubia^[c_120v_07]

A little **tallow** and **arsenic**

Keeping dry flowers in the same

[Figure: fig_p120v_3]

state *all year*

This is a rare secret, & which gives pleasure for adorning tables, rooms & cabinets *out of season, when winter denies flowers*. Take heed, therefore, to ~~ee~~ pick them when they are in full vigor & growing. For if you were to take them when their season is past or when they are starting to wilt, they would not keep. Having thus chosen them, therefore, take sand, the leanest & driest you can find, which should be very fine, like that which goldsmiths use to work enamel or like that for stampings. But above all, it must not make dust, nor remain on the hand, or leave a mark on it when you have pulverized it & then poured it. For it is

River sand washed by the current of the waters is good, being passed through a linen cloth to shake the powder.

+

Flowers are also kept in their same beauty in distilled vinegar ~~in~~^[c_120v_03] a well sealed vessel which does not allow any wind, which should be well sealed with wax & mastic. Carnations & roses, the residue of common vinegar makes them rot. If the sand makes dust, & clings to the flowers, & is not easily removed with a paintbrush, it is no good. The leanest is the best.

+

Make sure your box is well joined, in order that the sand does not trickle out. Keep it uncovered in sunlight and remove it from the *serain & the moisture of the night*, & cover it & keep it in a dry place.

~~That~~ Take heed not to put the said flowers in big vessels, for when one pulls out one, one needs to pull out all.

Take good heed not to pick your flowers ~~q~~ in rainy and humid weather, but when the sun has been shining on them.

a sign that it has some humidity, & if the flower also had some aquosity, it would rot. It also ought not to be ~~too~~ coarse, for with its heaviness it would weigh down the flower & make it lose its form. Having thus chosen it as is needed, take a box, in which you first make a mound of the said sand, on which you will set the stalk of your flower, ~~in such a way~~ laid down so that the flower touches neither the bottom nor the sides of the box, but remains in the air. Then, weigh down the stalk with more ~~on~~ sand in order that it remains firm & fixed. Finally, take some of the same sand & with two fingers pulverize & cast it delicately on the flower, ~~e~~ imitating in that the flow of an hourglass. And when the flower is as if half covered, strike your fist on the table where the box is set in order that the sand drops & enters everywhere. Finally, cover it all over and thus lay in other flowers, in order, one over the other, as many as your box can contain. That being thus arranged, expose it for several days to hot sun. And while the flower dries, the sand, which ever accompanies it & holds it, does not allow that in contracting, it shrivels & closes in on itself, but it must dry in the same state as when you put it there. Now take heed that you choose for that effect cornflowers, marigolds, the yellow meadow flowers called *ranunculus*^[c_121r_03] or *palta lupina*,^[c_121r_02] amaranth & suchlike, and broom, and others that your experience will teach you.

The sand with which GOLDSMITHS buff enamels or the white one that GLASSMAKERS use, & any lean sand that does not hold together, pass it through a horsehair sieve, for it ought not to be so thin. Next, dry it well in the sun for several days to remove all humidity from it, and ventilate it like grain so that the dust goes away. Once it is rid of that dust & well dried, use it as you know.

Pansies are kept thus.

For keeping fruits all year

One needs to pick them in *serain* & *s* quite dry weather & by the stem without touching ~~it~~ the fruit with your hand, and put them in glass bottles that have a wide opening, like tall glass boxes for putting preserves. Fortify them with straw or something else so that they may not break, and seal them well with wax so that they may not breathe. And if they had a glass lid, well-sealed with wax, they would be all the better. Put them in a case in your well, or in your cellar in a vat, or in a *cos*^[c_121r_01] of earth full of water.

For where the hand will touch, it will rot, and it is even good not to breathe on them. You can also put in leaves from vine.

For casting in silver

You need to arrange your animals as said and compose the same **sand** ~~two parts~~ out of 4 parts of **plaster**, of two parts **reheated brick**, & one part **reheated feather alum**, and mix it well. Then, having been prepared thus, and you wishing to mold it, take the three parts of an earthenware bowl, from which the **PEASANTS** eat their soup, of the aforesaid **sand**, & add to it **pure feather alum, reheated & pulverized** in the mortar, as much as you can take with 4 **fingers** and the **thumb**, or a small double **handful**. Then, mix ~~mix~~ well & wet with a little **sal ammoniac** & the rest of the **common water**, +^[c_121v_01] & stir it with your **spatula** so that it all becomes like a **thick sauce** or **thin mustard**, & having rubbed the animal with **eau-de-vie** with the **paintbrush**, cast, & blow, and beat the **table** to shake the mold, & do as with others. Do not forget to put in it **crocum**, for it prevents the molds from cracking & is appropriate for all **metals**.

Alloyed silver is better for casting than the fine one, provided that it is sweet.

One needs the **feather alum** to be well pulverized and well mixed.

Sal ammoniac is a friend of **gold** & of **silver**.

which needs to be placed before the **sand** in the **bowl**, which is put in the **water**, & not the **water** in the **sand**

Latten is the enemy of **gold** & the friend of **silver**.

Silver for casting

It is **not fine silver but alloyed**, & which does not become perfectly white on the fire because they put it to whiten after the fusion to also clean it of the **solder** ~~or of this~~. When you need to attach some ~~leg~~ animal against another or to repair, it is commonly **teston silver**. And all **alloyed silver**, as long as it is sweet, is good.

Before starting to cast in **silver**, one needs to have **earth** ~~of which~~ which withstands the fire, like the **sandy earth** ~~of qu~~ mixed with **cloth waste which** **FOUNDERS use to cast their cannons**, or any good lute which withstands the fire, in order to surround your molds & fortify them, for they must be all red. One needs to also bind them with **iron wire**.

That before ~~eastng-lar~~ reheating the molds, you have the mixture one needs to make the **silver** run.

If the **GOLDSMITHS** knew ~~knew~~ the substance to make **silver** run in their works, they would buy much of it. Some buy it five **sous** for a denier.

*I have used **silver from the Capital***

Before ~~binding~~ luting & strengthening your molds for **gold & silver** with the aforesaid **earth**, one needs for the cast to be made & the vents, & the molds to have been reheated ~~of~~ very red to burn the animals, flowers, and plants that are inside, & to clean them well of the **ashes**. Once quite clean & prepared, lute them & bind them with **iron wire**, & reheat them again until they will be quite red.

Arranging various animals

When you uncover some **female lizards** entwined while biting each other, & which is the most difficult thing to mold because of the number of feet & because of the tip of their tails, which are very fine, ~~One~~ take heed that if some part should ~~trou~~ be uncovered that remains as if suspended in mid air to steady it, in order that the second cast, which you will do on top for the second half, will not vary. And to steady it over the void, take a little **wax** & rub^[c_122r_02] it, & lengthen it on a **table** into the form of a **thick needle**, then cut that which you will need, & with the tip of a hot **iron wire**, join it where it will be necessary. Steady also on the **frame mold** all that will have detached from it (when you uncover the half of the belly) with some **wax**, taken lightly with the point of a penknife, & joined & melted with the **iron wire**. And when you make your gate, you ought only to bring the wax to the place & to the edge of the **wax** which, being joined to the animal & melting, will continue the gate up to the animal without spoiling anything, which is a secret.

[Figure: fig_p122r_2]

One arranges **snakes** bound together in embraces of love, but that is when they are small.

[Figure: fig_p122r_1]

[Figure: fig_p122r_3]

[Figure: fig_p122r_4]

Flower in the mouth of the snake

If you want to put in the mouth of the snake some flower or some branch of a plant which contains the antidote against its bite, take a little branch, as best arranged as you can find, & pose its stem into its mouth. Then put two little pieces of wax around the stem of the plant. And with the end of a iron wire that is hot, melt the wax a little, & with the other hand, close the jaws of the animal. And then you can cut the head to make it burn with the flower. If the plant is strong enough, it will hold up by itself, and should it be weak like wormwood leaf, which droops, the humidity of the sand will lift it up, & make it swim & hold up without putting anything there, although you could pass underneath it some thread, going through with a needle.

Cleaning the bowl and the spoon with which one tempers the sand

Be careful to clean, as soon as & quickly after you have cast, your bowl & your spatula or spoon with which you temper your sand, because ^[c_128r_02] if it dries in them, it crumbles & falls into the fresh sand & makes a hole or a fault in the work. Also, when the mold is reheated, these little pieces crust up & flake off & prevent neat casting.

Molding hollow

Wax on its own cools too quickly & does not run well everywhere, & tallow keeps its heat well & runs everywhere, but on its own it is not good. But when wax & tallow are mixed, the work is all the better. Crayfish & other small animals can easily be molded hollow for the body, but as for the legs, it will be awkward.

The first part of the mold, that is, the first cast on the clay slab, cracks more readily in the fire than the second.

Molding medals and flat things

You do not have to make the gate with legs thus

[Figure: fig_p122v_1]

, but rather in this way

[Figure: fig_p122v_2]

, which embraces the medal well. For the other way, with legs, is only done to accommodate more delicate works and the other, which is wide and in one piece, works better for flat medals. But take heed that all gates be very thin close to the medal & almost not as thick as the medal, if it is not very thin like **paper**. And then, from the medal toward the gate, thicken it as it goes, for it comes out better thus. If the gate is thick at the entry to the medal, the work will never come out well. Make sure that *desp* it is moderately thick from the half of the gate at the top, & from the same half at the bottom very thin. Do not forget to make grooves ~~at the~~ *hau* in the top of the gate to prevent that the **metal** runs furiously.

A means *di far correr lotnegra*^[c_123r_01]

Take **white arsenic**, two ounces, 2 3

Orpiment or **yellow arsenic**, two ounces, 2 3

Aes ustum, two ounces, 2 3

fine copper filings, moderately ground, 2 3

Antimony, 2 3

Rock salt, 2 3

Raw tartar, 2 3

Sandiver, 2 3

Saltpeter, half, that is to say 1 3

Coarse common salt melted, half, 1 3

Sublimate, half, 1 3

Borax, half, 1 3

Sal ammoniac, as much as **borax**, that is to say 1 3

Note that you need
to lute well your **crucible**,
in order that the substances
do not take air, for
they are exhaled.

Lute well your *crucible*,
in order that it does not break.
For if it breaks, the
substances evaporate
& the **fume of it is**
dangerous. If within xii
hours it is not melted
and mixed, it will not be
well made.

GOLDSMITHS who have knowledge of this substance sell a denier of it for five **sous** to other **GOLDSMITHS**, & especially to **THOSE WHO WORK IN PLATE AND LARGE WARES**, for at the end of their works, they can **solder** over the first **solder** by means of this mixture. In general, all those who

want to mold & cast something delicate. This material should not be divulged, lest it be abused.

The grain is like broken steel.

Take these substances, of the best kind you can find. Weigh them as said above, and pestle them separately, keeping your face covered, over the nose & the mouth, from the eyes down, to avoid the exhalations of arsenic, sublimate, and orpiment. Mix them well, all together, then put them in a good crucible that is so large that the substances can have the fourth or fifth part as empty space. Cover the crucible with a good tile, adapted in a circle precisely on its opening. And having bound it from top to bottom and on the sides with iron wire quite strongly, lute it with earth mixed with dung or founder's earth that ARTILLERY FOUNDERS use. And in this, be careful & diligent, & do not forget to mix in pestled glass throughout the lute to fortify your crucible in such a manner that it takes no air, for the substance would be worth little, because the 4 five last ingredients would be exhaled.

Your lute being dry, put, in the early morning, your *crucible* in a *four à vent*, & at the beginning, give slow fire, as much for reheating your *crucible* as for gently letting the fury of the *saltpeter* pass. Then, invigorate little by little & with judgment the fire. And ~~there~~ leave in the full vigor of the fire your substances for xii hours or a natural day. Make each time a good quantity of this substance, so as not to do it often, because the *fumes, which are dangerous, could hurt you*. And before working at it, take in the morning good buttered toast, and hold the said *butter*, or *zedoary*, or *gold coins*, in your *mouth*, and ~~ada~~ cover your *face* with a cloth from the *eyes* down. From this mass, the crust will serve you ~~make-run~~ to clear ~~the great works d~~ the *silver* from the *metallic* mass ~~like snakes & similar things~~ when it starts to melt. ~~But~~ And then the grain that will be at the bottom of the *crucible* should be put aside for ~~principally delicate flowers and herbs~~ putting a little in the *melted silver* when you want to cast it. However it is necessary to always put a little of this grain in the *silver* when you want to cast it is well melted and when you are ready to cast. Thus, do as you make *fine tin* on *copper*, & for *looking-glass tin* on *lead* and on *tin*. And just as *looking-glass tin* sours *lead* and *tin* too much if you put it in too great a quantity, likewise, the grain composed of the aforesaid substances would sour your *silver* if ~~[c_123v_01]~~ you were to put in too much and obscure it. This aforesaid composition will suffice you for a *long time*, when it has been for a whole day on a *gentle* gentle fire at the beginning & invigorated degree by degree until the end. Then, having given it one load of charcoal, let it consume it by itself, & let your *crucible* cool. Next, break it. You will find two hard slabs & *cakes* in the *crucible*. The upper one is as if petrified ~~Onee~~, composed of *salts, sublimated & mixed together*. The lower one is *metallic*, composed of *filings, æs ustum & antimony*, having the grain very small. Pulverize the upper *cake*, made from *salts*, & put some to clear, & clean the *silver*, and the *metallic grain* will serve you to put in the *melted metal*.

Charcoal fire

Or else after you have had your drugs *pestled* by some *RUSTIC*. And having put them in your *crucible*, & the latter luted & dry as said & placed into the furnace, have the fire managed by a *SHOP BOY* familiar with charcoal.

One sells well to *SILVERSMITHS* this *metallic* mass to soften their *solder*, because when melting, *latten* exhales. And with a little of this substance, they *solder* over the other *solder*.

Animals with hair and fragile and very thin flowers

Animals with hair are awkward to mold because the hair is raised & is represented as though mixed up & ~~to~~ clumped together. Starting, one ought to keep it flat with something dessicative & that makes it firmer. And in this, the most singular thing is **wheat oil**, with which you will anoint it. Once cast, you will be able to repair it. The bodies of **butterflies** and plants that have a stem & leaves which are wooly with a certain capricious & downy hair, also need to be anointed with the same **oil**, to keep this down flat; likewise flowers that have very delicate & thin leaves, for dry **wheat oil** makes them rigid and firm. And if someone brags about molding what is presented to them, give them to mold the downy head of the plant called **dandelion**^[c_124r_01] or a **pappus**, which comes from the seeds of **burdock** & flies away at the slightest sigh of **wind**.

Noyaulx for molding hollow

Animals of **gold** & **silver** can readily be molded *s* hollow, to avoid weightiness and costs as well, if they are not very small. But to make the core & the *noyau*, one needs the **mold** to be freshly molded & not dry.

Spider's web

It comes undone in **water** & thus cannot be molded *en noyau*, but one casts the **spider** and then one draws the drawn threads between the grass that they make **in the fields** on some **quarton** with a **point**. One makes around it an **edge of paper**, glued to the **quarton** & one casts with **tin, very little alloyed with lead**.

Fine gold

There is a property of **gold** which, even though it is very fine & unalloyed & has been passed through **aquafortis** & **antimony**, is nevertheless so brittle that it hardly withstands the **hammer**. And the composition of **verdet**, described above to make **gold** run, makes it as soft as **lead**.

Rouge clair enamel^[c_124v_02]

Fine gold is opposed to it, for *[illegible]* on it, it remains yellowish. But alloyed gold is more appropriate for it, such as that of écu & pistolet. If Gold *f is not put back on the fire*, with its own pale color, renders the enamel a dead color. *Ma* And for this occasion, once cut, one puts it back on the fire to give it a reddish color, to make the enamels beautiful. Otherwise, they are matte.

There is rouge clair which, once it is used with the arene, loses its beauty.

Some can be found that have grains of gold inside, and it is also the opinion of good GOLDSMITHS that the good one is made with gold.

Casting in gold

Molds are reheated better & more surely in a closed fire, such as pot in a reverberatory furnace. So that when GOLDSMITHS want to cast some important piece of ~~gold~~ that has cost a lot to model in wax, they put the molds in a pot & cover them, & fill the pot with earth, sustaining the fire that holds them together & tight. Then, they reheat the mold, earth & pot together, and when everything is quite red, they cast the gold. Fine gold does not run well, but alloyed gold does.

Gold & silver do not sour,
being entirely red and hot, quenched
in water.

Gold is a quarter heavier than lead.

When gold reaches its perfect heat, it is green like an emerald.

Take care that in the place where you want to cast the gold, no lead, tin, or lime of these has fallen in the forge.

A means to make the gate for small female lizards

Because you always have to make the gate by the tail, and because it is ~~us~~^[c_124v_03] delicate and thin that the ~~gate would struggle~~ metal would run with difficulty, especially when it is curled, roll wax in little threads of this thickness

[Figure: fig_p124v_2]

and apply some with the hot iron wire, as is said, one at the end of the tail & the others, that are applied in the same way, from one edge side of the tail to the other, as you see depicted. But take heed to make sure that with the end of the hot iron wire, the end of the wax barely touches the animal, for the sand of the second cast will not touch this part. But make sure that the end of the wax arranges itself only at the edge of the empty part of the first mold. Make also conduits of wax around the legs & around the contours of the body which are a little long, & they will serve as feeders for the molded thing.

Follow here

above ^[c_124v_04]

When the tail, which is delicate and closer to the gate, comes out well, the rest will also come out well.

The principal thing is that the ears of the snake come out well-molded.

Your gate must be very thin at the entrance of the animal & of the thickness of a knife.

[Figure: fig_p124v_1]

⚙️[c_125r_01] From small rolls, you make your gates and vents without danger of crusting & removing

anything from the mold, because the wax, being taken away, leaves the empty space all made. Make your vents

coming from the head, which is in the bottom, toward the gate. Make also your gate so that it is too but a little thick, and make within its course two or three notches, for this breaks up the fury of the metal

& from these conduits & feeders, you can also put in small threads of wax which are joined to the body, in order that the metal goes more easily from one part to another & promptly runs everywhere. And from these conduits, you lead your gate & your vents without spoiling anything.

and makes it flow with ease, without bubbling nor making excessive fumes, which hinders its run.

You can divide it also in two or three branches thus

[Figure: fig_p125r_2]

when it approaches the molded thing, and always make holes in the gate.

Plaster

When you ♀ mold something to cast wax in it, you mold in plaster alone, reheated after being pulverized. For, once reheated in stone, the outside is cooked & the inside stays almost raw. Transparent grey plaster is not strong, but the one that, being tempered, is white & sets very quickly, is good. However, the grey I have found to be quite firm & hard after having set, but it takes longer to do so. One needs to know the nature of each. If you You will never mold very neatly if not you do not temper, very thin & liquid, your plaster or your sand of noyau. Temper it immediately quickly after it has been reheated.

+

If you mold with plaster crud alone, reheat it nevertheless as said. One needs to oil well the first mold. And when the second one has set well, and it is ready, soak it for a long time in water. And if it does not want to release, soak it in hot water, for cold water hardens it.

Scimitars^[c_125r_03]

To know^[c_125r_04]

The **WORKERS** from **Damascus** or from **Hungary**, neighbors to the **Turks**, separate, in the **ore**, **iron** from **steel**. And, from this first **steel**, first melted from its **ore**, they cast **scimitar** blades in **sand** *sab* which afterward cut the other **iron** without any difficulty, because any **melted iron** is harder than **soft iron** beaten from pigs & bars. Thus is the **steel** of **scimitars**, but it is quite brittle. When one un-hilts *þ* a **scimitar**, one recognizes by the tang that enters the hilt that it is cast in **sand**.

And **hot water** softens it further. **Cold water** does not penetrate it like it does with the mixed one, because it is harder & the mixed one is more spongy.

Hearing from afar

Make a small hole in the earth, & place your **ear** fully there, *at night or at a silent time*, & you will easily *hear* the noise.

With this **plaster**,
thus reheated as powder,
one can cast medals of it
that do not fear the
rain, especially if they are
varnished. One can find these in **Germany**,

Secret^[c_125r_05]

on the houses. But take heed that the **water** be very hot, & if it is boiling, there is no danger. All **plaster** molds, alone or mixed, release in it.

Vipers and snakes

I molded a **viper**, which, for casting, is more appropriate than any other **snake** because it has scales beautiful & very visible on all the body & principally on the head and under the throat. It has a flat head, the snout reddish, tending toward incarnadine, & snubbed like the **horned asp** or like ~~a~~ the top of a **pig's** snout, big jowls, the eyes very close to the snout, and the mouth wide open, where it has double canine teeth on each side, all coming out of a strip of flesh that covers and clothes them. It also has, in the throat, a tube of flesh, made like a **dog's** penis, from which comes its stinger. Other **snakes** have a double row of teeth.

If you want ~~cut the~~ to mold the **snakes** with the mouth open, you must cut off the head & leave it inside, for it will not be released.

Molding turtles

It is a matter different from the casting of **snakes**, & plants, and flowers because the cavities that are between the two shells require several pieces. They are molded in **plaster** to be cast in **sugar** without making a gate as do all things that you want. [\[c_125r_06\]](#)

Plaster for casting of wax

When you want to cast in **wax** in the **plaster** mold, you must know as secret that there is need for your mold to be in **hot water**. Never does the animal come out so neatly as in **metal**, because the **wax** sticks. But it is to model an animal closest to nature ~~and~~ to repair it afterward. One needs to smooth well away all the scales, ~~when~~ for **wax** would enter there & not release well. In molding thus the animal, flatten down the scales for **wax** &, on the contrary, rub them in reverse in order that they stand up for animals, for they will only be more visible. Also, do not wait for the **wax** to ~~a-bit~~ cool completely to release it, but do so when it is still a bit warm. When you have also molded the first cast of the animal, uncover well the half, in order that, in its release, there is as much of it in one half of the mold as in the other. Make also strong wide gates, close to the animal, in order that it is fortified when it is released, & afterward you cut this off.

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Alabaster, commonly called so, which is nevertheless **plaster**, is very hard but it shrinks a lot. It is very good to make medals, but it wants to be very finely sieved.

Molding fruits and animals in sugar

Sugar is fatty when runny and brittle & breakable when dry, and with it, one casts well round things & large muscles, but awkwardly things fine & delicate. However, try well-clarified sugar. One needs to soak for one night or one day the plaster mold before casting the sugar, in order that it is very full of water & does not imbibe the syrup. One needs also for it to be of easy release, for the sugar is sour & brittle. Finally, do not consider casting anything in sugar that does not release well and that cannot be neatly molded in two halves, to open it when you will need to. If you want to mold a bunch of grapes, one needs to take it, like any other fruit, in its true vigor, for if it is withered, it will not come out that way. Take heed, therefore, to make your molds in the natural season of that all things. The grapes that are usually wanted cast in sugar can be made artificially or with wax or earth, or even with some grapes attached with some melted wax on some slab & other full thing, so that they are very close together and release well, & only make up one half. Or, if you have some of those grapes called *chauchés* or *sauvignons*, which have the grapes very close together, encase half of them in the clay slab and cast on the other half. And if some grape is not released, pluck it out. Note that neither in sugar, nor in metal, can a bunch which has light & separated grapes be cast properly, because the end of the bunch is so delicate, especially if the grapes are kept, that it could not sustain the large grapes. Thus, you will need to cast hollow, which you could not do if the bunch does not have the grapes close together & molds without having them scattered & spread apart.

To cast pears & apples in sugar, one ought not to make any gates, but rather, fill one half of the mold and then join the two, and keep turning it until the sugar has set and is cold. One ought to mix nothing in the mold apart from plaster, reheated as you know.

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One needs for the mold to have soaked one day and one night in cold water for, and to be humid, when you cast in sugar.

The sign that the syrup or the sugar melted in water is sufficiently cooked to cast fruits, is when it makes threads

when shaking it. And if it passes that point, it is not good, for it will always be humid. If the sugar sticks, one needs to throw some wheat starch in the mold or rub it with an almond.

Crocum ferri

It is much sooner made with **iron rust** than with **filings**. For if the **vinegar** is good, you will see it boil with large bubbles ~~as if it~~ on the **rust**, as if it were on the fire; on the **filings**, it does not boil unless it is put on the fire or **hot ashes**. However, when the **filings** are passed through **vinegar**, & you have made it evaporate & heat up, & it is very red, if you do this again for a second time, the **vinegar** will have much more strength, & the *crocum* will only be finer for it, & redder. Those who use it to cast in **gold** ~~ven~~ buy the ounce for forty or fifty **sous**.

It does not harden the **molds**, and, in scraping, one cannot tell that they are harder from it. But it makes the **mold** less dense, and it drinks in and attracts the **gold** better.

Plaster

You can mold with it as large a piece as you please. But if you take your **molds** from large works & pieces of **wood**, it will not release well unless you ~~boil~~ make your **wood** imbibe **very hot wax**. For the **wood** absorbs & drinks & in this way attracts the **plaster**. You can assume the same thing for any other large piece of work. But the cure is to ~~l'ab~~ saturate ~~l'ouvr~~ with **very hot wax** the work on which you want to cast your **plaster**. For by this means, it will not drink it up & will release very neatly.

If the **plaster** shrinks, it will always make flashing. Seek the hard kind and ~~it~~ put your **molds** well in the **press** before casting.

It is not good when it shrinks.

Plants difficult to burn in the *noyau*

Any plant which has a hard stem & like **wood** is very difficult to burn in the *noyau*, such as **asparagus**, **thyme**, & similar things, because they stay as **charcoal** in the small conduits, & if they do not reduce well into **ashes**, it is not possible to empty them from the **mold**. Some reheat them, to do this, two or ~~d~~ three times. Others, putting several plants together in the **mold**, pass through ~~threads~~ the plants & the ^[c_126v_01]~~es~~ **molds** circle of **earth**, which is to receive the **tempered sand**, ~~plusi~~

This does not proceed from plants that have a stem with lines, because **rosemary** burns well, but it is in the nature of certain plants.

some threads, as much to secure the plants, in order that they do not rise ~~by~~ when you throw in your **clear sand**, as to give them venting when the **mold** is reheated. For, in doing this, the ~~mold~~ thread burns & leaves some empty space around the plants, which serves as vents & places for evacuating, & to give air to the plants so that they burn better. For what makes them stay as **charcoal** is that they burn in a closed fire & without empty space because of their fine sprigs. Try, therefore, to thicken the main stem with a little **melted wax**, & let it cool, then mold it. And when the **wax** melts, it airs it, the principal stem, with space & as if loose so that it burns better. Or else, anoint them with **oil of petrol or sulfur**, of **turpentine**, **oil of brick** & similar things, or **aquafortis** or **eau-de-vie**, or make **sands** with **crocum**, **iron scales**, loops of **iron**, **emery** & things that withstand several **days** of great firing.

Animal bones are not so difficult to burn & reduce to **ashes**, because once the **flesh** is burnt, the **bones** remain loose & the weight of the **quicksilver** makes them break & disintegrate, once calcined & burnt.

Asparagus always stays as **charcoal**, like little pins. Try to take it, and **thyme**, at the beginning, when they are growing, so that their stem is still thin.

Molds of **plaster for wax**

When your **mold of plaster** is done & dried, take heed that your **mold** be of good release, for sometimes it happens that the animal, being wounded or thin & withered, makes wrinkles, where ~~retire~~ its scales are, where the **plaster** enters. And this not being of good release, the **wax** animal would attach itself & would break, & you would never have it perfect. *Take heed also* to make your gates for the **wax** very wide. Thus, & the gates should not be too thick. They are made when ~~the animal is~~

[Figure: fig_p127r_1]

the **molds** have been made from both sides & the animal is outside of it.

FOUNDERS' earth

It is *terre bolvene* mixed with *dung* or *cloth waste*, which withstands fire, which you need to always have provision of to lute your molds that ~~have-b~~ are meant to serve for casting *silver* & that one needs to reheat. Those where one needs to burn some flower or animal should not be luted until they have been reheated once, and they have been cleaned of *bones* & *ashes* remaining inside, and, having removed the *clamps*, you have opened the two halves to see if they are cracked. For there is *plaster* that is not so hard in the fire, one as the other. Moreover, there is some which makes crusty the things which stay burning inside. And these are imperfections that one needs to avoid, either ~~by~~ by bathing well with *eau-de-vie* the animal before casting in the *tempered sand*, or mixing in more or less *brick* or *alum*, or reheating the *brick* more, or in place of the *brick*, mixing in *crucible bottoms* & similar things which resist well in the fire. Having therefore reheated your mold to burn it inside, leave to cool well. And if it is neat & not cracked, put the *clamps* back & lute it with this *aforsaid FOUNDERS' earth* & sprinkle a little *sifted ash* & let dry a little. But keep yourself from luting ~~that they are not~~ until the molds are cold. Those for casting *silver*, where there is nothing to burn inside, only need, except when the gate & vents are made, luting & reheating once. Do not lute the end of the mold where you want to make your gate, but leave it uncovered & the exit of the vent as well.

The *earth that LOCKSMITHS*
use to braze or solder, which is

sandy clay earth, or else *clay* mixed with *sand*, after having dried & *sieved* & then composed it, is good for luting your molds because this *earth* melts rather than cracks. And any *earth* that melts ~~is~~ cannot be lacking in this.

Iron wire to
give it bond

[Figure: fig_p127v_1]

Lute thickly your molds, & if they are small, you can reheat them immediately in a good fire, especially those of *crocum*.

If the **earth** is good, & ~~it~~ does not crack while reheating, & does not separate from the **mold**, the **molds** will also not crack & will not make flashing at the casting. Reheat with slow ease in a closed fire, & do not expose them hot^[c_127v_02] to the air.

Lute rather thickly in two or three layers, especially right in the joints, in order that the **silver** does not come out of the **mold**.

If the **molds** ~~that~~ were ~~do~~ to crack, it is ~~made thus~~ at the first reheating, for at the second, they no longer crack.

*The **smallest** **molds** are reheated more quickly. Take ~~them~~ therefore, the first reheated ones when you cast, for you can put several of them to reheat.*

Light the charcoals first, in the **forge** or in some other place nearby, & having placed your **molds** on a layer of **good embers**, not burning too much, to have a slow fire at the beginning, put there & adjust a little the half-lit charcoals in the **forge**.

Reheat in a reverberatory furnace.

To test if your **earth** is good, before putting it on your **mold**, lute at the place of the ~~fe~~ wall of the **forge** which is around the **blast-pipe** & barrel of the bellows, & light the fire, & if it withstands this without cracking, it will be good.

Casting in **silver** and **gold**

Wanting to melt, always put for these two **metals** a **small stone of pulverized borax** at the bottom of the **crucible** & the **gold** and **silver** on top. This makes it so that if the **crucible** gives off some vapor or sour fumes, it will not impair these two **metals**. For **gold** in particular, this is good.

If you have several **molds** to cast, do not think of filling them in one cast, for the **metal** would be cold. But having cast while hot & filling one, remelt & cast in the other.

Some let the **silver** rest a little outside before casting.

Gold and silver, melted with the aforesaid things, scarcely become porous.

For **gold**, one does not need ~~a~~^[c_128r_04] as much ~~tin~~ *crocum* as **feather alum**.

When your mold starts to redden on the inside, & ~~that the cast loses its blackness, then put your~~ & when looking inside the cast you ~~you~~ do not see ~~plas~~ a single point of blackness, continue to maintain it in this heat & if need be, add in some half-lit charcoals with your pincers. However, ~~com~~ put in the forge your *crucible* with a little ground borax at the bottom, & the silver that you want to cast ~~in your forge~~ should be on top, letting your *crucible* reheat between the lit charcoals ~~jus without blowing~~ until it is red, for before, one ought not to blow. And when you do blow, push in a longish & continuous movement the bellows, giving them a little shake when pushing & another when pulling toward you. In this way, the heat becomes stronger. ~~Com Do not~~ Take heed to raise sometimes your *crucible* ~~with the~~ with hot pincers, because ~~if~~^[c_128r_02] if it is placed right in front of the blast-pipe & the bellows ~~wind hits the~~ wind of the bellows hits the *crucible*, it will cool your silver rather than heating it. Make sure that the lit charcoals support it from above the blast-pipe, & take care that it is at a distance of three good fingers from the wall of the forge. In this way, it heats better. Therefore, when your silver starts to melt, if you recognize that it is brittle, seeing cracked & burst lumps, take the size of a hazelnut of arsenic & two times as much of raw tartar, coarsely pulverized, for in this way, they have more ability to heat. And occasionally throw it in the *crucible* on the silver, which clarifies it. But if you have some of that crust sublimated on a metal substance, which looks like grain of steel, as previously described,^[c_128r_01] take a little of that, leaving ~~#~~^[c_112r_02] the others, & throw it on your melted silver.

Small molds are reheated quickly, but big & small ones should dry beforehand in the furnace, for the humidity of the mold, by the ~~e~~^[c_128r_03] ~~fo~~ heat of the furnace, is attracted outside. But the fierce heat of the charcoals chases it from the exterior through the inside.

All alloyed silver produces film, and all other metal as well.

Silver does not want to be uncovered when melted.

~~#~~^[c_112r_03]

Coarsely pulverized

A lump of adulterated silver vitrifies in red because of the arsenic & orpiment.

You will see that it will torment it & heat it very well and soon render it very liquid & ready to cast and be clarified, as it should be. When it is in this state & when it is very white and polished, shining like quicksilver, prepare yourself to cast. And to this effect, have some lean delicate sand, in a terrine or another vessel, that you would like to help yourself to. Make a pit in your sand, then, with your pincers, take your well-reddened mold & place it in this pit of sand. Cover immediately the opening of your mold in order that no ash & dust enters inside, & then enclose it with sand up to the edge of the gate & the vents. This done, uncover your mold & throw on top of your well-melted silver, the size of a pea or thereabouts, some of this metallic grain, which will immediately spread through all your silver & make it boil & turn. Cast as soon as you have put in this substance, for it is this that is the secret to making the silver run, since its crust heats it & clarifies it. You can cast silver finer than the alloy from the capital and like that of the real, but you must add this grain in.

With all of this, do not let yourself forget to put, before all things, a little borax in the melted silver, for even though goldsmiths do not put any in, nevertheless it is good, and I have seen it practiced well. Next, one puts in the crust of the substance at two different times & then the metallic thing. Then make sure *[illegible]* that it be placed at the end of your forge.

If you want to blow the ash that is around your mold when you hold it between the pincers, hold it with the opening at the bottom, & blow.

When silver is well melted, you can uncover it and blow with the small bellows, not continually like with gold, but only to cast out the charcoals in order to put in the substances that make it run.

Whitening of cast silver

Because one commonly casts in **base silver**, & especially the **Germans**, and that such an alloy readily makes a film or crust, ~~which is contrary to our~~ some **GOLDSMITHS** ~~from France~~ are usually quick to whiten their works, especially rough ones, because they only use **common bullitoyre**, which is **tartar** & **common salt**, nearly as much of one as the other. But I have seen an excellent **German** working thus. Having in my presence cast a **little lizard** with an **alloy of teston**, he made a greyish ~~no~~ crust. And to clean it from it, he boiled it in the above-mentioned **bullitoyre** of **tartar** & pulverized common salt ~~and~~ mixed with **common water**, in the fire of his **forge**. Once taken out, he **brushed** it. And because it was not as clean of this crust as he fancied, he burned some **tartar** in some paper until it was black & no longer **smoked**. Then, he wetted the aforesaid **tartar** ~~d~~ with the **water of bullitoyre**, composed of **salt** & **tartar**, & covered all his **lizard** with it. Then, he put it between the live ~~of~~ **charcoals** of his **forge** & blew a little. When the **lizard** was red, he took it out, let it cool, then reheated it in the **bullitoyre**. Next, he **brushed** it in **clear water**.

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Note that the **bullitoyre** for **silver** is never good in a **crucible** because the **water**, taking the form of the ~~f~~ **tartar**, evaporates. But the **vessel** for boiling, being of **copper**, is excellent for the whitening of **silver** & for the mixture which colors **gold**.

He took heed not to let his **water of tartar** boil so much that it would have poured out on top, because then its strength goes away. Therefore, when this first fury of boiling comes, remove it from the fire & put it back. He held as a secret this **burned tartar** put on top for **base silver**.

Painting plants of metal

If you are in a hurry, it would be better to mix your color with a not-too-thick **gum** ~~or~~ because **oil** takes a *long time* to dry and runs if it is layered thinly, as the plants require. And if you still want it done promptly, temper your color with **glair** beaten with **peelings of the fig tree**, and your work will soon be dry. But layer it thinly.

For wormseed^[c_158v_02]

The pallid white of this herb is made from *vert de terre*, white lead or ceruse, a bit of massicot, stil de grain yellow, and *cendré*^[c_013v_04] of azure. Mix & compose your color according to a natural branch that you will have.

Viper color

It is the most beautiful snake that can be molded, because it has very beautiful scales, & hard & transparent. Its true color is made with good verdigris ground well with some good vinegar, if it is of lead or tin. And if it is in some place darker, fumigate this first color with sulfur, as you know. And if one needs to lighten and whiten, like under the throat, rub with coarse linen. The male ejects from its nature,^[c_129r_01] which is at the bottom, when it is firmly pressed, a little mass like half an arquebus ball made in the genitals and full of very venomous^[c_129r_02] spurs.

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Put a bit of metalline in your tin & your lizard will resemble silver.

Molded roses

They are awkward to mold because the petals are very fine & weak & doubled. But, to ~~obl~~ avoid this, one needs to anoint them with wheat oil, which is very dessicative. And having quickly dried, it firms & stiffens the petals to be able to separate them & withstand the tempered sand. The same is done with flies, with pansies & similar delicate things, with flowers from the caper plant.

Animals dried in the oven for *a long time*

Plant them on a slab of **earth**, arranging them with points of **iron** wire, as if you wanted to mold them, and ~~they~~ dry them in an oven after the **bread** has been taken out. And they always remain thus, as much for **snakes**, as **birds** and other things. But it is necessary that they be dried promptly.

Note that one needs to give them their shape & put them in the **sand**, as with flowers, & promptly dry them in the oven, which is hot enough, like when one takes out the **bread**. And it should stay there a day & a night in order that it is *ehau* dry, for otherwise it would be *smelly*. However, take heed that the oven not be too harsh, but rather like the heat of the **sun in June**, otherwise the animals cook. Once dry, do not wet them, but clean them with a paintbrush or clean them with a brush.

Animals cast in **copper**

Try, ^[c_052r_02]having cast them in **copper**, to burnish them like **gemstone foils**, to see if they take color similarly.

Advice concerning the gate

~~Do not~~ Be careful to not make your gate very wide, and do not forget to make in its conduit two or three holes and notches, & as your gate approaches the *eh* molded thing, divide it into three or four parts like **fingers** which are pointed & are not very deep. For the **metal** runs more gently without being hindered by vapors & fumes.

^[c_129v_02]Always make
the entry of the gate
near the medal
notched & lumpy,
to draw out the fury of the
metal.

[Figure: fig_p129v_1]

Spider molded on a leaf

The very big ones usually have hairy feet, which are vexing to mold if you do not lay them flat, or burn them with a candle, or stiffen them & lay them flat ~~with some~~, anointing them with wheat oil. Kill them in vinegar & urine, like snakes &, or in eau-de-vie, and then shape them on a well-made vine leaf or other thing. Next, you can give them back their capricious hair with ~~bourr~~ the sieved fine hair of cloth waste, having anointed them ~~with a~~ with fish glue or similar. Their true color is of vinegar & verdet, & then fumigate them in various places with sulfur. Having made your ~~tourt~~ clay slab, place on it your vine leaf, and the dead spider in the middle, & pierce with a point of iron or latten wire the middle of the spider's body & the leaf together. Next, place diagonally small points of latten wire around the vine leaf to secure it well. Then fix, with a little melted wax and the point of a hot iron wire, the end of the legs, adapting them with the end of small pincers. Do the same thing with the end of the small cornicles of the spider. Return ✚^[c_112r_02]

To make the gate

for the spider on the

leaf and to prevent

the sand from covering the spider from underneath the belly, furnish the end of the

tail & the bottom of the body with a little wax, melted & applied with the hot iron wire, as you know. In

this way, when the leaf burns & the

wax is melted, there will remain

two little holes in the leaf which will be the gate of the spider.

✚^[c_112r_03]

Once the wax is cool, scrape the excess with the point of a penknife in order that the end of the legs stay neat. Next, place the circle of earth around & cast your tempered sand, like for other things. In this manner, you will need to burn the vine leaf in the mold, otherwise not. And to cast more easily, let the animal die fully, in order that, when struggling, it does not mix up its legs. Having made your first cast, uncover the reverse of the leaf and make the second cast.

Animals dried in an oven

Small **s cats** are skinned and one removes their eyes & all their entrails. One puts a small stick vertically between their teeth to make them open their mouths wide. Then with **iron points** one attaches their feet to a small board, giving them the fitting attitude & gait. Once thus attached by their feet with small rings of **iron wire** thus, ^[c_13or_02] one needs to suspend them **in the sun** with the backbone downward. In this manner they take ~~& d~~ their shape & dry, & the belly tightens & the tail remains high or with the bend that you will have given it. Once a little dry by this means, one turns the head as one wants, securing it with some tool. Then one finishes drying it in an oven when the bread is drawn. Next, one places in the hollow of the eyes balls of **lead** or of **wax**, painted according to nature. One paints them with **well-gummed ink** so that they seem to be jet. One gives it a painted tongue, horns, wings & similar fancies. Thus for **rats** & all animals.

^[c_13or_03]

[Figure: fig_p13or_1]

which, surrounding the fingers of the paws, stick in the jacket of **clay**.

For reddening live **crayfish**, which will seem boiled

Rub them in **quite good vinegar** in which there should be a little **eau-de-vie** & hardly any, & they can be served as cooked & will move around.

Molding a single **spider**

One needs to plant it on the **clay slab**, as has been said, on a **vine** leaf, and make there your first cast; & once it has set, uncover the **spider** up to half its legs, then make the second cast.

In order

The hairy feet of large **spiders**, like any animal hair, does not mold well if it is not flattened, having anointed it with **wheat oil**, which stiffens it & is quickly dry. Hairy things mix with the **sand** & do not burn well.

Molding a single vine leaf

Plant it with the points of fine ~~iron~~ latten wire & place diagonally on the clay slab, then cast the first mold. When it has set, uncover the ~~back~~ reverse & make the second cast, which once set, you can take away the leaf. And you will need to reheat your mold only once, because there will be nothing to burn.

Molding a crab

It is a secret and a masterpiece to mold it well, because one needs to proceed differently than with other animals, because its shell is very difficult to ~~not~~^[c_130v_02] burn & in this case, one ~~it~~ needs to sometimes reheat the mold three or four times. And with all of this, it leaves a hard crust, grey like ash. But because it does not mold in one piece & one cast like plants, but rather in two casts like snakes that release well, one removes this crust, not with quicksilver, which would do nothing,^[c_130v_01] after it has been opened, with the very fine point of a penknife with dexterity, as with the little crusts of the second cast, which enter in the nooks that the sand or the molded animal made. But, ~~la~~^[c_130v_03] because it has curved legs, here is the cunning & secret for releasing it.

It is painted like a crayfish.

Therefore, as you have molded it on one side, which is on the back, in the same fashion as others, uncover its belly & all its curved legs. Make your second cast in the same fashion as others, but as it will have set, keep from opening the mold until you have first reheated it well. Otherwise, because of its curved legs, you would break everything. In this lies the dexterity. If you recognize, after having reheated & opened it, that the crust is not burned enough, reheat until it is.

~~Know that~~ For opening the mold, there is no need to soak it, for once reheated, it will open by itself.

Stag beetle

It is as difficult to burn as a crab, therefore do for it as you did for the crab.

For molding thin

After you have molded *en noyau* ^{la^[c_033r_01]} the first *e-figur* mold, let it dry well before taking away the figure of **wax**, ~~in order~~ in order that the mold does not corrupt. Next, make a small lasagna of **paste** of such thickness as you would like, and having anointed with **butter** ~~your~~ the hollow of your first hollow mold, adapt the **paste** to it, and then make your second mold on top. If you were to anoint with **oil**, it would be absorbed & would not be as appropriate as **butter**.

Plants that are awkward to burn in the mold

Mold them with two or three casts, which, once reheated, will open, & it will be easier for you to take away the **charcoal** from inside.

Trial

Letters and molded **paper**

Write with well gummed **ink** or with any color which has body & which does not erase once moistened with **eau-de-vie**. Then, place your **paper** on a **clay** slab & moisten it with **eau-de-vie** and cast on one side & the other.

For adorning **beds, mirrors, and suchlike**

Rough out some design in half relief on a quite flat **slate** to adapt it to either round or flat things. And having cast it in **mixed tin**, quite thin, you can **gild** it with **gold leaf** & adapt it to whatever you want, and fill the ~~vut~~ bottom of the relief with small **rubies**, **orpiment** & little grains of diverse colors.

For teaching a **doge**^{i^[c_131r_01]} well

It is necessary to keep it tied up, & when it does what you command it, to make it love you, give it some **cheese** that has been held under your **armpit**. Which must be a bad drug, & for the **MASTER**, if he is red-haired, & for the **APPRENTICE** too.

Molded waxes

Figures of wax composed of ceruse & lead white are not for burning & melting in a mold where you want to cast gold & silver, for this would sour it. And then, if you think about taking away these waxes composed of things coming from the metals reheated in the mold, you will be wrong, because, the asperity of the fire making them seethe ^{it}, ^[c_131r_02] the wax goes away & the composition of the ceruse or other metallic color attacks the mold. And for this reason, if you want to rough out something

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Nota^[c_119r_01]

White wax is more delicate than the other & it does not leave any filth when you want to make noyau and mold hollow.

in a round form to cast it in gold and silver, put only in your wax what you prepare for this effect ~~sin~~ from all these drugs, except casting with melted sulfur, since it is melted, & candle smoke. The melted sulfur goes to the bottom and nevertheless leaves its quality in the wax, making it melt promptly in the fire & giving it firmness. In this way, you can melt in the fire this roughed out ~~ei~~ figure of wax. But if it is composed of ceruse or suchlike, it is necessary that you put your mold in boiling water.

For figures of flat wax, there is no need for all this, for the wax releases & does not stay in the ~~la~~^[c_033r_01] mold.

When the cast of tin or lead becomes porous

If your cast work has become porous, it can be repaired with very hard wax which you can gild afterward with silver or gold. To prevent this, if you cast thin, the alloy of one 3 *d'est* of lead for one lb of tin is good. But if you cast with lead for a thick thing, one needs for one lb of the latter, two 3 of tin, for the lead, being fatty & weighty, carries more. From this alloy, I cast a large lizard like a natural one. In thick things, if which keep their heat a long time, if there is little tin, it makes it porous. Your mold must not be cold, but *of such a heat that you can handle it without harm, or that you can keep your finger in the gate without burning yourself*. It is also necessary that your lead or tin be as if red. Melt first the lead & then the alloy of tin on top. And as you want to cast, put a piece of rosin & then a little looking-glass tin. If you put too much lead into the tin, it does not run very thin. And to know this, if ^[c_123v_01] the tin cries loudly, it is a sign there is not too much lead. If it cries weakly, that means that there is too much. Take heed

You can solder with the *les* same substance, then repair it with the burin, file, chapple & suchlike.

Tin is a metal that penetrates, that becomes porous & burns, and is fanciful to use, more than gold and silver.

Lead wants not only to be red, but also lively & runny & liquid as water, which is a sign of its perfect heat, & the mold ^[c_131v_01] *est* is so hot that you can bear putting your finger in it. Do not open until it is cooled. It is a sign of a good cast, as much for it as for gold & silver, when it exits by the vents.

not to open your mold too hot, for this sours it, makes it porous & contracts the tin, & makes the molded thing break. Also, do not quench your hot mold in water, for this makes the ~~the~~ met tin or lead contract.

Mold made in two casts

It is opened, once reheated, to clean it; next, one puts the clamps on again, one lutes the mold & especially the joints, then one slowly dries the earth. And then, as it no longer smokes, one leaves the mold to cool until you can hold it without harm. Next, put in the presses or in the sand in a terrine, & cast in tin. For if you were to cast in silver or gold, it would be necessary that your mold be reheated twice & cast when it would be completely red.

If your mold *f*, through the fault of the plaster, retracts in the fire, you need to open it after the first reheating to tighten it again, & clamp it and lute again, and tighten again.

Method for reheating the molds

Light charcoals in the forge, & then arrange them in rows in a corner of it, according to the size of your mold, in such a way that it can be furnished with three or 4 fingers all around, and especially at the bottom of the mold, which is the thickest ~~and which~~. Your charcoals thus arranged, place your molds on top of them, & not on a grate, as some do, because they would take the fire too harshly. And leave for some time thus, & little & by little, warm your oven, always adding some lit charcoal. And as long as the mold is humid, the charcoals will be as if died down from below. But as it dries, they will kindle by themselves. And when it is dry on one side, turn it to the other. And when it is dry on both, & it will no longer smoke. At that moment, invigorate the fire & cover it with lit charcoals. And as it will begin to redden, do not blow the charcoals with the little bellows, for this would make it blow burst. And similarly, when it is red, keep it well covered with lit charcoals & do not uncover it, for it would crack. Make sure wind from a window does not beat upon it. Let cool

When you want to reheat your molds, & be they luted or not, mark on the belly the place to put at the bottom, against the lit charcoals, ~~that~~ because if the ardor of the fire were to make them crack, it would be better that this be at the belly & from underneath than on the back.

If your mold is small, one ought not to leave it ~~rest~~ so much in the fire, for it corrupts and cracks there, for it reheats more quickly than a big one.

by itself. When it begins to redden, it is soon red everywhere. But make sure, through the gate, that it is red at the bottom & that nothing appears black.

Common sand from the mine

In a frame, if one casts hot, it becomes porous; therefore, one only needs to dry it out.

Crocum ferri

Having ^[c_132v_02] passed it through vinegar & reddened it in the fire, I had it finely ground on porphyry, until no roughness was *perceived on the fingernail*. Then, I wet it with very good vinegar & left it there ^[c_132v_01] two or three days, stirring it several times each day. Finally, I boiled it & reddened in the pot & *crocum* all together in the *four à vent*. It came back in a mass full of small bubbles, but that can be pulverized very finely between the fingers. I put some in the sand, a half as much as feather alum. I tempered the sand quite thinly & molded out of it a very small female lizard, which molded very neatly & delicately & very finely. The *crocum ferri* does not render the mold harder, but it firms it. And when your mold is soft & fatty *when scraping it with the fingernail, it is a sign that the crocum is good, very fine, & well prepared*. The quantity cannot spoil the mold, because it is a friend to gold. And I believe that silver would come out well. And that the mold, through this means, does not crack. *Make it from filings of needles*.

I have tried to make it so the molds where it is mixed do not crack during reheating & thus do not make flashing.

It is better made with distilled vinegar.

One can put some amongst the molds, where you want to cast silver, for it firms the molds, and *you will find it so, by scraping a little harder than the other where there is none*. It molds very neatly.

This one is appropriate for all molds & keeps them from breaking & bursting in the fire. And for flat medals, it withstands several casts. The one of steel fillings & needles is redder & better.

Gilding animals cast in silver

You can gild them with amalgam without spoiling any of the features, if they are made of silver.

Hard wax for imprinting seals

It is made from **white wax**, which is harder than the other, & one mixes in **very finely ground ceruse or lead white** until it becomes as hard as you fancy **tt**, adding to it a drop of **turpentine** to bind it. Next, mix in whatever color you want. This is the **wax** **GOLDSMITHS** use for modeling.

Feet of **small**^[c_133r_01] **female lizards for gold and silver**

Because the feet of these, which are very small, are very delicate, when you have molded the top and **d**^[c_128r_04] you uncover the belly & the bottom of the feet, cover them lightly with **wax** & then cast the second mold. And the **wax** being removed, it will leave a **g**^[c_133r_02] little gate for the said feet. And should the bottom of these come off in one piece, you can repair it well. And the scales from the top of the toes will come out well.

At the end of the nails of **large lizards**, place **make** on each one a little circle of **wax**, to make the gate thus

[Figure: fig_p133r_1]

Marks from the points of **iron wire** which are found on the head of the animal

L^[c_133r_03] With the points, one has previously set the stance, especially that of the head. But the head being pierced, there remains around the hole some moisture and a little exudation, which hinders the **sand** from covering the point & there always remains some little opening **g**. But to avoid this, you can plant in the slab of earth an **iron point**, ~~erre~~ cleaned & rounded at the top end, & on this end place there a little **hard wax** or ~~some~~ a little **mastic** or **cement** and, by means of the **hot iron wire**, hold in place the throat of the animal, which can be removed when you come to uncover the belly & the throat to make the second cast.

Clamps and broken mold

When you have made the first reheating & removed the clamps, and you have ~~the~~ opened your mold to clean it by blowing with quicksilver, which is used only in enclosed molds, close the mold again & put the clamps on again, but not in the first place where they were. Lute again & dry again. But if it is for a cast with silver or gold, lute with the remainder of the sand that was used, for it is the safest. If your mold, while reheating, is broken, you can adjust it with some clamps & lute.

X

Bubbles and little holes which are found in the mold

This readily comes about when you cast two or three small molds, one after the other, in the same bowl, for the last one is cast from the bottom & thickest of the bowl, which readily becomes porous. The thinnest casts more finely & more neatly, provided that one blows strongly enough when casting on the tempered & cast sand in order to dissipate these small bubbles.

When the sand is cast thickly, it readily becomes porous

Thing that does not release

One needs to cut it to make it burn in the mold, but cut it with chisels in one go, in order that the blood does not fall on the mold & does not create filth, which, once reheated, is difficult to remove. Next, put your mold in the oven or similar heat, in order that it dries promptly & retracts before making a crust or mold on the mold.

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When you mold small female lizards and you want to uncover the part first molded, begin to uncover the heads & you will recognize its place by the pin. Do not attempt to uncover the legs until you have uncovered the rest of the body, in order that the stripped body, as it moves, does not remove the legs from their place, where it is vexing to put them back. When you remove the little points which hold the legs, fix them & press them with something, in order that, when removing the pin, they are not removed from their place, or, in the end, you can put them back with some wax.

Various animals entwined

You can entwine a **snake** entwined with a **lizard**, one biting the other, or a **snake** that eats a **frog** or a **wall lizard** ^[c_133v_01] & suchlike. But because these entwinings can in no way make a good release, cut what you can & leave the rest to burn. And to keep a **wall lizard**, which is small, in the mouth of the **snake**, which is raised & needs to be supported in the air ~~pe~~ because the head of the **snake** is posed raised, put underneath the **wall lizard** ^[c_133v_02] an elevation of **earth** suited to support it. And if you put your **mold** in the **oven**, the animal, drying promptly, will retract & will burn better afterward. ~~if you see~~ These entwinings are also made to cover a wound or fault in the animals, which one usually wounds when one catches them. Also, do not forget to attach & join with some **wax** *s*, finely applied with **hot iron wire**, all the parts of the animal which pass one on top of the other or those that you notice are not well fixed on the **wax earthen** slab, in order that the **tempered sand** does not remove it. And it is to

avoid putting **points**, which should not be put except at the raising of the head, at the thickest places of the body & the simple & delicate parts in the middle of the **lizard's** feet, the nails of which you will enter into the **clay** slab, in order that they remain secure. When you have made the first cast & uncovered the belly of the animal, do not forget to put small thin *s* ^[c_133r_01] slabs of **wax** at the end of the **lizard's** legs. But, if it is a **small wall lizard**, lightly cover with **wax** the entire bottom of the foot, ~~and~~ and ~~this~~ the **wax**, being removed after the second cast, leaves a cavity which fills these small fingers with **metal**, & then one repairs them. Take heed therefore to attach well with **wax** the parts of the animal which pass one over the other, in order that the **wetted sand** entering between two does not take it away. ~~And if~~ For if this were to happen, the ~~mold would spoil~~ shape ~~in the first place~~ would ~~spoil~~ corrupt & your **mold** also because it would not have the thickness that ~~it~~ ^[c_128r_02] you think & would be pierced & spoiled. And, even though to avoid this you can make the **mold** thicker, however, should ^[c_123v_01] this mishap happen, you will be able to repair it in this way.

For mending a pierced mold

If the molded animal comes away in some place ~~to not have~~ and deviates from the stance that you gave it, because it was not quite dead or because it was not well attached with the **iron** points or with **melted wax**, and it does not have the thickness that it needs on the outside, at the middle of the swelling, or is pierced, before removing the animal from inside, uncover what seems to you the weak part, or the place that is pierced, and make small holes all around ~~all-around~~, then soak the back of the **mold**. And cast promptly on top of the same **tempered sand**, which will enter in these openings & mold & attach to the other. But, one will need to lute this place well afterward.

Sand of *crocum*

One can use the mixture of *crocum ferri* in molds for **silver** as well as for **gold**, for it firms them & keeps them from cracking & making flashing. And I believe that for flat things it would withstand ~~well-de~~ several casts, which, however, for **gold** & **silver** is hardly practiced.

Try, for **lead** & **tin**, *crocum*.

For making ☀ **run**^[c_134v_01]

Verdigris & **sal ammoniac**, as much of one as the other, **borax** & **saltpeter**, as much of one as the other. But the **s borax** & ~~sel-arno~~ **saltpeter** together must only weigh half of the others, that is to say, as much together as the **verdigris**. Grind them finely into powder on **marble**, then grind them again with some **good strong vinegar** until it is fine, like a **couleur** and **verdet** ground in **oil**. Next, leave it to dry on its own, if you have time, or in the ~~slow~~ fire of the forge, & make sure it is well dry.

Grind

spider

One of the principal things for the cast is to cast very **gee** hot, **s** especially the great **metals**.

For casting of gold in large works

One needs not only to clamp the molds well but to fortify them with good bindings of iron wire or little bands made for this.

Before casting in gold, clean your forge well of lead & tin.

Secret for soldering gold and silver in small works

If some piece of small foot does not come out well in gold or silver, by fault of not having made a gate of wax underneath, beat some soldering gold very thinly, then cut it in as many small spangles as you need. Take some of this phlegm or white thick which saliva that is found on the teeth, & with the point of a burin, apply it to the place you want to solder, & place there a little spangle of gold; & next, with a little fat earth wetted with saliva, make a small layer on the opposite side to hold the solder better. Next, pulverize on top a little borax & put in the fire. Boiled water of quince seed & others also.

Couleur^[c_135r_01] for gold or mixture

Verdigris & sal ammoniac, as much of one as the other, & as much as a bean of saltpeter. For if you put a quantity in it, it would make it all boil so much that it would boil over. Saltpeter is only put in to make it boil, in order that one recognizes when the substance has boiled enough.

This couleur, put on brittle melted gold, renders it soft immediately.

Softening^[c_015r_01] gold

Gate

It is necessary that it be longish with regard to the thing that you molded. And for big molds, at the very least, it is necessary that it have four or five **fingers** of length. You can make it wide up until the middle & then divide it in three points in this way. And as much as the molded thing will be small, it is also necessary that your points be small. And in the middle of the gate & of its points, make there some openings in order to prevent the fury of the **metal** & make it run gently. One also needs to **e** conjoin the folded parts of the animal with little notched lines, **a** especially the end of the tail or other delicate part, in order that the **metal** flows everywhere & carries itself from **e**^[c_135r_02] one part to the other.

Do not forget to make a gate of **wax** for the feet of **lizards** & delicate things like this.

When you have molded an animal in the first part of the **mold**, do not let this part dry before you have taken away the said animal, for the **mold**, in drying, contracts and would also make the animal contract. Keep it therefore in some **moist & humid place** until you have

[Figure: fig_p135r_1]

done it.

Vine leaf and **small frog**

Take **vine** leaves to mold as they are in growth, likewise with all plants & flowers, or a young **vine** growing again after having been cut, or when they rebud *in autumn*, because the new leaves are more lumpy & have more apparent lineation. On the contrary, old leaves are smooth on the inside & pierced in several places. Therefore place your leaf bottom down on the **clay** slab, and secure it with **small points**, nevertheless leaving it its natural curve. And make a notch in the **clay** to hide the stem at the first cast, which, once made & dry, you will take away the stem from the leaf & clean with it well with **small bristle brushes** & fix it with a small mound of **clay**. Next, make several gates around the leaf with **wax**, as you know, & **gee** make the gate thin & with several lines & lumpy.

The **vine** leaf is painted with green made of **stil de grain yellow** & **verd de terre**.

You can cast on the leaf a **spider** or **frog** & whatever you will like.

Casting in ☀^[c_135v_01]

Take a *crucible* with a capacity suitable for what you want to put in it, coarsely pestle a little *borax* & put it at the bottom, then the ☀ on top. Arrange the *crucible* on the *charcoals* of the forge in such a way that the wind of the bellows blows on it from underneath and not at the side, for this would cool it & would not heat it enough. Make sure also that it is distanced three *fingers* from the wall of the forge, in order that it can be surrounded with *charcoal*. Let the said *crucible* reheat until it is quite red. Then, make your *BOY* blow on it with long and strong pushes, for in this way it heats *well* better. And nevertheless, ~~blow by~~ when the *gold* is melted, blow on top with small bellows, for the *gold* will become brittle & take on a crust. And as long as it makes swirling fumes as you blow thus, it means that is not soft enough for the cast. Uncover therefore the *crucible*, & without moving *eh*^[c_135v_03] it from its place and without interrupting the blowing, make it lean toward you in order to see well inside. Throw in it the size of a *bean* of *borax*, & blow inside in jolts with the small bellows. But if there is *charcoal* inside, blow a little stronger to make it go out. And if the *gold smokes* & swirls, put some more *borax* in and ~~note~~ blow on top, making sure that, if it is still brittle & not softened^[c_015r_01] enough, it does not cover itself^[c_135v_02] when you blow, as if it had cooled. But if it does not make this sign, it is soft enough. At that point, blow very strongly in order to heat it well, and as you think it is hot enough, throw in on top, in the *crucible*, the *couleur*,^[c_135r_01] composed, as said before, of *verdet*, *saltpeter*, *sal ammoniac* & *borax*, a little. And ~~let~~ *rest* blow always with the small bellows, and the *gold* will become shiny like

If you cast in *gold* some important piece, lute your mold with the same *sand* where ~~there is~~ there is some *crocum*.

If you want to cast some large work in *gold* or which is important, make at the foot of the forge, or at one end of it, a *four à vent*, where you can hold your mold in the completely *re*^[c_135v_04] red *sand*.

One can cast two or three lb of *gold*.

a mirror. And when you want to *[illegible]*^[c_136r_01] cast, put again a little of the *couleur*^[c_135r_01] & let rest a little, always blowing with the small & large bellows. Finally, arrange your very red mold between the *moulets*^[c_136r_03] or in a *crucible* full of very hot sand, & cast. And when it has set, throw, if you want, in water. For gold does not get damaged like tin, which jumps.

To melt gold in ingots, it is of no importance to *gee* blow on top with the little bellows.

For large works, the *crucible* of sand needs to be put in a *fourneau à vent*, to become entirely red at the end of the *fournaise*.

The gold that the wind hits or that one forges becomes black. But a little *aquafortis* uncovers it immediately.

If you have some work to forge of latten *sol*^[c_136r_02] on latten, as one does small statues, put between the gold & the latten a plate of lead. And before reheating the gold & putting it again in the fire, soak in *aquafortis* & it will be soft.

It is enough that the gate be of the thickness *[illegible]* of the medal, that is to say from the middle of the gate to the medal. But if the medal is very thick, one ought not, for this reason, to thicken the gate, for a very thick gate never comes out well. *Mai* Also, it could be made wide, as much as can be done, to embrace the medal.

DEsm^[c_136r_04] Enamelling thin works

GOLDSMITHS scrape gold leaf with the brim of a burin, & then set the enamel down on it.

For casting in latten

The latten from skillets in which one makes the mush for LITTLE CHILDREN, which is soft, is appropriate for the cast. Some say that German tokens are contain a lot of calamine. However, as they are thin, the calamine exhales out when melting them, as it does in all meta remelted latten, which, through melting again, would return to red. However, fresh calamine & on its own, put again on melted latten, makes it run & cast neatly, because the one that is in the remelted de latten is half corrupted from its nature, & makes it become porous & blusters because it is disposed to exhaling. Therefore, use calamine alone, on its own, very recent, on the melted latten. Take heed to cast very hot & that your mold be red like for gold, silver, copper & metal.^[c_016v_05] If you cast with recent calamine, keep away from the fumes, for they are pernicious. I wanted to use German tokens to cast medals & took thirty & xii nails of rosette, like for chairs, which are of soft latten. This substance, containing a lot of calamine, like all strong yellow latten, has made great fumes, which is what prevents latten from running and makes it porous. Make many vents & cast very hot, that your latten is white like water or melted silver & similar to a very polished steel mirror. The second fusion comes out better, for what calamine there is has been exhaled and does not make fumes as much. If it is in a frame which does not break & withstands a,^[c_033r_01] the second cast comes out neat because it is imbued with calamine fumes, which embrace & receive the second one. Sal ammoniac alone, put in latten, renders it neat & shiny. Huile tingente even more so. It does not need any sand other than the previous en noyau & that the mold be red like for gold. Make many vents. And if you cast yellowed latten with the prepared tutty, you will not have any bad fumes.

This metal is very fanciful to cast because of the calamine smoke, and one ought not to leave it pass rest even a little bit outside the fire, like some do with silver, for it is immediately cold when it feels the air and the wind. It always leaves some type of tail, like glass, when you cast it. CASTERS do not usually take that very yellow latten, because of the calamine passed through the fire. But when wanting to cast red copper, they yellow it either with fresh calamine or with prepared tutty. Wanting to cast, one purifies it well of charcoal with a stalk of copper or iron, and one covers it with a cloth soaked in pig fat mixed with saltpeter or sal ammoniac, to keep it from the wind & from cooling.

For casting in red copper

Pure red copper from a cauldron or other thin works is appropriate for casting. And to make it run, throw in some sal ammoniac, & when you are ready to cast, put in a little fine tin & very little. And note that one needs to cast copper very hot in the mold, which needs to also be inflamed & entirely red like for gold, silver, latten & metal.^[c_016v_05] You will recognize that it is hot enough when it is smooth, thin & shiny like a mirror ~~of eu~~ of steel, newly polished, or like melted silver. Keep it from the wind, for it will quickly cool. Stop the cast with tongs to keep it from cooling.

Red copper comes out more neatly than latten, which has strong smoke that prevents it from running. I molded it *en noyau* neatly like the principal^[c_137r_03] & thin like paper. It is necessary that it be so hot that it is white & shiny & polished like melted silver and like a mirror. I cast it in the same sand as above *en noyau*.

Copper and latten are the longest to melt, longer than any other metal, especially red copper. But also it flows & comes out very neat, provided that it is cast very hot, that it is like water.

Removing your mold from the fire, plant it in ~~des~~^[c_137r_02] a brazier that fills a pot or a vessel.

Huile tingente^[c_137r_04] to make metals run

Take some ☿ sublimate of Venice, true & not arsenic sublimate, a pea, *aes ustum*, a pea, sal ammoniac, a pea. Pulverize everything separately, & next mix everything in a glass bottle & put on hot ash. You will see that everything dissolves like wax, making many colors. Let it ~~everything~~ set & put a little of it on each melted metal, & it will run marvelously.

FOUNDERS OF LARGE CASTS FOR STATUES throw in much tartar to clean it of its filth & nastiness, & much sal ammoniac to render it thin & neat. And when they want to cast, they put in much tin. The cold & humidity strongly disagrees with it, which renders dangerous the work of the FOUNDER, for one only needs a spring of water in the pit to lose everything.

Clamps

They are made with flat pincers of iron wire, reheated & refolded, then beaten at the ends on the anvil. When they are thus fine, they are subject to burning, being put often in the molds for reheating. Therefore, use some new ones.

[Figure: fig_p137r_1]

Tempering sand for molds of flat medals

Flat medals of wax or metal are oiled very lightly & then are touched with a paintbrush with eau-de-vie. And in order that the mold, wetted with water, takes without refusing the oiled thing, one heats the water well for tempering the sand, for with cold water it would refuse. Medals are oiled because they are not malleable & thus could break the mold. And animals, which are malleable, do not want to be oiled. Hot water should be of such heat that you cannot hold your finger there without feeling strong heat. Temper your sand thicker for flat medals & solids than for lizards & fine things. Your sand having set, clean & scrape your mold on one side & the other, & make a notch at the foot & the border of the medal on the side of the gate, in order that you can take it away better. Lower also the mold, scraping the medal all around, in order that, from all sides, you can take it away without it corrupting the mold. Next, make your scorings around of the first mold cast mes, in order that the second cast joins with it without varying, & especially make a notch at the bottom of the mold where the head of the molded thing is. Make some also at the sides of the gate. This done, dip the reverse of the first mold in water, oil it, & thus it will not be imbibed. Rub the reverse of the medal with eau-de-vie & secondly cast, tempering in hot water. If you have molded a medal en noyau, having made the first cast & this one having set, outline, with the point of a knife, the surround of the medal, in order that it is raised on the cast & not buried in it. Then having made the second cast & having opened your mold, have take away the medal in one go, with one two knife points q, and that one takes it from the side of the gate & the other from the side of the head, which is opposite.

Take care not to oil your medal too much, for if the oil seeps out, it diverts the sand from becoming smooth & amassing, & makes it wavy & lumpy. One should only touch the middle of the medal of the p^[c_137v_01] with the point of an oiled paintbrush, & then spread the oil everywhere.

Make especially sure that the gate is the widest you can p toward the medal & embraces it well, that the entrance of the gate is ample, always narrowing toward the medal. Do not forget also to notch the entrance of the gate.

If you want to cast gold, silver, copper, or latten, it is necessary that they be perfectly red & inflamed on the inside when you cast, & perfectly reheated two times if there is something inside to be burnt & cleaned.

The molds of animals that one burns must be heated in such a way that the animal burns. But if it has thick bones, it is troublesome to pull out & ♀ often breaks some fine things by its weightiness. One does not put ♀ in molds that can open. This readily happens with flowers, the mold of these does not open because they are made all in one go.

When you want to reheat your molds, put the clamps on the joints, in order that, when reheating, they do not bend, contract, or break. This is done after the gate is made.

The scrapings of the mold can still be used, using them in place of brick, after having reheated them, & also the pieces of the molds that have been used. One lutes with it also important things, like works of gold or silver. One also reheats it, & prepares it with se sal ammoniac water, as spat^[c_108r_02] from Germany, & it is excellent sand for frames for all metals.

The molds of things which one needs to burn inside the mold are souff not opened until the thing that is inside is burnt, like with molds of crayfish, crabs, stag beetles, portraits & pieces of sulfured black wax, which do not release well.

One ought not to mold on brick or wood because they lea drink & attract water too soon, and do not allow the sand to set. It would never be better than on a fresh clay slab. Yet, I have experienced that grey earth dries the mold too soon. The yellow is better.

For medals and flat things it is necessary that the sand be thick enough wet, because it sets quickly. And when the sand is thus thick, one can hit and shake the table where the mold is placed, to make it run everywhere. But when the sand is thin, like for flowers and plants, one ought not to hit, nor when there is something attached with wax or another thing that is subject to coming off, like crayfish legs or similar things. And if the sand is, by chance, too thick, you promptly put in it some pour water. Having put the sand in water, it examine that it is thick at the bottom & thin on top. The thinnest is cast at the beginning, and then blow, & the thickest at the end in order to fortify the mold.

Talcum mixed in the molds

I took the one from which I had pulled the oil. I crushed it very finely even more ~~s~~ in a steel mortar with a pestle, very lumpy like a file. I rendered it very fine & in a cottony & downy powder. I mixed it with sand & mixed it together & cast it *en noyau*. It molded ~~en no~~ very neatly & one ought not to doubt that it holds in the fire.

Gold cast very thinly

When GOLDSMITHS have something to solder promptly and do not have leisure to forge it, they melt some gold and then throw it on a cloth or other things that withstand the fire, and they flatten it immediately with a hammer or similar thing. And it ends up very thin & even receives the impression of the cloth.

Fine gold, not alloyed, can be cast in medals, but not in plants & lizards & very fine things if it is not alloyed.

A pansy anointed with wheat oil can be cast in alloyed gold.

And other thin leaves, but only if the branch is not too big and the leaves, separately cast, can be soldered.

Counterfeit^[c_003r_02] diamonds put in a work

Give a light coat on the inside of the setting with black modeling wax, then anoint the inside, thus waxed, with wheat oil, & then powder this with lamp smoke, for it is necessary that ~~this~~ its color not have luster for false stones. This done, set in your stone & ~~then~~ with a bit of wax, then, with a steel point & a small finishing hammer, join the edge of the setting to the stone in order that daylight does not enter in. But keep from knocking the stone, which would break.

Casting of lead and tin

When it is often melted, it becomes brittle & ~~#~~ frangible because it is cast very hot & renders it half calcined. Therefore, use new.

The alloy that I have put in use for lizards & snakes is two 3 of fine tin for one lb of new & unadulterated lead.^[c_139r_01] The mold is made of the aforesaid sand, common to all^[c_139r_02] metals; when it is reheated let it cool until you can hold your finger without harm in the hole of the gate. As for lead, one melts it in a crucible ~~ju~~ in the fire, with bellows, until the crucible & the lead are red. When it is in this state, purge it of charcoal, either with a scraper made for this purpose or with the wind of the little bellows.^[c_139r_03] This done, let it rest thus red, & reheat a little on its own, then throw in, if you want, a little rosin to burn the filth. However some find it better not to put any in, because it leaves filth. But, when they are ready to cast, they ought not to forget to throw inside, as well, as much as a bean of looking-glass tin for each lb of lead, and that it^[c_139r_04] should be red like melted metal when it enters in the mold. And if the mold is big, it is better to put it in a press, in order that it joins well & that the lead does not spread outside the mold. However, should this happen & that for the first or second or third time your mold has not filled, cast boldly, for, provided that your metal is red, it will set again, & join with the other, and come out very neat, like the principal.^[c_137r_03] The same can be said for fine tin for thin things. And the alloy of fine tin is one 3 of new lead for one lb of this. Large molds should be placed in very tight presses, between two sheets of copper ~~pu~~, & then bury them in the sand, which is better than ash, because ~~t~~^[c_139r_05] is by its weight it seals better. Otherwise, these large molds are subject to opening slightly by the weight of the metal. Some make square pots

When the medal is thick, one is not compelled to cast as hot as when it is thin.

+

Note that if you want to cast them in cuttlefish bone, they ought not to be very hot because they will burn the cuttlefish bone. Test for this effect with paper. If it turns the paper red, it is enough, it is good to cast, but if it blackens the paper, it is too hot.

If you want to cast a written paper, make your alloy with ~~plom~~ half lead & half tin, & as soon as it is melted, cast between two cartons in a very flat & level place, & with a point of gold or hard wood, engrave on the left the writing that you want. And having poured lead on a carton, press on top with the other adapted carton.

either of **earth** or **plates of copper**, or **iron**, or **wood** covered with *fer blanc*, to bury more easily these aforementioned **molds** between the **sheets of copper** & the stirrup or screw of **iron**.

Cast of **wax** to represent an animal that one has not got

Take some **white wax**, which is more appropriate for this work than anything else because it is firmer & does not leave as much **filth**, as much as you need to mold the animal that you propose, & no more, and half as much **charcoal**, **pestled & finely passed through a linen or a sleeve**. The **charcoal** gives color and body to the **wax**, which would otherwise be transparent & the features would not be seen as well. Therefore, put your **wax** to melt in the charcoal fire. And when it will be well melted & liquid, take, for a **bowl with handles** full of **melted wax**, as much **sulfur** ~~la~~ as a large **walnut**. Pulverize it, melt it over a slow fire, & when it is melted, do not leave it on the fire, because it will become too hard, but take it away & agitate it always with a little stick, & let it finish its bubbling, & when it is as liquid as **water**, throw it in the **wax** that you have removed from the fire. And mix & always stir the one & the other, in order that they mix well. Next, mix in, always stirring & in several goes, **the aforesaid pulverized charcoal** ~~in several goes~~. And as it will be well incorporated, take heed if *your wax has passed its high heat, which you will recognize* when it no longer **smokes**, when it makes large tracts ~~se~~ **repulling** at the edges, & motionless & close ~~to~~ one to the other. For, if you were to cast too hot, you could not separate your **wax** from the **mold**, & it would set in the cast. When it is in this good state, stir it with a little stick, in order that the **pulverized charcoal** is everywhere & not placed at the bottom. And in this way, cast in your **mold**, little by little, & not in one go, because the **wax**, by its unctuousness, does not flow

This **black sulfured wax** is for modeling round figures that are not for releasing and that one needs to burn in the **mold à noyau** before opening it, ~~pe~~ like those which have arms & legs out front or entwined. And then this **wax**, by means of **sulfur**, melts with very little heat and exits without leaving any **filth**. If, by chance, the **pestled charcoal** remains there as **ash**, by opening the **mold** & blowing inside, it stays neat.

To make **snakes** with **wax**, or another thing to fix on a **candle**, one needs to cast with **modeling wax** of all colors.

like other things, & on this occasion, you can cast two or three times until your mold is full. As for the mold which is of white plaster, pulverized & reheated as for previous sands, you should make it well in advance, for it serves several times. But before you use it, soak it for a good hour in cold water & for at least as long in water so hot, that, at the beginning, you cannot hold your finger in it. And ~~q~~ take heed that it does not imbibe ~~b~~ more, ~~thus~~ but rather that it shows itself to be very wet everywhere, without the water being imbibed in it. And, removing it from the hot water, closed, cast your wax in such a state of heat as has been said. And neither the first nor second cast come out readily until the mold is imbibed. Let it cool before opening it, in order that the cast thing does not break. You will recognize that the cast is good when the wax tipped out of the mold is thin and smooth. Remember to make many gates all along the mold, in order that the wax may run better, thus

Make the first

[Figure: fig_p140r_1]

gate twice as large as for other molds. And if, in the first cast, your work becomes porous and does not come out neat ~~[illegible]~~, it is all the same, for it is necessary that you realise that the three or four first ones are not readily good. In the first one, you recognize if there are some barbs, which keep from releasing well and you remove them if they do not remove themselves at the second or third first casts. And the more you will cast, the neater you will make it, and your mold will serve you for more than a hundred times if it is well managed. But it is good to soak it one night or one day before casting in it, in order that it be well imbibed. The same must be done for fruits of sugar. This wax is very soft & amiable & pliant as copper, and it is so strong because of the sulfur, which renders it meltable much before the other, such that you can prove it on a hot slate. And the sulfur that you will have put in it will be found, the second time that you melt it, cracked at the bottom. Having thus passed through the wax, it does not inflame from a candle. And on this occasion ~~that~~, I think it will cast very neatly for medals. One uses the same wax in place of varnish to engrave^[c_004v_02]

When your animal is cast, cut with a hot penknife the flashing & superfluous things. And if you want to refold it & twist it around on some stick or taper, put it to soften ~~on~~ in hot water, and hold it while twisting it around.

Cut down the protuberance of the gates, in order that they are smooth & that the wax has more of the silver to run in one go without turning around in the folds of the snake.

X

engrave on silver & copper with aquafortis. With this also, one takes the hollow form of the relief & then one casts in this hollow form some tempered sand, which once more represents the relief very neatly. And then, you can cast on this one its hollow form in copper, gold, and silver, and make seals of great singularity.

Seals

For casting in sulfur

To cast neatly in sulfur, arrange the bread pith under the brazier, as you know. Mold in it what you want & let dry, & you will have very neat work.

Try sulfur passed through melted wax, because it no longer inflames & no longer makes eyelets.

I tried plaster & brick alone and molded en noyau like others. My mold was very neat, having lightly oiled & rubbed with eau-de-vie my medal. I made my gate ample at the entrance, becoming narrower up to the medal, which was very thin. I notched the gate which embraced well the medal. I dried the mold well on a slow fire &, at the end, heated it well without reddening it. I let it cool in such a way that I could hold my finger to it without burning myself. I made an alloy of 4 3 of tin & six deniers of lead. I cast red, and it came out well. Next, I put in for 4 3 of tin, xii deniers of lead; it came out very well.

When there is nothing to burn in the mold, it is not necessary to reheat it for lead & tin. But for flowers & what should burn, yes.

Molding and shrinking a large figure

Mold it with **bread pith** coming from the oven, or as the aforesaid, & in drying out, it will shrink & consequently the medal that you will cast in it. You ~~it~~ can, by this means, by elongating and widening the imprinted **bread pith**, vary the figure & with one image make many various ones. **Bread** coming from the oven is better. And the one that is reheated twice retracts more. You can cast **sulfur** without leaving the imprint of the **bread** to dry, if you want to mold as big as it is. But if you want to let it shrink, make it dry, either more or less.

Casting of **lead** and **tin** in **plaster**

If you want to cast some flat medal or some animal that is not very weighty and that does not need to burn in the **mold**, you can cast in **plaster** & **brick**, mixed like above, and not in **plaster** alone, for it contracts too much, feeling a harsh fire if it is not accompanied. But, with **brick**, it holds well. However, take heed to dry out your **mold** at length & on a slow fire & with patience, for there is no need to reheat it. But when your work is of flowers or other things that want ~~to be~~ their **molds** reheated & set ablaze, mix in some **feather alum** & even some *crocum*. I have molded in **plaster** & **brick** very neatly, & it withstood several castings.

Molding a **crayfish**

The gate is made by the tail, very thin.

If some little thing is missing from it, you
can reattach it or else fill it with **GOLDSMITH'S**
cement,
because
it
can be
painted. [\[c_141r_01\]](#)

The **crayfish** is one of the most fanciful to mold, but also provides an example for casting many other very difficult things. Males are distinguished by the eggs that females carry and by the four ~~legs~~ little white leglets at the back that males ~~ap~~ have inside their tail, after the eight main legs. It is only a good thing to dry them out a little, because the lumps only come out ~~hard~~ rougher & more beautiful, for everything that is of shell does not diminish. It is true that if you let them dry too much, these little inside leglets diminish & become more slender & do not have as much body. If also they are too dry, the flesh separates from the scales. Take heed, therefore, to use moderation. They have some hair between the legs & at the end of the tail. And because all hair is vexing to mold, because it gets mixed up with the **sand** & is not released, you can burn it with a **hot iron** on the **crayfish**, so that no one sees it. As for animals that have hair or feathers, it is necessary that you anoint them with **olive wheat oil**, which is quickly dry & which will keep the hair flat & spread out. Thus, you will have the form of your animal and the hair will also show, but made wavy, and this is something which can be repaired. If your **crayfish** has eggs, which are delicate and which would be awkward to uncover without breaking, you would do better to make the first cast on the belly & eggs, in order that ~~you~~ you only need to uncover the back, which is hard & easy to handle. And the belly & the eggs will remain in the **mold**, and one will need to burn them inside before opening your **mold** & ~~en~~ for the second time. Thus, ~~all~~ it will open easily, for what is burned will no longer be attached. Thus, the second cast, which is made on the first one, which has set well, separates easily from the first after having been reheated, which is a singular secret for similar **molds**.

Do not forget to rub with **eau-de-vie** before molding.

Stag beetles, **crayfish** & **crabs** are molded in the same fashion.

If your **crayfish** ~~a-d~~ has no eggs, mold the back on top & the belly on the bottom. You can give it some.

It can be molded hollow as for the body, but the legs cannot. And to do it well, **crayfish** are already fanciful enough to mold without looking for the hollow; this ought to be reserved for **turtles**.

When you open your **mold**, you will find the **crayfish** with **white bones**, but not in powder. And without opening it, the ♂ will have done nothing.

Layer these **oil** colors very transparently.

To paint it, boil it with **wine** & a little **salt**, in order that they become very red, & take this as a model. Paint the back with **vermilion** mixed with **lake**, & the sides & underneath^[c_141r_02] the belly & the legs with **vermilion**, & **yellow ocher**, and **white**.

Having therefore let your **crayfish** dry a little **in the sun** or on its own, if it has eggs, they will shrink while drying and will only be more beautiful. Therefore, make your slab of **yellow POTTER's earth**, like for other figures, lay your **crayfish** on top, the **s** back ~~on top~~ on the bottom, & the legs, belly & eggs, which are all the most fanciful parts to mold, on the other side and on the top. Push the back down in the **clay** slab, up to near the legs, which is about halfway. And fix the body with an **iron wire** point in the middle &, if it seems necessary, another at the end of the tail. And in order that the big legs show themselves lower than the head, which is *enf* half sunken, extend them &, from underneath, add to them a little **clay** to raise them. Hide also the horns in the **clay**, under the big legs, to arrange them afterward as you like. As for the small legs, extend them on the **clay** until the joint, and the other half of the legs remain above, curved, for the first cast. However, in order that they do not move & detach, secure them well, not only on the **clay**, but ~~att~~ fix them with **wax** & a little hot **iron** right in the joints. And if you want to find the most fanciful cast, you can attach the end of one of the legs with the same **wax** on the body, or on one of the big legs, and also make, if it has eggs, the tail to be half folded on the eggs, & fix it in this form with an **iron wire** point. Above all special heed, since the thing is **s** thus arranged, that it can be well cleaned. Lastly, having rubbed the **crayfish** with **eau-de-vie**, cast your **sand**. Having set, uncover the back of the **crayfish**, the head & the eyes & its little pincers, the big legs, and the small legs all along, for one needs to uncover the most that one can, both the long horns & the tail, except if you have folded & curved it to hold the eggs. Other animals

Secure what will detach itself, like the hairy brows near the mouth, with some **melted wax** underneath.

[Figure: fig_p141v_1]

Uncover the most that you can, but take heed that the notching that you make in the mold will release well.

Make the mold lean on the side that will be the thickest of the animal.

To paint it, one does the middle of the back **mixed** with **vermilion** mixed with a little **lake**, and the sides & the belly & underneath the legs is with a flesh color made of **vermilion**, **white of ceruse**, a little **yellow ocher**. As in this & all other things, have always the natural one in front of you to imitate it.

Lay the horns on the big legs, & ^[c_156v_06] or make with **whitened latten wire** & **solder** them.

Take heed ~~d~~^[c_082r_02] when modeling to arrange the legs in such a way that they do not pass the belly of the ~~crayfish~~^{crayfish}, ~~Auttr~~^{Auttr} and that, placing them, they sit well on the belly, otherwise the legs would break from the weight of the body, which is massive.

are not uncovered as much. But because the **crayfish** is awkward to burn & clean, one needs to uncover as much as one can, especially the little legs until the end, for these are awkward & if they were not to be uncovered and you were to have to pull them, you could break something in the mold. While uncovering with the point of a knife, or even a burin or other appropriate thing, clean very carefully the **sand** which will be in the joints & elsewhere with your little brushes. And if something gets detached, attach it with **wax**, as said. And attach also the horns in the same way. And make also the gate, along the end of the little legs, with some **wax**. And fill the holes made by the **iron wire** point with it. And once everything is quite neat & more than half is uncovered, **oil** your *ut*^[c_142r_03] mold & *n'oubli*, after having dipped the reverse in **water**, & do not forget to **oil** all the delicate parts which are between the legs and the little pincers. Then, rub the **crayfish** with **eau-de-vie**. And make your second cast, having flattened the first mold, in order that the clamps join better. Your mold must be wider on the side that is imprinted than on the back. Do not open your mold after the second cast unless it has been luted & reheated & unless what is inside is burned. Do not forget to put *crocum* among your **sand** when you mold **crayfish**, for one needs to reheat strongly, & the *crocum* withstands marvelously. Molding a **crab** & a **crayfish**, it is^[c_142r_01] all the same. When you have uncovered your **crayfish** on one side, only delay making the second cast as little you can, for *el* **crayfish** dry *se* out. It is not just about uncovering the **crayfish** well, in such a way that you see an entire half, but take heed that your mold itself, in which you uncover, releases well, for even if the **crayfish** were well burned, you *despoui* would not be able to open your mold without breaking.

Repair with penknives, *fillegible*^[c_142r_02] files, little *chaples*, or burins, &c.

Make all around them, as you see, a gate of **wax**, & at the end of the tail, also two or three, from which you make the principal gate.

[Figure: fig_p142r_1]

Make a gate of **wax**, elongated in a line like a **thick thread**, all along the end of the legs & at *u* the extremity of the tail. If there is also some piece of leg or other part that is further away from the line of the others, or raised above, or folded on its own, give it a gate of **wax**, which from its extremity joins either at the body or at one of the big legs or at some other place which receives a lot of **metal**.

Having uncovered it, attach & secure with **wax** the two little hairy horns of the **crayfish** & other things which are not *en despoui* secured at all.

Molding grasshoppers and things too thin

If you have a written paper to mold that is too thin, after you have made the first cast & it has set, give a little thickness to the reverse of your paper with melted butter, which is the most appropriate means there is, & for fortifying the wings of either a butterfly or a grasshopper, or some delicate part of an animal to which you need to give thickness. But take heed to apply this melted butter underneath the wing or in whichever place it cannot be seen. For giving thickness to a pansy or other flowers, butter is not good, but rather wheat oil, which is soon dry & holds firm. Wax would not be appropriate here for it is too hot once melted, & it makes the thing to which it is applied contract. But butter is amiable and handleable.

If you write on paper or on common carton & if your letter is of gum, the humidity of the clay slab or the wetted sand for noyau will moisten your letter & undo it. Therefore write with cinnabar wetted with oil on oiled paper & press in.

[c_142v_02]+

Reheat your molds with charcoals previously lit in the forge, in order that the fire is not so hot & does not break the molds. And do not make as much fire where the mold is thin as in the place where it is thick.

Molds

Make the notches from those that enter more into the inside of the mold than on the outside, for in this way, they have more strength. Keep from reheating in one go & in too ardent a fire, for this makes them melt break.

Do not keep them in a humid or enclosed place if they are not quite dry e, for they go moldy. So do dried animals.

One ought not to reheat molds twice when the animal can be removed without burning, like a toad, which can well be molded hollow like all thick animals. However, it is always good to redden the mold once.

Lute for luting your molds

I have not found one that is made more quickly than this one, nor better. Take this **lean earth** of which the **FOUNDERS OF ARTILLERY & BELLS** make their *trusseaulx*^[c_142v_07] and molds, which is lean & sandy. Temper it ^[c_017r_01] moderately like a very thick **mortar**. Mix in it about half **horse dung**, & then have it beaten well. Next, mix in a third part of **discarded cloth waste** or **shearings of cloth**, and beat it again quite strongly. You can reheat your mold as soon as the lute is placed.

Molding turtles

The **water turtle** is more beautiful to mold because it has prettier scales & straight legs. And **those of the garrigue** have crooked ones. They are of long life; getting ready to put them to death, open their mouth & pass a long penknife through all the intestines, & then make it swallow some **vinegar** mixed with **eau-de-vie** or **urine**, as for **snakes**. One needs to mold them in several pieces, & the back itself, sometimes, because the sides for some are narrower than elsewhere & are not released on this occasion. To make them die, one ought not to boil them, for they come apart, & even the shell, from the **hot water**. They come out better hollow, because their great thickness corrupts the mold. **Those from water** are more vigorous. **Those of the garrigue** are thinner, slower & more sleepy. If you scratch **those of the water** on their shells, however sleepy they are, they move. **Those of the garrigue** do not.

They die rather quickly in **vinegar** mixed with a little **eau-de-vie** or **urine**, as with all other animals.

They keep themselves, in the *winter*, with their eyes closed & are as dead, being numbed by the **cold**. They hide **in the earth** or **under wheat chaff** or **warm manure**, & live only on the moisture of the earth.

One ought not to mold them as soon as they are dead because they are still too stiff. But on *the following day*, you will manipulate them & fold their legs as you wish.

MOLDERS from Foix

Those who mold crosswise^[c_090r_02] make their sand with *crocum* & calcined slate, but slate always retains its asperity & becomes porous, because it is fatty. *En noyau*, it is not good; in sand, it can be accommodated. They sieve their sand, grind it on porphyry, and wet it in water, & they take away the finest, which is on top, then reheat it.

Toad

Once molded, it can be removed without burning it, because it releases well. Choose the biggest & the lumpiest. Because they contain a lot of metal, it is best to mold them hollow, for they come out better. You could make your cast in one piece & large, but it *s* would be awkward to cut. It is best to do it in three or 4 parts, which are a little wide close to the animal, & include as much of the edge of this, which is close to the gate, as can be done. Make also some gate conduits from the end of

[Figure: fig_p143r_1]

Let the mold cool before opening it, especially for thick things.

one leg up to the other, in order that the spread out extremities come to join one with the other by means of the said gates, which you will start in the round parts, empty of wax, that you have put at the end of the feet to attract the metal. Thus, the gate being made by wax, you are in no danger of encrusting something from the molded animal. And it is more expedient to make thus the gate of wax, to cast the second mold on top, than to wait to do them after the mold is reheated *q*, for at that point, it is necessary, if possible, that everything be ready. One needs to heat well & evenly redden the molds where there are gates of wax, in order that it melts well & leaves nothing inside.

Carcanets made à jour

They are molded like **crayfish** *en noyau*, first on one side, that which is hollow being raised up with **clay**, & then one uncovers them from the other side & one makes the second casting. They can also be cast well in **frames**, provided that they are released easily. If they are not, one models them in **wax**, or else one fills the cavities that cannot release with **wax** or **clay**.

Iron filings

Because usually **filings** are mixed with **filth**, it is good to redden them in the fire to burn the **impurities** and then wash them in **clear water**. In this way, the dirt will go to the top of the **water**, which you throw out, & the **good filings** will go to the bottom.

Carnations

Because the ones that are cast are usually massive, ~~or bi~~ they are weighty, & for this reason, one makes them with **leaves & sheets of silver**.

Turtles

Those of water are more beautiful & easier to mold ~~than those~~, being flatter & having a longer head & tail *q* and legs straighter & better to release than **those of the garrigue**, which are lean, wrinkled & well ensconced in their shell, which also have a rounder top of the shell & nevertheless narrower *v* on the sides than near the middle, which is the reason their *l* top shell cannot be molded well in one piece like **those of the water**.

When they are better mortified & rested two or three **days**, they bend and are handled better.

~~Therefore~~ Thus, you will mold their top shell in two pieces, the bottom ones in two or three or four, according to the need. But, note that if you want to release your **turtle** from the mold without burning it, it needs to be molded thus in several pieces. But, if you want it to be burned ~~p~~ inside, you can mold the top shell in one piece. Therefore, to put your hand to the work after you have killed it entirely in **vinegar** & **urine**, as said, let it dry well. And clean it well with your small bristle brushes. Next, ~~not~~ take your **clay** slab and put it on top and *smudge* it a little, in order that the bottom shell fastens to it, having, nevertheless, earlier shaped the head with a strong point, as with other animals, making it hold high by the means of ~~one~~ a little **fresh clay** that you will adapt from underneath. Stretch the said head & legs with your little pincers. The head arranged, dexterously place ~~d~~ a **grain of yellow millet** in each eye with pincers, because as soon as they are dead the eyes are burst and putrid. You can do this as well with all other small animals, with some **grain of large amaranth**, some of small, and **grain of rapeseed**, & this done, you will arrange the legs, securing them with **iron** points and then, with some **clay**, fill up all the empty space around the **turtle**, that is to say what is between the two shells, in order that the **sand** entering there does not prevent it from releasing. And because the legs should be lower than the shell of the s e^[c_07or_03] of belly, make a little pit in the **clay** slab to adapt them there. Your **turtle**

[Figure: fig_p144r_1]

animal eyes of my invention

[Figure: fig_p144r_2]

having been thus arranged & well cleaned with brushes, place ~~the~~ the circle of clay around the slab. Then, with a band of clay placed on the middle of ^[c_07or_03] ~~the~~ the back of the turtle, as you see, & at the widest place, divide your mold. Subsequently, oil with your paintbrush dedicated for this the half of the shell you want to mold. Temper in hot water, *so that without burning yourself, you can hold your finger in it without burning yourself*, your sand, a little ~~p~~ thick. And ~~f~~ before casting it, rub the shell with eau-de-vie. And next, cast your sand & let it set, and note that all things that have shells or that are hard or are not malleable, like snakes & lizards, want to be oiled to release. Things that are malleable do not need this. Hot water makes the tempered sand ~~in water~~ set better on oil, which otherwise would be refused.

[Figure: fig_p144v_1]

Once your half of the **turtle** is thus *desp* molded, separate it, with its half mold, from the **clay** slab that you will set aside to return it to when it is necessary. Next, clean your half mold & smooth it & flatten, like the others. But because it happens that because ^u[\[c_063v_02\]](#) of the **clay** *entredeux*, the half mold will consist of more than half of the **turtle**, cut & pare down smoothly the excess, & clean everything well with **brushes**. Then, make on the top edge of the mold, on the side that is cut & halfway, two notches, like for other molds, and return your **turtle** to its slab as it was, & secure its two legs, which are not molded, with **iron wire** points. And stuff all around what is empty, up until the edge of the top shell, with **clay**. Next, place the circle around and put a **clay** *entredeulx* on the first mold, a little above the notches. And having **oiled** the ^d[\[c_132v_02\]](#) first half mold, & its notches, and the shell of the **turtle**, & having also showered it with **eau-de-vie**, heat your **water**, temper you **sand** with a little **sal ammoniac water** & the said **hot water**, & cast. Having set, adapt the sides of these two molds smoothly, & on each side secure their joint, which can only just be perceived, with two **clamps**, in order that when uncovering afterward the underneath of the **turtle**, they are not undone. Next, uncover the side of the belly & of the throat, in the way that you uncover a **crayfish**, which is the most difficult to mold of the little beasts, which are molded in two halves.

[Figure: fig_p144v_2]

You can mold the **turtle** with one piece for each side, but one would need to burn it. And afterward, to make the hollow, the reheated mold cannot be **oiled** because it drinks the **oil**.

+

If there is some *crocum* in the **sand**, the joints of the molds can hardly be perceived.

Turn to the second leaf.^{[\[c_144v_02\]](#)}

Casting in three frames

One casts in three frames **bronze** mortars & similar things, which are easily released, namely the body of the mortar in one, ~~the two frames~~ the core in the other, and the ~~core~~ bottom of the mortar in ~~un~~^[c_145r_04] the third one, ~~for small work~~ because otherwise the molding that is in it would not be released.

Inquire^[c_145r_05]

[Figure: fig_p145r_1]

A

Cuttlefish bone

One ought not to cast either **tin** or **lead** too hot in it, for it would burn the **bone** & come out lumpy. And to know when it is at a good heat, dip a little piece of twisted **paper** into it. If it blackens it without lighting, it is at a good heat. But if it burns it & catches fire there, it is too hot. **Gold** & **silver** are able to be cast well there, but it never comes out very neat. To mold something delicate well, it is necessary that the **bone** be not so dry **H**, for it is brittle & does not release as neatly & crumbles & flakes. However, before casting in them, dry them, & especially for **gold**, which does not want humidity. You will recognize that they are dry enough when, after having brought the inside & the imprint of these to the fire, *they cry & crackle once brought near the ear*. Then, join them & lute the joints with a little **clay**, & make it dry lightly by the fire, & cast, & then shake the **mold** or scratch over rough scales, & let it cool before opening. Usually one cuts the **bone** in the middle, and the duller part and that which does not have any half circles

[Figure: fig_p145r_2]

is the most delicate and smoothest for molding, & thus one always imprints there the principal;^[c_137r_03] the other is scaly on the inside, as it demonstrates on the outside. Thus, one does not use this for delicate things that are molded on two sides. One smooths & flattens these two halves on some **smooth wood**, then one scrapes **charcoal** on top to make it release well. And to make the **charcoal** run evenly everywhere, one knocks on the side of the **hand** that holds half of the **bone**. Once both **charcoaled**, one takes the main **bone** that is prepared & rounded on the sides, and having set the medal on top, one tightens and presses it quite strongly.

But ~~because~~ the **fingers** do not press evenly, for ~~one~~ if you press on the edges, the middle will remain hollow. Begin, therefore, by the middle, & then follow the edges. But to make it better, put on the medal something flat & smooth, or some large square file *e*, & press with this, for you will press equally, sometimes ~~after~~ with your **knee**, other times with your **foot** with your shoe taken off, & make the **bone** be on top; thus you *l'emprand* will imprint it without breaking it. If, on the first go, it is not molded well, return to it several times. Then, repair & smooth on the sides your *d* halves of molded **bone**. ^{&[c_145v_01]} And to cut it well, always begin coming from the softest part to the scales. And if your medal does not come out by itself, scratch the **bone** from the back, which is rugged, and it will release. When you want to cast, secure & join your two **bones** with some small points of **wood**, &c. But to mold very neatly, there is only our **sand**.

+

Flowers

When you mold them, if they are not strong enough to hold themselves upright, pass a **thread** through the **mold** to keep them from rising up, & cast the **sand** little by little, & always blow strongly in order that it settles everywhere, otherwise it will become lumpy.

Because you did not put in this a **clay** slab, the **mold** sometimes holds to the **table** where you cast it. To undo it, hit a great blow of a **hammer** at the side of the **table**.

Molding plants and flowers

One does not need **clay** slabs, because plants or flowers are not laid on top but as in air, without touching on any side anything. &[c_145v_02] Only the *es* circle & contour are needed, which should be higher than for flat molds. And thus, take heed to make it strong and thick according to the size that you want, otherwise it would burst, the **sand** being inside. Secure it & fortify it well by the foot, & join well all the joints. Then, take your flower, well joined & securely adapted to the end ~~of-eir~~ of the gate of **wax**, which should not be rough but rather smooth, in order that it can release well. Then, wet your flower or plant in some **good eau-de-vie**, ~~or-else-moin~~ placed in a long glass

[Figure: fig_p145v_2]

It is enough to reheat
your **luted** mold once
for flowers & to heat it the second time
if you cast with **tin** & **lead**,
for with **gold** & **silver**, one needs
to reheat it twice.

Cast your **tin** very red in the mold, *of such heat that you can hold your **finger** there without harm in the hole.*

in order that it gets wet everywhere; if not, wet it with a large paintbrush dedicated to this. Then, pass through the end of the mold which closes the circle your bit of iron wire, which holds the wax gate, and cleave with it the clay closure, as you see, & place it low, so that the plant or flower touches no thing & can leave enough thickness for the mold, for the tempered sand always raises the plant or flower. Thus, if it is not stiff by itself, pass with a needle some thin thread *pø* on the flower to keep it from rising. Or, if you were to forget, lower the flower with some *b*^[c_146r_01] small stick until the cast sand begins to *d*^[c_082r_02] thicken. Your flower being well arranged, *d* choose a bowl big enough to temper in it as much sand as it takes to fill your mold. Put in a little sal ammoniac water, then some fountain water. And when the *ett*^[c_146r_02] bowl is nearly full, put in, by sprinkling, your sand, & mix & dilute it well in order that it all becomes smooth, for if it were to coagulate, it would spoil the mold. For flowers, it does not want to be so thick, and especially at the beginning, you will throw, in thrusts, the clearest one on the flower, & when it will be half covered, blow strongly everywhere, to make the little bubbles disappear. Next, finish filling & blow always. Make the mold lean a little toward its widest part, and if you find the remains of thick sand, which has not thinned well, cast it rather toward the gate than elsewhere. Finally, you can even cast some thicker tempered sand in order to make *make* a quicker set. I have molded thus a marigold with its leaves. The *crocum ferri* is safer for flowers, and when there is *crocum*, lute with the same sand that has served, and is the most excellent of all.

The alloy with which I cast a large branch of marigold, which came out neatly like the natural with its flower, its buds, and its leaves, was of one lb of fine tin mixed with two ounces of lead.

If there is some flashing, repair with a penknife.

Uncover the molded flower by gently undoing the mold with the point of a knife, & better yet, wet it well in water. Next, use small hog bristle brushes, a bit of iron wire, &c. When the mold is reheated the first time, leave it to half cool, then gently pass through the gate an iron wire to make an opening for the burned ashes inside. Next, blow inside with bellows, then turn the mold at the gate to make everything come out, & sometimes suck and draw out with the mouth.

Take heed not to attach the tail of the flower too much to the gate of wax, for fear of spoiling something when you pull out the gate of wax. To pull it out, one needs to dig out all around a little, & then pull it with your little pincers by the tail of iron.

Molding turtles

This is the continuation of the second preceding leaf.^[c_146v_02] When you have well uncovered the part of the belly of the **turtle**, the underneath of the throat & of the legs, & having cleaned it all well, do not forget to neatly uncover this cavity that these animals have in their shell between the neck & the shoulders. **Those of the water** do not have ones as deep as **those of the garrigue**, which are leaner. And among these, there are some that have ones more ensconced than others. Do not forget, therefore, to uncover all of this well to better represent its nature. But if there is some cavity which twists too much inside and can neither be seen nor released,

put in some small pieces of **wax**, & with points of hot, **thick iron wire**, stretch & adapt the said **wax**. Then, *boueh* stuff with **soft clay** the entrance of all its cavities. Put the **clay** circle around your **mold**, made already of two pieces, which contains the back of the **turtle**. And to mold its belly, one needs to divide in three, as you see. That is to say, you will put an *entre deulx* of **clay** on top of the throat & another on the edge of the shell of the tail, [#]^[c_154v_03]. And having **oiled** **and** the shell of the belly & having rubbed it with **eau-de-vie**, cast your **sand** a little thick, & temper with **hot water** as before. Having set, remove these *entredeulx* of **clay**, then uncover well the front & back legs, that is to say the part underneath & the tail & the throat, & remove the **clay** from the cavities *qu*, all in one piece if you can, for this will show you if this cavity will release well. And if the pulled-out **clay** brings with it the **wax** that you put there, put back it in the places that cannot release, as is said. And if some part is taken away or let go, attach & rejoin it to the **mold** with some **wax** & the point of hot **iron**. Do not forget to put some *pø* **melted wax** at the end of the nails of the **turtles** to make the vent. Your belly shell molded and uncovered, your **mold** can be seen thus.

[Figure: fig_p146v_1]

in such a way that only the entire belly shell be uncovered, to mold it alone

[Figure: fig_p146v_2]

Take heed to make a border of **melted wax**, with a **hot iron**, all around the edge of the top shell which is toward the tail, in order to make the vent better. And make two little strings of the same **wax**, ^r connecting from the end the belly shell to the said edge of **wax** that is around the shell of the spine, and make sure that ~~turtle~~ of the tail of the **turtle** stays between these two strings. This is to make the vent better. This done, **oil** your **mold** and what appears of the shell. Put the **circle** around & cast with **hot water**, as before, observing there what you have observed. Do the same to mold the third part, which is the tail. And having set, ~~You Uncover your mold~~ remove the **clay** contour, clean your **mold**, & smooth it & flatten it on all sides with a knife, like for other **molds**. Dip it lightly in **water**, then try to release it. Usually one begins ~~ment~~ with ^{e[c_017r_01]} ~~back~~ the back shell, ~~it is~~ that is to say, the **mold** on top, which is in two halves, and this one is easier to release. The other one follows after, but because it is neighboring the shoulder of the **turtles**, which are deeply ensconced, it is sometimes awkward. Thus, when moving & pulling the **mold** gently, take heed to pull the one which will present itself as the easiest, for one needs to release one after the other. The most awkward of all is the one which molds the ^{e[c_017r_01]} ~~of~~ throat, the underneaths of the legs & the hollow shoulder pieces, which are of such bad release that if you had not provided for it, by filling with **wax** before molding what does not release well, it will be awkward for you to pull your pieces out without breaking something. But should this happen to you, there is still a remedy, provided that you keep ~~pi~~ the broken pieces.

For you can reassemble them with **points** of **rather strong iron** & fill the crack or fault that could be there with **melted wax** & the **hot iron**, as with others, in order that the core for molding hollow is made better. Next

Go to the second leaf^{f[c_147r_02]}

To avoid breaking when releasing, take heed to uncover well up until what can hold.

+ Casting of **copper** alloyed with **℥**, which is like **very base solder** / *ard*^[c_147v_01] and **old K**^[c_086v_03] and some *R*^[c_147v_01] out of xii

I have cast with it the cleanest I have seen, in very small figures & thin as **paper**. I have cast very hot in the very red mold, and have put in the melted substance of ~~this~~ the two substances compositions, which make **silver** run, & have made as if I had wanted to cast **pure silver**. This alloy is white in *bullitoire*, like any alloys which resemble, however little, **℥**. For casting something delicate, use this one.

Lute

There is no better than the one ~~that has~~ which you have molded, namely pieces from your molds. But one needs to choose those better reheated.

Crucible

Take heed that it is three **fingers** from *fe* the mouth of the bellows, & that the said bellows beats from *us*^[c_015r_02] underneath the bottom of the *crucible*, otherwise it would cool it.

Casting of latten

I took the one of latten skillets, which are beaten & forged thinly. ^[c_147v_02] Once well heated, I cast in it two or three grains, like peas, of sal ammoniac. This clarified it like a mirror. Once very white from the force of being hot, I cast in it some pulverized calamine, raw & pure. I cast it in its very red mold. It came out very neat & thin like paper, & hollow on the reverse. But because it had crusted, I reheated it, that is to say reddened, let it cool, then put it to the whitening, of one part raw tartar & of one half common salt. Once well boiled, I rubbed it with a scratch-brush in clear water. And because the first time it had not

Do not let it cool when melting. It always makes a tail, like melted glass, because of the calamine.

Usually, the soft latten of skillets becomes red from casting, especially when it stays a long time in the fire, ^m because the calamine exhales itself. But sour latten of candlesticks becomes yellow & pin filings.

come out as clear as I wanted, I reheated it again, let it cool, put it again to the whitening & the scratch-brush. It came out very neatly. You will do thus for copper and silver. And if you want to give ^[c_148r_01]

Beautiful color for latten

Having cleaned it well, as is said, & scratch-brushed it well, make it boil in water & turmeric root or terra merita, and it will become very beautiful.

Whitening

If it is for silver, do not pestle your tartar with iron but with the handle of a hammer, for if you touch & dip iron in your whitening, the silver would become red like copper & you would need to reheat it & put it again in whitening. Mix nothing with your tartar that should not enter the whitening, for this corrupts it. Do not let it spill out of its first boil, for in this is all its strength. The whitening is made with one part pulverized tartar & a half of common salt.

Molding the foot of the **bittern**, or of the **eagle**, or of other birds **[c_148r_02]**for the foot of saltcellars or vases

One usually molds the foot & the leg up to the joint. And for this effect, one molds it in five pieces: the leg in two pieces, the top of the foot in two, and the bottom in one piece.

in three pieces

[c_148r_03]*Crocum ferri*

To make this quickly, redden the **filings** in an **iron** case, stirring it often. Then sprinkle it with **good vinegar** & let it evaporate, & without removing it from atop the fire, let it redden & inflame. Once cooled, pulverize it on **marble** & return it to the fire, ~~you~~ sprinkle with **vinegar**, and then inflame. Thus it will quickly be colored & made fine.

Molding turtles

[c_148v_01]Next, reassemble the parts of your mold and clamp carefully all the joints, as much as above & below as on the sides, having not forgotten to notch the joints of the molds, as with others. Having clamped it all, undo the clamps on the side & not the others. And thus, your mold of several pieces *sem* will open as if it were only in two halves. If you want to mold hollow, make in the middle of the ~~of the part~~ mold of the belly a hole, from side to side, which, inside, is of such capacity that the end of a little finger can almost enter it, widening like a *clervoise* the outside of the hole. This is to cast the core. But note that all these difficulties would be nothing if you wanted to mold hollow, because you could mold your turtle in two pieces *fillegible* and burn it inside, as with other animals, and it would be done quickly. But since the turtle is massive & would be weighty if it is not hollow, one considers it better molded in this way hollow, and in *eha* this fashion, to make a mold well, one really needs three days. Take heed in hollow & fanciful molds to have some strong plaster, which endures the fire without bursting, if it is possible. But if you cannot have any such, mix a little more feather alum & add to it also some *crocum*, which fortifies it & makes it so that the flashing, if there is any, comes out so finely that it is easily undone. Also, do not forget to tighten your molds well with a press to avoid flashing which is made either when the mold is not well joined or when it bursts. To repair, if the features are not apparent enough, retrace them lightly with a burin, then soften them with a small chisel. The flashing is removed with the *chape*, a type of burin. For the lumps & scales, they are made either with a little gouge or a little round cutting-punch, or with the point of a small chisel, not tempered, & struck on a small file.

Make this hole before molding joining your molds.

Softening iron and rendering it very soft

Take sublimate, quicklime, soap from Venice, horse dung, a little less sublimate than the others. Wet all of this together like paste, & impaste the iron with it, & envelop it in this with some bad linen. Then make it reheat until it is very red. Or leave overnight in a good fire until the morning. It will be very soft for engraving on it well whatever you want.

Base gold from Germany, electrum

One calls it gold from the Rhine, which one finds in the rivers, and is spangle gold. Goldsmiths from Germany wanted to refine it, thinking to separate it from this whiteness, which they deemed to be silver. But it always remains whiteish, which demonstrates that this whiteness is fixed, & it does not lack color. This is electrum, from which one can make cups which will demonstrate poison.

Various arts from Germany

They are very much helped by water mills, & most of the artisans of metals, of gold, & of silver, & others, make have their large works beaten with these trip hammers. And to draw iron wire, they redden large masses of iron, & having made it into a point, they hook it thus all red & thus promptly draw the wire.

Medal to be repaired

If you want to mold any medal to serve as your pattern, & at the same time repair it, cast it in a majority of tin & copiously put in looking-glass tin to harden it.

Molding vases in several pieces

Goldsmiths who work in large wares and plate get whatever wooden forms they please turned on a lathe. And then, with some wax, they model on top masks, festoons, and whatever they please. And next they mold in three, in four, or several pieces.

Gold solder

They take, for one gold denier, one grain of the fine alloy, like old douzains are.

Molding a fly

Large flies can be molded & ^[c_149v_02] made by casting. But one needs ~~par~~ to anoint underneath their wings with wheat oil, which dries quickly and fortifies them & gives them a little thickness. The same is done to butterflies, cicadas, grasshoppers & similar things. But to cast them more easily, one applies them on some leaf or bouquet. The others are made by hand with a very thin silver sheet. One ought not to keep them once dead, because they dry out and their legs break. ^[c_149v_01]

Wheat oil is put underneath delicate things to render them more rigid & firm & to make them hold their natural position. Because being weak & delicate, the tempered sand, weighing down their tops, would change their form.

Bat

They have very thin wings, & if they are large & dry and their wings extended, one would need a very large mold & it would not be certain that the metal would run sufficiently. Thus, when you want to mold them, choose the medium-sized ones & make the pose ~~qu~~ so that they have their wings half folded. Because in this way they will come out better, but support the side of the wings with wax, as you know, to feed the cast well.

Very strong wax

Mix with this rosin and bole, and do not cast it very hot.

^[c_150r_01]Various alloys of tin and lead

For hollow things like turtles, half fine lead and half tin.

For flowers, almost all tin, namely a lb of fine tin and two 3 of fine lead.

For lizards that are as thick as one or two fingers, almost all lead, namely a lb of fine lead and 4 3 of fine tin.

Molds

They are less subject to cracking while reheating when they are very thick, rather than when they are of little thickness, provided that the thickness is sufficient. For being thin, they scarcely need to be *rechi* on the fire, & a long time on the fire makes them corrupt, especially when the **plaster** is not strong.

It is better to reheat a **mold** on its own than several together, because one needs a larger & more violent fire for several than for one. And, **glowing charcoal** stopping up the space between the **molds**, the heat reverberates from one to the other in such a way that more often you will find your **molds** burst & cracked on one side more than another.

Therefore reheat your **molds** alone, not making fire there, except to cover it.

And because your **lead** and **tin** become sour when frequently melted red, to soften, ^[c_015r_01] melt it without reddening, and cast in a rod.

Brick cools the **metal**, & if this were not for giving bond, it would not be necessary.

The reheated **molds** cannot withstand several casts. But those in which one wants to cast only **lead** or **tin** ~~and~~ or flat medals, having been only dried, withstand many.

Very finely ground iron scales render them very firm & strong.

Molding hollow

This iron wire point, which is put thus ~~bi~~ through the hole, is to better hold the core & keep it from shifting. All of this being ^[c_112r_05] thus arranged, lay your mold on the table, the hole at the top, as it is marked here on the side, & then adapt a circle of soft clay ~~au~~^{tr}, two fingers high, around the hole, like for other molds. And then temper your molding sand moderately thick, & cast it through the hole until it is well well filled, up to the surface of the clay circle. But take heed to not cast ^[c_150v_04] in through the middle of the hole, but rather from the side, for, since the already made mold drinks and sucks the moisture ~~of the new~~, the new one that you cast in ~~which dries quickly~~ on the edge of the mold, being quickly dry, s would obstruct the mold, & it would not finish filling. And when you cast from the side, if you recognize that it is obstructed, you can clear a path. Having cast in, blow on the ~~f~~^{the} wet gate, & put the end of your finger in the hole a few times, ~~pe~~ or some small point, to unblock it, & make the hollow wax fill up. Cast in, at the end, the sand, tempered a little thick to give strength to the mold, for water coming to the surface s of the mold always makes it softer. Having set, scrape off the clay circle & the excess which is on the hole through which you cast the noyau, & nothing will be discernable. When your mold is thus prepared, lute it all around with the same sand which served for the molds. Next, reheat it in a slow fire at the beginning, & the mouth of the gate at the bottom, in order that the wax flows out gently. For if you were to give it great heat until the wax came out, it would boil inside & leave some pustules & lumpy things, although

This point is placed in the middle & through the hole of the gate when the mold is in several pieces, like a turtle, and this is done in order that the core does not shake. But when the mold is only of two pieces,

[Figure: fig_p150v_1]

it is not necessary to put points
in the middle of it.

[Figure: fig_p150v_2]

Before casting the core, make some notches all around the hole through which you want to cast, in order to always better secure the mold.

Mixed **tallow** is the reason that, when emptying the **wax**, the hole does not become obstructed. One needs half **tallow** & half **black wax**.

All very thick pieces come out better in hollow, because a thick mass of mostly **lead** remains hot a *long time* & eats the **mold**.

You can, after the cast is done, mold **a** the part of the shell of the belly where you have made the hole on the natural one, ^[c_150v_03] and reattach it with **solder**.

X

Note that, after your
core is cast, it is

better to put the **mold**

in **hot water** to open it, in order to remove the most **wax** that you can, always softening ^[c_150v_05] it in **hot water**. For the less **wax** that remains in it, the better, in order that, when reboiling in large quantity in the **mold** when you reheat it, no pustules or lumps are made in it. And then, if there is hardly any **wax**, you will not need to reheat it as much. When opening the **mold**, the cast will break. But it can easily be repaired, even though you cast **A** ^[c_150v_02]

[Figure: fig_p150v_4]

the **white wax** with which you have composed your **black sulfured wax**, has such little substance, since being dry and purified, that it leaves nothing inside, and flows very gently. As for the **charcoal** which is mixed in, if some remains, it burns & reduces to **ash** & is emptied afterward by blowing through the gate. You could even open your **mold** after the **wax** has melted, if there is no fanciful thing which could break, like some reattached thing or similar. After having covered the **clamps** with the **lute** from your **sand** & having covered all of the **mold**, give it on top a layer of **common lute**, & then sprinkle this with some **pestled brick**, in order that you can handle it better. Let the **lute** dry slowly before firing it, which melts the **wax**. The **wax** having left through the gate, that which remains with the **charcoal** will burn. Being reheated for the first time, **lute** it *pou* once more, ~~to reheat it the second time~~ because the **plaster**, not being good, will have readily made the **mold** retract, and the joints will crack open, which might make large flashing. And for the second time, one ought not to reheat it if you only want to cast in **lead** or **tin**, but rather only make sure that the **lute** is quite dry & the **mold** moderately hot. For these **turtles** that have a large size & enough thickness, it is better to ~~mold~~ *aut* cast your **lead** an alloy half of **lead** & half of **tin**, especially for hollow things. For, if you only have very thin & very weak things to cast, like flowers, rely rather on the abundance of **lead** than of **tin**, which becomes porous once cast a little thick, & readily makes some flaw around the cast. **MAISTRE Alexandre**^[c_151r_02] says that he has never gone wrong with half **tin** & half **lead** for things weighty & with the thickness of the **back of a knife**. If there is *crocum*, the joints hardly appear, & consequently, the flashing is very small & thin. You can repair & through the hole of the belly, pull the **earth** of the core, leaving it wet a *long time*;

When you have cast your **black wax** in the *a*^[c_033r_01] **mold**, & when it is quite cold, you need to ~~the~~ open your **mold** halfway, to make the cast. And if the figure of **black wax** breaks, there is no danger, for it can always be reattached with a **hot iron** ~~touching~~ point. Or else, if the pieces are not separated from the **mold**, *qu* they meet up & join like beforehand by joining & binding well the two halves of the **mold**. When the figure is large, one needs to cross inside many **iron wires** to sustain the core.

[Figure: fig_p151r_1]

A^[c_151r_01]

only in **lead** or
tin. One needs,
however, to redden
the **mold** nearly as
much as if there were
inside some
animal to burn,

in order that the **wax** melts well & leaves nothing inside & flows on its own by keeping the **mold** leaning toward the gate when reheating it. And when the **mold** is reheated, leave it to cool gently, then blow inside, and draw toward yourself, while sucking, in order that the **ashes of the wax** come out. Do this with **bellows**.

however, do not remove it until you have completely repaired the **turtle**, for you will use this **earth** as **cement** if you need to embed something or repair with the **small chisel**. If there is some flashing at the joints of the **mold**, you will remove it, either with the **burin** called a *chaple* or a very sharp penknife, or with a **small file**, & then with the **small chisel**, always having the natural one, to do this better, in front of you. You can curl on a **file** the point of a **small chisel** which is not quenched to make something lumpy. For these **two turtles** & hollow things that presuppose being large enough, cast your alloy of half **lead** & half **fine tin**. There is more work in molding a **turtle** than for twelve **molds** of flowers. If there is some *crocum* in your **sand**, there will not be flashing, & if, by some chance, there is some on the sides, it will be thinner than **paper**, as long as your **mold** is tightened well with a **press**.

And to make the scales of **turtles** or other animals, you can make some little small chisels in the fashion of a **round cutting-punch**, others in the fashion of a **gouge** or the scale of a **snake** & **lizard**, and others on a **file** to make the curly & lumpy bits.^[c_151v_02] The **turtles** which are not molded hollow do not have as much work, for they are molded in two pieces, to repair them with small chisels,^[c_151v_01] small cutting-punches, small gouges & small serrated chisels.

[Figure: fig_p151v_1]

Wheat oil

One needs to make it between two quite sparkling hot iron plates, especially the lower one, which will be sloping, on which you will put some wheat, quite even & uniform. And then you will place the other, all red, on top, & you will press it until you see the black oil drip well. Reiterate that until you have enough of it. This oil dries immediately. It gives gold color to silvered & burnished things, augments the color of gilded things, serves as a varnish on iron for engraving^[c_004v_02] on it afterward, for varnishing sword guards tawny. And could also serve MAKERS OF GILDED LEATHER well.

One needs to use it when it is newly made. And for things to be molded, it must not be as thick as for coloring.

It is not for anointing hairy animals, for it is too strong & stiff, but it is good to give form to the legs of a small animal, like a fly & suchlike. It is also excellent for coloring false white stones.

Molding a rat

The hairs of its whiskers would be awkward to come out in the cast; you can therefore shave them with fire, like *d*^[c_052r_02] the **tyrant of Syracuse**,^[c_152r_01] & afterward you can replace them with *d'arg* natural **silvered** ones. The tail is beautiful molded because it is made of scaly circles, nearly like the one of a **lizard**, & in order that the hair does not hinder good molding, burn it in the fire of a little candle. The rest of the body should be anointed with **wheat oil**, which will keep the hair stiff & couched, so that the **sand** will not raise it by getting entangled in it to prevent coming out neatly. The **wheat oil** being dry, which will be quick, you will be able to pass a very thin comb to divide it, in order that it appears in the cast. On a **small mouse**, you can even put some **common oil** to lower the hair. And before molding these animals (except **snakes** & **lizards**), let them ~~rest~~ remain dead one or two days to have them more handleable. For they stay rigid after their death & cannot be well fitted to their true shape until they are a little softened. However, if you mold it quickly after it is dead, or give it its shape before it stiffens, you will do well. *Att*^[c_152r_02] And because the eyes die, *you in it en* if you do ~~not~~ mold it promptly, you will be able to^[c_152r_03] substitute in the eyes the **halves of well-rounded peas**, stripped of their skin & shell. Some make the **rat** shed, others anoint it with **olive oil**, which is amiable, for **wheat oil** is thick & has too much body. This is why one scarcely uses it, only to give some feature to a **fly** foot or under a wing to keep them rigid. Others couch the hair with an **egg yolk**, which is quickly dry & amiable. Shape it, before **oiling** it, on the **clay** slab, and raise its head with an **iron point**, & secure also the feet with **points**, & the tail. Rub it with **eau-de-vie**, once dry from the **oil**. Then, cast your **sand**; next, uncover it like other animals, & make the second cast. One ought not to open the **mold** until it is reheated & the **rat** burned.

+

The **rat**, because it is thick, comes out better being hollow if it is a **big rat**. A **mouse** molds better, because it has shorter hair. It is not possible to mold well an animal that has **biggish bones**, like a **bird** or **rat**, without opening the **mold** to clean it well, for **bones** do not calcine.

All feathers & all hair is awkward to mold according to its nature.

Butter for anointing hairy animals is better *e* than **wheat oil**, because it is more amiable.

If the **rat** is big, it is good to remove its entrails, or, having molded it, to dry it in the **oven**, because the large amount of humidity that it has comes to boil in the **mold**, & spoils it & makes it lumpy.

Do not put your **mold** in the **cold** until it has slowly cooled dry. Otherwise it imbibes the humidity, which makes it break.

Repairing cast things

It happens often that what you have cast makes flashing, either through fault in the **mold**, or from the cast, or from the **metal**. The fault in the **mold** comes from **plaster**, which is not hard & strong and does not withstand fire (which is corrected by mixing it with *crocum*). Usually as well, if there is an imperfection, it is from the cast. If there is also too much **tin** in a moderately thick thing, it does not come out well, because **tin** cast thick retracts & becomes porous. Also, things molded hollow are fanciful to cast. If, therefore, some flaw should happen, take a **leather** cushionet full of **fine sand**, & having placed it on the *bequet*^[c_152v_02] of the **GOLDSMITH's** table, where one *files*, place your work on it & secure it with a **rope** which passes under your **foot**. The **sand** in the **bag** obeys & arranges itself by and by, thick on one side & thin on the other. Then, forthwith, with a **burin**, make & trace roughly the fine lines which were omitted or which are not apparent enough, or with a **file** or a *chaple*, remove the flashing. And if there is some fault in the substance, which left some pit or too-hollow thing, rescape this with a **burin** and notch around the edge, then imprint this with some **wax**. And place the imprint on a **delicate plate of lead**, & mark thus the appropriate measure of **lead** or of the alloy similar to your substance, then place the piece of the notched thing & attach it well with some **latten wire**, then rub the edge with **rosin** if it is **tin** or **lead** & place all around some small thin pieces of **solder** or **tin** or other things, then with a **hot iron** or in the fire of the **forge**, **solder**, and next repair this with the aforesaid tools & with the appropriate **small chisels**.

For **gold** & small work, one needs to cement it on a ball of **lead**, which will be placed on the cushionet & will be held thus with the **rope**.

[Figure: fig_p152v_1]

[Figure: fig_p152v_2]

Molding hollow for seals or other things

First, model your figure in **wax** on a piece of **glass** or smooth **slate**. Next, mold it with our aforesaid **sand**, *t* having first anointed lightly with **oil**, as you know, & then rubbed with **eau-de-vie**, *having* and tempering your **sand** with **hot water**. Having the hollow form, cast it in **alloyed lead**, in the same form as other figures that you make very neatly. However, if it did not come out at all neatly, repair it. And then, ~~cast some~~ mold with some **wax** on the relief of **lead**, & you will have a very neat hollow form in the **wax**, which comes out very neatly on the **lead**. Next, in the hollow form of **wax**, cast your **tempered sand**, which will make for you a relief, on which you will cast your hollow form in **silver** or another **metal** for seals. But note that you should not make your hollow form with **melted wax**, but rather, only heated in **warm water**, or, even better, in **warm urine**. Or else, if you have a relief of **gold** or **silver**, or other **metal**, very *façé* neat & repaired, imprint on top your hollow form of **wax**, & then in the latter, cast your **sand**, which will come out in relief, on which you will next cast your hollow form for seals or other works. You could even cast a hollow form on the principal^[c_137r_03] of **metal**^[c_016v_05] relief, & even with **lead** & **tin**, which will not melt the principal^[c_153r_03] if it is lightly anointed with **crushed chalk** with a paintbrush, or smoked with candle **smoke** or with dried glair of egg.

^[c_153r_01]When you have imprinted your seal of **wax**, mold *en noyau* this piece of **wax**, which is hollow, like your seal, & your *noyau* will render it molded, similar to *u* the imprint & the seal.

It is necessary that your **wax** be mixed with some color which hardly has body in order that you see the imprint better. **Lamp smoke** or **soot black** is good for this. **White wax**, for this effect, is *exé* better.

Giving the thickness that you wish to a medal

Having cast your first mold, mix *[illegible]*^[c_153r_02] *crocum* or **well-ground iron scales** to firm it up. And having set & rendered your hollow form very neat, take some paste of fine

flour. And to flatten it, take a small stick of **boxwood**, very round & of the same thickness everywhere, which has, at the two ends, a little circle, more raised than the rest, to give the necessary thickness to the **paste**. And then, with this rolling pin, flatten it in such a way that it is delicate & thin enough. Then apply it on the hollow of your mold and press on it with some **cotton** & your figure will imprint itself in the **paste**, in relief on one side & in a hollow form on the other. This done, anoint with a paintbrush, wetted in a little **melted butter**, the part of the **paste** which is hollow. Then, cut the excess **paste** which surpasses the hollow of the mold *H*. Anoint your mold also with **olive oil**, as you have done with others, place the **clay** contour & cast *s* your second mold. And you will have your medal as thin & hollow on one side as you will want. You can have diverse rolling pins, which will have ends, some more raised than others, to make various thicknesses, or use **sheets of lead & copper** of various thicknesses or of **carton**, cut with the rolling pin.

[Figure: fig_p153v_1]

If you were to rub your **paste** with **oil**, it would drink the **oil** & penetrate up to the mold, which it would attack. But **butter** remains on the surface of the **paste** & is not imbibed at all. You should not, on these reverse sides, temper your **sand** with **hot water**, for it would melt

[Figure: fig_p153v_2]

the **butter**.

Testing the goodness and strength of a **sand** to be reheated

After it has set, it must be found smooth & easy to cut, and not rough. It tests better in a large & fantastical mold than in a small one, for the large one remains *long* in the fire & the small one is soon reheated.

Softening^[c_015r_01] **gold**

Sometimes, there is **gold** so dry ^{*it*}^[c_128r_02] that neither **cement** nor **antimony** can soften it. But only **verdet** can render it soft.

Gold not being fixed

Gold as gilding goes away once the piece is reheated & kept in high heat, especially if there is some lead, for lead will pierce in the fire a piece with gold, because it holds closely with ȝ.

Cutting lead

Because it is fatty & grips & sticks to the knife or chisel, wet it & you will cut it like glass.

^[c_154r_01]Sometimes gold & silver take on, through certain fumes, some color during the casting. But these are not at all scales & crust, but rather this color goes away with whitening & bullitoire.

Softening^[c_015r_01] silver

When GOLDSMITHS WHO WORK LARGE WARES have forged their platters, it very often happens with their sheddings that it bursts & cracks for being too soured. To avoid this, throw in, when it is well melted, some dry mortar composed of sand & good lime which has been worked, & pulverize it & throw it in.

GOLDSMITHS do not work at all with the silver from reals that is not alloyed, because it is leady & when forging it sours.

Some solder, for small works & things which only go in the fire once, with some old sou & carolus, reheated & beaten. However, if the sou is not very good, the solder eats away & one needs to solder there twice, & one finds there too much copper. Others solder with half silver & half fine copper.

Iron scales

Once well pulverized & ground on marble, & mixed with the aforesaid sand of noyau, and dried slowly without reheating, it endures several casts of lead & tin. Copper & latten^[c_154r_02] come out well. But if it is not well ground, like crocum, it goes to the bottom, if the sand is not tempered thickly enough.

Metal filings

They are not made by themselves if they are not aided by some portion of similar metal, melted to assemble them & put them in a bath, for they are sooner burned than melted. Tin and lead filings are made with tallow, the one of gold with salpeter, the one of silver with sandiver.

Latten

It is very capricious to cast. It must be cast very hot. And to better achieve your goal, throw on it some sal ammoniac to thin it. Alloy it as well with a little red copper and, when you want to cast, a little tin to make it run better. It always leaves a tail like melted glass. It does not require as long a gate as others.

Molding

It is only good that it die down a little on the outside & nevertheless be red on the inside, for when it comes out of the fire, the air & vehement exhalations of fire do not receive the cast so well.

Casting of silver^[c_154v_01]

Silver needs a longish gate. For gold it does not matter. Silver, when soldering, tolerates the water one throws on it. But gold would spatter, & needs that for that reason, one casts solder bran on the solder.

Let the mold cool well after the casting before opening it.

Reinforcing flowers and delicate things

For flowers & delicate things & herbage, one does not use wheat oil but melted butter, of which one gives a light [#\[c_154v_03\]](#) coat on the back of the petals of the rose flower & the pansy & other flowers that need it. But one reinforces the *f* little legs of flies & other small animals with wheat oil to strengthen them & make them hold up.

with a small paintbrush

Strawberries

The leaves are cast separately & then are joined with solder. And because the strawberry fruit is cast solid, & by that means is heavy, and the tin stem which is delicate will not be able to hold it up without soon breaking, one makes the stems with latten wire & then one solders & joins them.

Molding a rose

Because the little branches of the **rose bush** which are ~~apart~~ around the flower are sometimes very spread out & would make too large a mold, one makes and molds them separately, and the **rose** & some **e** buds separately. And then one joins with **solder** the little branches & leaves of the **rose bush** to the stem of the **rose** on which one intentionally leaves the little tips of the small branches. Put your leaf or **rose** as low as you can in the mold because the **sand** always raises it up. You ~~en~~ can also mold several petals together, once arranged one on top of the other, separating them with threads, as is said. And regarding the **rose**, you can give a thin layer of **melted butter** on the back of the petal, ~~of~~ on the first petals on the outside, not on those on the inside ~~be~~, to fortify it & give it the strength to withstand, in order that the **tempered sand** does not spread out & expand more than it should. You ~~them~~ can also mold well the leaves of **rose bushes**, **strawberry plants**, & similar things that are flat & can be flattened without spoiling them with two gates, for opening your mold when it is reheated, & cleaning the **ashes** from it, ~~All~~ and making vents & several gates. And this is the easiest way, but the other can also be done. And with small veins of **wax** adapted & joined from leaf to leaf, you can make gates. You can even make a vein of **wax** from the back of the first petal ~~until~~, which will join to the gate. All of this facilitates the cast. ~~Auleu~~ The principal thing is to let your reheated molds cool down well rather than cleaning them & blowing inside them to make the **wax** come out, because when the mold is hot, the **ash** holds to it as if attached. But when it is cold, it wanders and leaves with the air or when one blows one's **breath** through the small opening. Wet the **rose** with **eau-de-vie** before putting it in the circle of **clay**. Do not forget to **oil** the **wax** gate. And when you have cast your **tempered sand**, blow thoroughly until it begins to set. The **rose** came out well. But because the **sand** finds itself mixed among the petals, make your work soak in **water** for a *long time* in order that, shaking it in the **water**, the **earth** is gone from it.

[Figure: fig_p155r_1]

You can well give a bit of thickness at the ends of the stalks that support the leaves, anointing them lightly underneath with **melted butter**, because the leaves are large & weighty, and the stalk of **lead** & **tin** would not have enough strength.

I would be of the opinion to mold the **rose** on its own with a little of its stem close to its bud, & then to join it to a longer one of **tinned latten**, because the **rose** in full bloom has great volume & weight.

Rose

Because the flower in full bloom is billowy & has its petals disordered & turned in various ways, it does not appear beautiful if it is not painted & also inasmuch as it has weight ~~or for~~ that the stem of **tin**, which is brittle & delicate, would be unable to support. One molds the flower of the **rose** on its own & separately, making its gate largeish in order that it comes out ~~b~~ better. Then one cuts this gate down closest to the stem of the bud, on which one grafts next & **solders** a stalk of **latten wire** to which one also **solders** the leaves. But because **tin**, being thus thin, is troublesome to **solder**, and any leaf can be melted, and also because the cast flowers & especially the **rose** are not beautiful without being painted, one does not take pains to **solder**, but one ~~it~~ grafts the pieces to join them & one **glues** them with **fish glue** that has been a little tempered & thickly melted. And in order that it imprints better, one heats the **tin** work gently & at a distance, for once cold, the **glue** would not take. After your flower is thus repaired, you follow the joints of the added parts with **modeling wax** ~~esb~~, which is a **white wax** mixed with much **well-ground ceruse** or, even better, **lead white**, melting it & applying it on your work with a small hot point of **iron**. In this way you can repair these little barbs that are in the middle of the **rose** or the holes ~~of the~~ that may be in any petal. Next, you will paint your **rose** according to nature. If you cast your **rose** in **gold** or **silver**, you can join & **solder** well. And in these same **metals**, when you have something delicate to join to the flower, like a **fly** or something similar, **fish glue** is singular for it & holds very well, fixing it with a few small points which serve as **nails**. The leaves & buds can be molded in two **molds** that can be opened once reheated, but not before. Next, these said things are joined.

Molding promptly and reducing a hollow form to a relief

You can imprint the relief of a medal in **colored wax**, & you will have a hollow form, in which you can cast *en noyau* a relief of your **sand**, on which you will make a hollow form of **lead** or **tin**, in which you will cast a **wax** relief. And then on that **wax** you will make your mold *en noyau* hollow, to cast there the relief of **gold** & **silver** or any other **metal** you like. But to hasten your work if you are in a hurry, make the first imprint & hollow form in **bread pith**, prepared as you know, which will mold very neatly. And into that, cast in **melted wax**, which will give you a beautiful relief on which you will make your *noyau*.

Very light and hollow work of gold

Cast a lizard or any medal you like in base silver, like billon. Next, gild it lightly. And once the first gilding is done & dried by fire, brighten, rub with a scratch-brush, & make another layer of light gilding like the first time, & do thus three or four times or more, according to the thickness you want to give. And then, having made a small hole in the least visible place, put your work into good aquafortis, which penetrating to the silver through the hole will eat it all away without damaging the gold, so that you will have a lizard hollow to its nails, or any other work, so light that by blowing you will agitate it. But take heed not to make the layer of amalgamated gold all at once, or ^[c_156r_01] of hardly any thickness each time, because that would block the small features, but proceeding therein as said, lightly & several times, and cleaning well, you will do well.

In order for the aquafortis to eat away better, it is necessary to ~~cast~~ cast in base silver.

Chasing

Lead is so fatty & soft that one cannot strike it boldly, & one needs to have a very light hand. The other great metals are easier. With a burin called the onglet you make & retrace the more delicate lines, with the ordinary engraving burin the broader ones, and with the chaple you remove the big flashing, and with the small chisels you soften the harshness of the lines, you smooth, you add relief to a line.

Molding a fly

Take the **largest** ~~the~~ **flies** that go into **pantries**, which are not hairy, if it is possible. If they are, anoint lightly their down & capricious hair with **olive oil** to lay it down. Also take them and use them as soon as you can after they are dead, because if you were to leave them to dry a lot, their **e** legs would break when you want to spread them out. One needs also, to make them come out better, to place them on something like a leaf, or similar thing, to help the casting of their little legs, which are so frangible that, by themselves, they would not come out well in the cast. They can be planted on a **sage** leaf or similar. They are cast well in **silver** & **gold**, but one usually makes the legs & wings separately & one reattaches them. I have molded one on a ^[c_156v_03] ~~e~~ **sage** leaf bouquet of **sage**, which had seven or eight leaves. And to make its stance ~~att~~, I fixed its legs ~~to the~~ on the widest leaf with a little **wax**, **melted** & reattached with a **hot iron wire** point. And in order that the wings come out better, I anointed the underside of these with **melted butter** with a little paintbrush. And with the same **hot iron wire** point, I anointed the legs & feet with **wheat oil**. And to lay down & couch the downy^[c_156v_07] hair that it had, I anointed it also ~~u~~^[c_156v_04] with a little **olive oil**.

I did not leave the **wheat oil** to dry a lot, because it is thick & has body, & the **eau-de-vie** does not take at all.

For unction, ~~e~~^[c_156v_05] **tallow** is too harsh, **pork fat** is too soft, and **butter** is the most excellent because it is soon dry & curdled & melted quickly & firmer. Take heed that the legs & feet are well set on the leaf & not outside it, for that which exceeds would not come out well, especially in **silver** because this ~~would exceed the~~, so fine, would be of no help in the casting. And, in truth, the feet which had been laid on the leaf came out well, but those which straddled from leaf to leaf & remained in the void did not come out in **tin**. The rest of the **fly** came out well, and especially the bouquet of **sage**, which is very beautiful molded.

One could even cast it in **gold** & **silver**, without the feet & without applying it on a flower, by making the gate under the belly & reattaching with **solder** the feet &, if need be, the wings with the same **metal**, & it could be **enamelled** by fortifying the wings a little, & the feet, as said.

If your **sage** or branch has something to repair, do as said below. And then paint according to nature.

[Figure: fig_p156v_1]

Once cast in **gold**, one **enamels** the wings with **window glass from Lorraine**, which is *verdesin* and transparent.

One needs to make the gate for the **fly** from the bottom ~~in order~~ with **melted wax**, adapted with the **iron point**, as you know, to which the **fly** attaches itself, & then the **wax**, while melting, serves as a gate for the **fly**.^[c_156v_02]

+

If some flaw happens to the wings of your **fly**, beat some **tin** very thin, &or^[c_156v_06] some **gold** or **silver** if you have cast it in it, & ~~with~~ trim with some **scissors** what one needs to reattach there, & next, apply it with your **small pincers** & **glue** it with **fish glue**, prepared as put below. And before, heat lightly your work, in order that its coldness does not refuse the **glue**, which will be soon dry, heating it from afar.

Next, cover lightly the joints of the reattached thing with some **modeling wax**, which is **white wax** mixed with a lot of **ceruse** or **lead white**, melting it well with a **hot iron point**. You will also cut some small bits of **spinet strings** & **glue** with the said **glue**, & once dry, that is to say the feet, repair with this. You will thicken them with the same **melted wax**, to render them equal.

A means of **GOLDSMITHS** for molding hollow

They mold in two **cuttlefish bones** their animal or other work that they have either already made or modelled in **wax** & cast in **lead**. Once it is well imprinted in the two **cuttlefish bones**, they place between these two **bones** a **paper**, & join the **bones** & cast. The work comes out split in half. And then, with ~~eh~~ a *chaple*, they hollow out as finely as they please the two halves cast in **gold** or **silver**, and then **solder** or braze them.

Flies

They mold better on a single leaf than ~~n~~ on a bouquet or a flower or the branch of a plant, because the single leaf molds in two halves, which, once reheated, can open and clean well, & the cast is made better. Take heed when taking the **fly** to not break the legs & to not let it dry too much, for then the legs

Rouge clair

Some GOLDSMITHS assay it on gold, thinly beaten *esp* & well burnished with a *chaple*. But it is better to assay it on a gold ingot. And also assay your substances in large or fantastical work, since if they appear good & extraordinary in large work, they will show excellently on a common work.

fall off. And if this happens to you, glue with fish glue the same legs and with wax, or fashion some out of swine bristle or spinet string. Fix the leaf on the clay slab with two

points, and the fly with one point in the middle of the body, & the legs with some wax.

Cleaning and degreasing your works cast from tin and others

Make some lye, carefully passed through good ashes, and since it is recent & not fatty, boil your molded work in it. And the tallow and fat leaves it.

Arranging plants or flowers for casting

Always put *at the top* the principal side of the thing, because it comes out better and neater than the bottom. Make the gate wide & make it so that the *supraplus* (which is the *masselote*^[c_157r_04] for FOUNDERS OF LARGE CASTINGS), And especially for silver, which wants the mold quite hot & to be cast very hot. Very thin things want to be cast very hot.

When you know that the stem of a flower, burned in a mold which does not open, is quite reduced to ashes, it is a sign that the rest is well burned.

Ash in the molds

One needs to let the mold cool before blowing to make the ashes go out. For when the mold is hot, they adhere against it, & once cold, they separate from it more easily & go away in the blowing with the wind as vapor.

Molding a bird

One needs to give it its shape. And to do this, place it on its side on a clay slab, and hide & sink within it half the said bird, in order that it only shows one leg & one foot, then you will anoint it with butter to make it hold the feathers down, finally of oil eau-de-vie. And then cast. And being set, clean & uncover whatever needs it. Next, mold the other side in the same way. But because the feet, being of bone that is difficult to burn & which are not able to be cleaned neither by quicksilver ~~if~~ nor by any other means, if the mold would not open, uncover the bottom of the feet & the toe or the little finger of the claw, & mold as a separate piece. Reheat & open your mold & clean the bones. The feet usually remain too weak to support the mass of a solid bird. And for this reason, one adapts an iron wire in the mold of the feet which passes into the body before casting; thus, they are reinforced. Some mold the wings in a frame. Others mold the head & the said wings separately *en noyau*, then join & repair them to first model a form that will be stiff & withstand the tempered sand.

They are skinned & filled with cotton cloth. & even better, one needs to dress them in the fashion that CURRIERS do, in order that they do not lose a feather, weight.^[c_157v_04] The dressing is alum & paste of flour.

^[c_157v_02]For making h... wine f...rs^[c_157v_01]

Take a sock from the right ~~at~~^[c_157v_03] foot that has been worn and make ~~drink at~~ it soak in water, and of the water that comes out, make that same person or someone else drink it, and you will see marvels.

[c_158r_01]Mercury in the molds for cleaning

Heed well that your mold be quite cold before blowing to make the ash go out, and next put in the ☿ to achieve the cleaning. For if the mold is hot, the ☿ penetrates within &, in flight, seeks out conduits & leaves an *odor of itself*, which sours the tin or other metal that you will cast there so much that it will break if it touches it even slightly. The heat of the mold also retains small grains of ☿ that make lumps, & contracting to the edge of the molded leaves, are joined there & make the leaves frangible. The ☿ cleans the ash well, especially flat things where there are not delicate lineaments which could be broken by its weight. And thus, if you can cast neatly without putting it in, do not use it. But if it is necessary to use it, mix your sand with *crocum* in order that it withstands the fire well.

And after having put in the ☿, evacuate it, turning the mouth of the mold downwards. Next, reheat the mold gently in order that the ☿ be gone from everywhere. In this way I have cast a branch of periwinkle, leaves & flowers, very neatly, having given to the flower a layer of melted butter on the back of the flower with a paintbrush.

[c_158r_02]Reheat the mold very red before ☿ casting in it, in order that the ☿ exhales well.

Colors for green leaves[c_158v_02]

One usually paints them in oil, because distemper colors have no hold. For marigold flowers, lightly ground minium for some, & for others which are more yellowish, a bit of massicot with it. For green, the verdigris has depth & is too dark. If it is a yellowish green, you can mix with the verdigris a little yellow ocher & stil de grain yellow. If the green is dark, put with it charcoal of peach tree pits, which makes a v greenish black, in the same way that black of ox foot bone looks bluish. And thus, by judgment & discretion, put the color on the natural flower or leaf to see whether it comes close. [c_158v_01]But layer it transparently, so as not to cover the lines of the work.

Large molds

Because of the great weight of the metal, they want to be put in a press[c_158v_03] in order that they do not open.

Candle smoke

It makes it come out neater, & even if it is a little thick, it does not hold to any place because it has no body. I have thus fumigated my *noyau* molds for tin & lead, and have cast in the cold mold, well dried beforehand, and it came out very neat. It is true that lead mixed with half of tin was very hot, because the medal was thick.

Gate

~~Even though~~ If the medal is very thick, for this reason do not give it as thick a gate. It suffices for the gate to have half of its thickness. But if it is thin, give it a gate of its thickness. Do not forget to make vents in the gate where typically the material becomes porous.

Never forget to oil the wax gate when you mold plants or flowers, otherwise it breaks & cannot be taken out.

Wax portraits

If they are painted with colors on the wax, & if the wax is not *en* tinted & mixed with color within, the color lifts off & is undone if you mold them *en noyau*, but the portrait is not spoiled. One needs to oil them lightly, bathing in eau-de-vie & tempering with hot water. If they are varnished, one needs to mold them two or three times to lift off the varnish, which sticks to the mold. After it is removed, you will be able to mold nealy. If they are on wood, one needs to saturate the wood with very hot melted wax, for otherwise the mold would be attached to it. Lead white is much better for mixing with white wax than ceruse, for lead white is firmer & whiter.

Chiseling

If the small chisel has passed through some part of a portrait, one needs to repair & retrace it all. Otherwise, it would look like a joined piece.

Fish glue

Beat it very fine & thin on a well-cleaned **anvil**, & next wet it with **eau-de-vie** over ~~eh~~ **hot ashes** & a low fire, & it will be quickly melted; & if it is not strong & thick enough, add some. [\[c_159r_01\]](#) And take heed ~~them~~ not to put it to melt in a fatty vessel, but in a new one, if you can. It is melted on the fire & is also dried quickly on the fire, but it may be warmed from a distance once on the work. It holds strongly. With it one joins flowers & delicate things of **gold**, of **silver**, of **tin** & other materials, which are in danger of spoiling if **soldered**.

Tin and lead

They are beaten very thin ~~without se~~. And the **tin** does not sour & crack as **lead** often does, ~~Ma~~ although it is more fatty, but one reheats it under **hot ash**. And it is necessary to beat them with several leaves together.

Cleaning files

Sometimes they are fattened, & by means of the **grease**, the **lead**, which is fatty in itself, or other **filings**, attach to it. And you will be able to clean them either with **hot charcoal** or a scratch brush made of **wires of latten**.

Carnation

It is molded like the **rose**, **marigold** & all other flowers thus, as is said, namely, whole-mold flowers, & all the leaves, if you want, in two halves, joining them by **solder** for the most secure way, even if you could mold them together in a closed **mold**. I cast one that came out very well. But one needs very thin **sand** & to blow strongly.

[Figure: fig_p159v_1]

[\[c_159v_02\]](#)

Molds

Make the two sides so that they are, *es* if it is possible, one as thick~~ness~~ as the other, in order that they can be quite evenly reheated. When you mold some animal that should be burned ~~you~~, like *crayfish*, you cannot open it to clean it, & make the cast so that it is not reheated. And when they are reheated one time, keep them scarcely at all without casting, for they are rendered musty & humid, & the *mold* is undone & loses its strength.

The part where the back of the animal is is usually thicker.

Plaster alone

Reheated *stone plaster* ~~fears~~ is undone in *water*, but that which is ~~reheated~~ & first pulverized and then reheated does not fear it. But if it is good, it hardens in it, like *the one of Paris & Spain*, which is hard in *stone*, as is that which grows in *lean & dry earth* and which seems like *white salt*. *Germans* make statues for their *fountains* with it, which are not spoiled, especially once varnished, but it hardens in *water*. When it is alone & not mixed, it sets more quickly than otherwise. One needs to *oil* very lightly your *molds* that are of *metal* or *stone*, otherwise it would not release. And however you *oil*, you have to temper it with *hot water*. And when it has set & well cooled, one needs to wet it sometimes in *cold water*, but if it refuses to open, in *hot water* & sometimes in *boiling water*.

Sometimes one even needs to make the *mold* boil in *hot water*, as when you have molded some *wax* that you fear would not be easily released from it.

Cold water makes *oil* withdraw to the surface of the *plaster* that has sucked it in, & thus it releases.

Press for large molds

[Figure: fig_p16or_1]

[Figure: fig_p16or_2]

The screw is riveted to this stirrup, ^[c_16or_01] which is nailed onto the upper plate, & by this means, raises it & presses it.

They are two sheets of iron attached by four small iron pillars, in such a way, however, that hes the upper is nt able to have play & run freely the length of the pillars, & that the lower one is fixed. At the end of the pillars is affixed an iron St. Andrew's cross, ^[c_16or_02] in the middle of which is a screw which tightens the sheets against the molds which are between the two.

Or, for small molds, one makes a frame, & having put the molds between two plates of iron, one sets tightens them in the frame with wedges.

The large wooden presses made with screws, besides being heavy to put near to the forge for casting, one cannot know when they tighten too much, & very often, they break the mold.

Sand for flowers

If it is cast thick, it bears down too much on the flowers & constricts them & reduces them as if massed together. Take heed therefore to temper it until thin, & blow strongly before the flower is covered. Cast at the side of the mold. And tempering the sand, one ought not only to turn the spatula but to beat the sand in water as if you were beating glair of egg.

Molding a foot or hand

Mix resin among the wax, & having incorporated it well, soften them in hot water or urine, & then make an imprint by pressing, & next cast in plaster, & it will come out quite neat & will release well.

Delicate work of gold and of silver

One can make flies from it by hand without casting, & the wings & feet can be joined by solder, which cannot be done with delicate works of lead & tin because they would melt. And the work of gold can be enameled.

Catching crayfish

Attach to the tip of a stick some liver or lung of a cow or sheep, & with a small string you make a basket hang from the tip of the said stick. Put in water where crayfish eat, & they will quickly come to accumulate on the flesh. Extract gently from the water, & those who want to go back into the water will fall into the basket.

Catching passerines

If they sleep in straw, like they usually do, close to the house, leave the closest window open & put in a lighted candle, but so that the candle is hidden & that its light only appears throughout the room & through the window, and all will enclose themselves in the room. But it is necessary that the night be dark & without ☾.

Catching birds

In winter, when the birds have molted, skin them & fill them with stuffing cloth &, or else dry them in an oven #^[c_160v_03]. Then arrange them on the trees, & have SOMEONE WHO SINGS, & you will gather them & catch many.

in an oven that is scarcely hot *In winter*. ~~it~~And^[c_160v_04] *in summer* this is done because, before they

would be dried, the fly would get into their eyes and make worms. *In winter* they are prepared better & dry by themselves

[c_161r_03]Preparation of sand for frames

After your sand *de noyau dalu* of *gip* of *lateribus*^[c_161r_01] & *alume jameni*^[c_161r_02] was used *en noyau*, gather the pieces of molds, break them on a long table with a large billet in order to pulverizes^[p088v_1] them well, and, better yet, sieve it finely. Put them in some pots into the *TILER*'s oven or bread oven, several times when it is well lit, in order that they become very red. Once cooled, repestle them, if need be, and sieve. Next, put it in a neat, adequate dish or *semal* or vessel, and wet it with clear water, and grind it & stir with a thick stick until it is well wetted & washed & the filth goes to the surface of the water, & continue to stir it thus, like the *gip mat* that one prepares to gild with burnished gold, five or six days, until it is not at all lumpy. *# nota* And, each time that you stir it again, leave it to rest & empty the clear water which will be on top by tilting or with a bowl or sponge, and put some clear water back in, & thus wash & stir it until it is well fine & purged of all filth. *Nota #*^[c_161r_04] Next, leave it a little to drain and dry, and make from it some little balls tempered in sal ammoniac water, and once thus *d* dried *l*, put them to reheat at great heat in a reverberatory furnace, where they should be quite red, *a good space of time*. Once they are reheated in this way, pulverize them & try to mold something in a frame, having moistened your powder with sal ammoniac water. And reheat & redden the frame, & if your sand retracts, one needs to pulverize again & wet it in sal ammoniac water, reduce into little balls & reheat it & redden & continue so many times that it

does retract from the frame when you redden it. The main thing is that it is well reheated, for otherwise the sal ammoniac would not calcine well & render the sand coarse, & for this reason, one does not need too much sal ammoniac in it.

[c_161r_05]#

Nota that one needs, *[illegible]* before drying it, to wet it all and ~~it~~ empty the liquid in another common vessel, leaving the litharge, in order that the stones & earth remain at the bottom afterward. One needs to let it rest & empty the water by tilting, & leave it dry.

nota

[c_158r_01] *Crocum ferri*

It is promptly made if you put the **filings**, well cleaned & washed, in an **iron** case, two **fingers** high & covered, & redden it thus in a reverberatory furnace, having washed it in **good vinegar** for the space of a **day**. And it will be well burnt & clean, mixed and ground finely on **marble**. Being well ground & once it is quite fine, ~~the~~ the **vinegar** will bite it quite easily & will soon give it redness & bonding, wetting it with the strongest you can find & next setting it aflame. And in three or 4 **ignitions** wettings^[c_161v_02] & ignitions, it will be ready. This one is columbine color & is found firmer for casting than that which is redder & the color of **minium bole**, made of **rusty filings** ~~eee~~, & has more tincture. Others burn the **filings** several times on a reddened **iron** shovel, showering it each time with **vinegar**.

For the **workshop**

It can be gathered from the words of **Herodotus**^[c_001r_71] that the navigation of the **Portuguese** was not newly invented by them, as they brag. At the beginning of the first book entitled *Clio*,^[c_162r_08] he says that the **Phoenicians** would come from the **Red Sea** by continuous navigation to the **coast of Greece**, mainly to **Argos**, to which they would carry merchandise from **Egypt** & from **Assyria**, which they usually sold out of within 6 *days*.
^[c_162r_01]

Navigation,
trade

Herodotus, on the first page of *Clio*, says that the **Greeks** were on a long ship on the **coast of Colchis** & to the **river Phasis**, whence they carried off **Medea**.^[c_162r_02]

Galleys

Herodotus, on the third page, says that **Gyges**^[c_162r_11] presented to the temple of Delphi^[c_162r_04] *pateras aureas sex pondo 30 talentorum*.^[c_162r_03]

Gold vases

Herodotus. **Halyattes**,^[c_162r_07] the father of **Croesus**,^[c_162r_09] *pateram ex ferro compactilem apud Delphos dedicavit spectatu dignam inter omnia quæ sunt Delphis donaria, opus Glauci Chii*^[c_162r_10] qui solus omnium compactionem *ferri* excogitavit.^[c_162r_05] *Compactile ferrum*,^[c_162r_06] which is made by assembly & things joined.

*Iron vase
joined and soldered*

As **SMALL PEDDLERS** lay open small wares in order to buy richer ones & to profit more and more, so I, from a desire to learn, am exposing what little is in my **workshop** to ~~have in~~ receive, through a common commerce of letters, much rarer secrets from my benevolent **READERS**.

Aes ustum

Once finely pulverized, it molds very neatly & has a certain fatness that gives it bond, | more than *crocum*, & I believe that it would not be inappropriate for a cast.

Rotten wood

The one which is white, light like a sponge, once burned in a closed fire, can be used for a frame for **lead** and molds very neatly. But such things do not endure the fire.

Peach tree

Because they sprout & flower among the first, & thus are caught by the ~~eh~~ *frost*, one lays them bare at the roots during winter in order that ~~the winter~~ the **cold** slows them and that, ~~le~~ blossoming later, the flowers come to profit.

Olive trees

In **Spain**, one lays them bare at the roots during winter, & in summer one plants them well with **earth**.

Bittern foot

To mold it, it is better to spread the toes & nails out well on something flat & leave it thus to dry a few **days**, because, in drying, the scales appear coarser & the nerves & tendons become more apparent, and thus the molded foot will be more artistic.

Molds of things that do not release

Animals that do not release can only be molded in two **molds**, which should not be opened until after they are well reheated & the enclosed animal is well burned. Animals that have bones or scales, which do not reduce into powder but rather remain as calcined lumps, will never leave through the gate, whatever blowing one does or whatever **quicksilver** one puts there, or a **feather** quill during molding to use as a gate. This is why one molds in two halves, in order that, the **mold** being opened after having been reheated, the burned thing can be cleaned out well. But take heed to let it cool well, in order that, when removing the **clamps**, being hot, and when it is most frangible, something does not break. The **crust** & **ashes** that it leaves & which adhere to the **mold** while it is hot are removed better once cold. Note also that on the bottom side of the **mold**, when you reheat, the animal which boils leaves some **filth**. And, on this occasion, one always marks the **mold** where the back of the animal is, in order that, when reheating, it is above & on top & that through this means it is neater.

PERFUMER

They readily put half of **amber** & half of **musk** & very little **civet**, because **amber** always overtakes the principal *scent* of **musk**.

To spare the **amber**, they readily put a little **musk** in the white layers, & ~~for~~ which gives a more forceful *scent*. But to remove ~~the~~ or hide the blackness of the **musk**, they put in a bit of **wheat starch from England**, which is perfectly white.

~~When the~~ **amber**

To perfume with **white amber** in the **Portuguese** fashion, take a *huchau* of **amber**, well broken up. And having put in a small **silver** bowl a **silver** spoonful of **flower oil**, or lacking that, **ben oil**, that is to say, a **silver** spoon **that one uses at the table**, put in your **ambergris** & place all on a low fire, and it will melt quickly if your **amber** is good, & it will remain there without lumps. Once all melted, put in the size of a pine nut^[c_163r_03] of **civet**, & make it melt, & mix it well together. Next, take your **gloves**, well-cleaned & well-dried, & dipping the **tip of your finger** very lightly ~~on~~ on the edge of the **oil**, spread it on the **glove**, little by little & with patience, & rub the **glove** between your **hands**, & trace the fingers & the stitches, one after the other. And leave it to dry. Next, trace again as before until the **amber** is all laid down.

Eau-de-vie

It is excellent for molding neatly, such that in the place where you do not put any, the **sand** will usually attach to the figure. But it needs to be in three passes. And because it does not take easily on **oiled** things, I believe that it would be good to put some amongst the **water** in which you temper your **sand**.

Crayfish

The hairy cornicles that it has under its beak ~~see~~ tend to come out lumpy & not neat because, being burnt, it is difficult to remove them & clean their **ash**, which, staying in the **mold**, ~~it~~ prevents the **metal** from running well therein, & for that reason, one makes a small gate of **wax** thread at the tips of them, both to hold them up and to blow out the **ash** that hinders.

Spare no **pins**, placing them not only in the middle of the body but also on the big legs, and two or three at the tail, according to the stance that you want to give it.

Crocum

That which is rusty by itself, being showered with salt water or vinegar or urine and then very dried out and reddened^[c_012v_01] in the fire, is very red ground on porphyry and is of the color of Levant bole, & approaching minium. But that which is showered with urine & dried out acquires a deeper tincture & approaches crushed æs ustum or vermillion. But the first one, finely ground, acquires a bright red color, in the like cinnabar, in eau-de-vie. And the ones and the others, prepared as said, and finely ground & rendered very hot, give off red fumes like a volatile spirit if, being thus hot and fine, one throws on top vinegar, urine, or eau-de-vie. Urine gives much tincture, and eau-de-vie also.

[Figure: fig_p163v_1]

Repairing

It is better to repair little with the burin called onglet, or with that which one calls chaple, or some small file. But above all, avoid touching your work, but only the flashing or the lump that will have occurred during the cast. And while repairing, wet & rub with your very small hog bristle brushes.

Gate

When you make the gate of some delicate animal, like a snake, make it come from the side of the belly & under the tail, for from the side, there are only straight lines, which are a lot easier to repair than the back, which is more visible & more marked.

Repairing flashing

Having gently removed it with the point of a chaple or burin, scrape it with the side of the burin, or gently with a small file, & rub with willow charcoal & little brushes. Make continuous the lines disturbed by the flashing.

Lead silver

It degrades a lot, because the **lead** which is mixed in works it like in the **cupel**, and makes it jump in little balls at the edges of the **crucible** & on the **charcoal** which covers it. It is also fatty, and thus it is good to melt all **coined silver**, like **reals** & others, & to put it in ingots before melting it for casting **lizards** & animals, for it comes out better. I molded some as neat as the principal,^[c_137r_03] such as a **little viper** of **silver**, and I made the alloy out of 4 **reals**, of 20 **sous** from **Spain**, & a coin of xx **sous** from **France**.

Blowing

When you melt **silver** & **gold**, do not blow strongly & with violence, because with the **charcoal** consolidating, the **crucible** would lower & *l'arg* could fall over. But when your **mold** is ready, at that moment, blow strongly to heat well the **silver** or **gold**. Both, once melted, want to be blown from above with **small bellows**, especially **gold**, for this removes their **fumes** & softens them.^[c_015r_01]

Molds

For those **which** in which one needs to burn something and which do not open before being reheated, one does not make any casts before it is reheated. For large **molds** in which the gate is big and ample, it is necessary that the gate be well notched & scratched, in order that the weight of the **metal** does not go with much force. They make hardly any flashing if they are pressed. But before pressing them, put between them and the **press** some **pieces of plump**^[c_164v_03] & **thick felt**, which is hardly yet crushed, for it fills the concavities & keeps the **mold** from cracking. The **clamps** should be placed before reheating or drying it.

When the **earth** from which you make the **earthen** slab to arrange your animal is too soft, the **points** that you put in it come out easily & come undone when you cast in the **sand**, & thus the **mold** spoils and the shape comes undone. Therefore, when you recognize that your **slab** will be too tender & soft, spread on top some **hot ashes** & blow with the **bellows**.

Sand

If there is not enough good **feather alum** or *crocum*, it will easily crack in the fire. But if it is mixed with it, as it should be, it withstands it. It is recognized to be good when, being hot after the cast, it quickly imbibes **water** when one quenches it & ~~rends~~ breaks easily because the **alum** & the *crocum* render it spongy. On the contrary, **bad sand**, which is only of **plaster** & **brick**, & little mixed with **alum**, breaks easily in the fire & hardens in **water**. Cast, if possible, all in one go.

Molds

Even though you cast in **lead**, the **molds** want to be well dried, especially when they are large, and one needs to redden them on the outside & keep them in continuous heat until they no longer **smoke** from inside. Do not place them to reheat at *different times, but continue once you have started*. And do not place them to cool **in the cold**, ~~With~~ for they would crack, but leave them to become lukewarm near the fire, & *when they are still of such a heat as you have noticed before by putting your **finger** in the hole, cast*. And when the **mold** is large, it needs more time to reheat & dry, & one needs to cast hotter.

Repairing

If in your cast there occurs some little hole, mend it with **gummed modeling wax** that is black or gray.

Lake

If, once it is ground, you let it dry without keeping it in **water**, it will dry out & you will have as much trouble grinding it as before. *La*

Stretching a **canvas** picture

If it is crumpled & creased from being rolled up, moisten it from behind with a **wet sponge**, & you will stretch it very evenly without spoiling it.

Plaster for molding

When it is long to set & dry, it is a sign that it is too fatty & humid, which is what makes it contract in fire & crack, causing flashing. That which is drawn from **lean soil** is the best. Molds of **fatty plaster** ought not to be kept for a *long time*, for they act like **fatty earth**, which when drying by itself, cracks. It is best to reheat them soon after they are made, & to cast. **Good plaster** keeps a *long time* in molds.

It needs to be well **oiled**, for it is more difficult to separate the two halves of the **molds** than when it is mixed.

Dragon's blood

It can be imitated with **lake**, which surpasses the dragon's blood in beauty if, tempered in **oil**, you glaze on **gold** or **silver**. Tempered in **varnish**, it dies.

Repairing **snakes** and **lizards**

You could well make some **puncheons** according to the form of their scales, & making some bigger & some smaller, according to the shape of the neck, the body, & the tail. If there is something broken, you can graft it on with small **pieees** points of **iron or steel wire**, & **glue** with **fish glue**, & then cover it all with gray or black **wax**. But it is necessary to let the **glue** dry for one **day** without touching it.

Stance of animals

Not only with iron points but with melted wax, animals are secured on the earthen slab. Wash them first in clear water, once they have died in the mixture

of vinegar & urine,
& with a sponge
purge their mouth,
eyes,
and the
head of
the slaver
which
comes out,
for
the sand
would never
set well
there and
would become
lumpy.^[c_165v_02]

If you want to make them keep their mouths open, put in a little bit of spinet string, which will not take up space.

Keeping animals

Having molded them once, if you want to keep them for molding again, put them back into the mixture of urine, vinegar & eau-de-vie where you killed the others, and they will keep for a long time without spoiling.^[c_165v_03] If you have a cut on your hand, take care that this mixture does not touch it.

Molds

Once molded, do not keep them for a *long time*, but rather use them *u* as soon as you can, because when kept a *long time*, they are subject to corrupting.

When they are reheated, the thing comes out better.

Lute

When reheating, you can use *common lute*. But when you want to cast, strip the mold of it^[c_165v_04] & promptly, with a brush, layer the lute of *plaster that has been used for molds*, for it will be dry when it is placed, & cast. One needs to mainly put this *lute* on the joints.

Silver

When it quivers once melted, it is a sign that it is quite hot, & because usually it is *lead*y, it is good to throw in it some *lime mortar*, for this attracts & gathers the *lead*.

Fly wing

In order that they come out better, put from the gate to the edges of these some *veins of wax*. Make sure also that under the belly there is enough *wax*, for this is what makes the gate.

[Figure: fig_p165v_1]

Joining some *fly wing*, or similar

They are joined with *fish glue* mixed with *eau-de-vie* over slow fire, heating also the work. Then, this is covered with *modeling wax*, which is grey.

For the workshop

If something is omitted: the **HARVESTER** is not reproached for leaving some **ears of wheat**.
[c_166r_01]

If any **ARTISANS** complain that one discovers their craft secrets, and if the **goddesses of Eleusis**^[c_001r_05] complain, as they did to **N. the Pythagorean**,^[c_166r_03] that one has divulged their mysteries,^[c_166r_02] excuse yourself based on the words of the ancient **Hebrews** quoted by **Josephus**.^[c_166r_04]

As the **hen** carefully searches the garbage thrown out of a **house** for a crumb or a grain that she divides among her **chicks**, thus one distributes to **ORPHANS** that which has been sought among the arts considered vile & abject.

Tablet of **Cebes**,^[c_166r_12] idle, but the **workshop** represents all things active.

If the jealous^[c_166r_10] disapprove that these things are picked up & taken from others, reply that since *nullum est jam dictum quod non dictum aut factum sit prius*,^[c_166r_06] & that one holds that all arts were invented *in the space of a thousand years*, so that you do not think that you are able to invent anything new but rather rediscover anew the books of **Numa**,^[c_166r_13] buried by & long unknown & forgotten, in order to publish them for those who do not know them; so that as the *preceding day* is teacher for the *subsequent*, thus you needed to learn from those who *preceded* you in order to teach to those who come *after*. The **Latins** took from the **Greeks**, as **Cicero**^[c_166r_14] from **Plato**^[c_166r_15] & **Vergil**^[c_166r_16] from **Homer**.^[c_166r_17] **Aulus Gellius**,^[c_166r_18] **Valerius Maximus**^[c_166r_19] only made a collection from various **AUTHORS** who had already written. **Livy**^[c_166r_20] made his xxiii book^[c_038v_01] from the 2nd or 3rd of **Polybius**.^[c_166r_21] **Serapis**^[c_166r_22] was deemed the **INVENTOR** of agriculture among the **Egyptians** & nevertheless, so was **Ceres**^[c_166r_23] among the **Sicilians**. **Pythagoras**^[c_166r_05] & others from **Tyana** learned by their travels the disciplines of which they called themselves **INVENTORS** in their country, &c. Will one not say the **WEAVER** has made a cloth or precious stuff, even though he did not dye & twist & ~~præ~~, wind & prepare the bobbins and balls of thread? Will one say the **MASON** has not made a **house**, but only piled up ready-made stones? **Apollo**^[c_166r_24] a **Chirone**^[c_166r_25] **MEDICARI** didicit & tamen deus medicinæ habitus.^[c_166r_08] **Homerus Orpheï**^[c_166r_26] poema imitatus est, nam cum **Orpheus** sic prius exorsus esset: Iram cane, deam dea, **Cereris** frugiferentis, ita reddit **Homerus**: Iram cane, dea, **Pelidæ**^[c_166r_28] **Achillis**.^[c_166r_29] In **Justino martire**,^[c_166r_30] circa principium.^[c_166r_09]

To the **Greek** examples, there can be added a psalm of **David**^[c_166v_02] of which **St. Athanasius**^[c_166v_08] makes mention *en in Sinopsi*.^[c_166v_07] It begins *Parvus eram*^[c_166v_04] & in the second versicle the royal prophet says, *~~Manus meae~~ Manus meae fecerunt organum et **digiti** mei aptarunt psalterium*.^[c_166v_05]

Keeping chestnuts

One needs to leave them in their bristled shells until one wants to eat them. And with this,^[c_166v_03] leave them in a **humid place** or the **gutter of some roof**.

Scented candle from Le Mans

Among the **wax** & candle they melt **rosin** that in **France** is called of **Burgundy**, which is white & not as brittle & dry as the other **rosin**. They also perfume the tip and the wick.

Softening^[c_015r_01] gold

Dissolve *caput mortuum*^[c_166v_06] in **distilled vinegar**, filter & congeal in **salt**, & cement ○ with this, and it softens it marvellously.

Augmenting the color of gold

Put **aquafortis of vitriol** on **hot ashes**. Cover the **bottle**, that is to say, the mouth, with a **tile**, then unstop it & thick fumes will come out; put the **gold** on this and it will take on a high color.

Petards^[c_008r_04]

[Figure: fig_p167r_1]

^[c_167r_01]

Petards are made of the best alloy of *metal* & *fine rosette* that one can, in order that they do not burst, namely one part of *metal* & two of *fine rosette* or *old cauldron*, which is even better. Some are of fifteen or seventeen lb & ~~eh~~ are loaded with two & a half lb of *good grain powder*, & they are for applying on windows & common doors. Others are of the weight of 25 to 27 lb and are loaded with 4 lb of *powder*. Others weigh 45 lb & are loaded with eight lb of *powder*. And thus they are formed according to the effort they have to make. On the outside, they are ^[c_111v_02] of a regular shape, but on the inside, they are made like a *crucible*,

[Figure: fig_p167r_2]

narrower on the inside of the breech & becoming wider toward the mouth. And this is to give force to the breech, because of the quantity of *powder* they hold, & so that they do not burst. ~~At the breech one gives them~~ Those of 45 lb have a thickness of eight l i n e s at the breech & become thinner on the inside toward the muzzle, which is of 4 l i n e s. They are xii *thumbs breadth* long & seven in diameter at the muzzle & opening.

Those of 27 lb or thereabouts are ix inches long & six in diameter at the muzzle. At the breech, they are vi lines thick, & 3 at the muzzle. The ones weighing 17 lb are 8 inches long & five at the muzzle. One covers them all together, all the forks & pegs & tools which one uses, with a thick canvas or thick cloth in order that they do not make any noise. It s is good that they should sit loaded for some time. After one has put the powder in, one tamps it down quite thoroughly, and then one puts in pressed paper, then a cake of wax well tamped down, & on the wax another plate of cork that goes in quite precisely & with force. In this way, the powder remains well sealed & gives much greater violence, & if you wish, you can put on the plate of cork one of wood pierced in the middle, if the petard^[c_008r_04] is pierced at the breech, which one holds to be the easiest, & which makes for greater penetration because it cannot recoil. And for those that have a pierced breech, one must have a good gimlet to first make the hole in order that the peg, which is made in with a gimlet-like point, may attach the petard faster & without noise. And to for these, one must cover the button, which is quite evenly filed, p with waxed canvas, or add wax to it in order that it precisely plugs the hole of the breech. But because the doors are sometimes iron-clad & the iron pegs cannot pierce it, one uses an iron fork made like pincers & another iron rod q made with three claws at the end, as you see depicted. And in this way, the petard holds itself well & is quickly placed. The iron pegs must extend from the petard with the entire point that is made like a gimlet, namely by three or 4 fingers, which goes entirely ^[c_017v_04] into the door. When the petards are placed, one fills the touch-hole with good pulverin^[c_167v_01] and s one puts in it a feather quill filled with powder tightly pressed & moistened with vinegar, or, if needed, one presses the powder in the hollow of the hand & having wetted it with saliva, one makes from it something like a cocoon or

[Figure: fig_p168r_1]

a peg which one puts into the touch-hole, & then, with a rope wrapped around the end of a stick, one gives fire & promptly retreats to take cover. The small **petards**^[c_008r_04] of 16 or 17 lb are attached promptly with a short hooked peg made like a wimble,^[c_168r_01] & if the **petard** is of a good alloy, one can give fire by **hand** just as one does with **petards** of 27 lb, but then one only puts in three lb of **powder**. It must certainly be a strong door if the seventeen lb **petard** does not blow it up. Some use little bells worn by **oxen** or **mules** on a **PEASANT** door. Others load two **pistol** barrels &, with a gimlet & a string, attach them with the muzzle against the door. If the **petards** are good & do not explode, they only recoil and cannot do harm if one is next to them.

A. This is a small peg, hooked like the hinge of a door & made like a *gimlet*^[c_080r_01] on one end, for quickly attaching a small **petard** with ear^[c_168v_01] of fifteen or xvii lb for a common door or window.

B. This is a small **petard** with ears.

C. This is a ~~gro~~ common **petard** of 27 or 30 lb pierced at the breech, through which a large **iron** peg passes, button-like on one end & made like a *gimlet* at the point, for quickly attaching the **petard** against a door that ~~does not have~~ is not covered with **iron plates**.

D. These are **plates of wax, cork & wood** for loading the **petard** & sealing the **powder** well.

E. ~~This~~ **Iron** fork made in the form of pincers of the height of a man, to quickly place the mortar without a peg. It must be of **soft iron** in order that its branches bend easily, if need be, to fit to the height or width of the door.

F. This is another **iron** fork of the same height that props up the fork made like pincers & also supports the **petard**, and with its claw at the bottom prevents the pincers from recoiling.

G. **Petard**^[c_008r_04] with ear,^[c_168v_01] placed with its peg.

H. Knife-like saws to cut a portcullis, if needed.

I. The large **iron** pegs which traverse & attach the **petard**.

K. These are common **iron** pegs, very round & covered with **canvas**, like all the rest, to turn the large **iron** pegs pierced close to the head.

L. **Axes** that one must always carry to finish breaking down, if by chance the **petard** has left anything whole.

M. A large mallet of **wood** for knocking down what was begun & weakened by the saws or *gimlets*.^[c_080r_01]

N. Are large augers & *gimlets* of **WHEELWRIGHTS** for smoothly cutting a door or window by making large holes close to one another.

O. **Crutches** of the height of a man, which it is necessary to carry to quickly put under a portcullis after the **petard** has gone off & to prevent the portcullis from falling.

P. Are small **iron** pincers for putting some **petard** low on the straight part of the bolt or *strap hinge* of the door.

List of processes

Molding **turtles**

Furry animals

Birds

Leaf of a **vine** - put

Of **strawberries**

Molding diverse pieces

Molding a vessel in a **frame**

Molding *capilli veneris*^[c_037r_01]

& plants that need

threads for their support

Molding a bouquet

Rose carnations

Molding hollow

Hollow **gilded silver**

Molding **crab** - put

+ **Crayfish** put and seen

Grasshoppers

Barbels

Butterflies

Flies

Bats

Enameling very thin **gold**

Molding in **sugar**

Molding **fish**

Casting in **sulfur** - put

Carton

+ **P Wax** put

Modeling

Stamped medals full of **lead**

Molding large pieces carved in **wood**

Molding and making hollow forms of animals from **metal**

+ **Wheat oil** put and seen

Stag beetle

Foot of a **bittern** molded

Thickness of a medal

Very hard wax

Molding a **pring** ^[c_091v_01] and that which is engraved

Molding pieces of carcanets

Things that are not released

Fountains

Grottos

Diverse **mosses** applied

Molding in three frames

Softening **iron** to engrave it

Engraving ^[c_004v_02] with **aquafortis** on **silver**

and **copper**

Stamping

White enamel, making it tender

with **calcined black river**

pebbles

Molding very thin like *BIMBALOTIERS* do

They mold in **paper** & **carton**, for neither **earth**, **sand**, nor **metal** would mold as neatly & would not receive. Or else they engrave in **stone from Istre** ^[c_169v_02] the principal side, & the reverse is of **paper** or **carton**.

Reducing a round figure to a hollow form

You need to first mold it with some **plaster**, as said before, & in the **plaster** cast in **wax**, from which will come out a relief that you will repair very neatly, and ^{b[c_169v_01]} model it as you fancy. And then you will model this relief of **wax** again in **plaster**, or better yet, with your **wetted sand** ^{#[c_112r_02]} like for *noyau*, & in the latter, cast in some **lead**, & from this you will have a very neat relief, & if it is not, repair on the **cement** or otherwise, & take heed that it is always of good release. And this one will always serve you well for making as many hollow forms as you please, in this way. Place half of your figure of **lead**, **oiled** & wetted with **eau-de-vie** according to the above, in the **clay** slab, then mold this half with some **white plaster**. Having set ~~Next~~ and having well smoothed & flattened the **plaster**, take your **black wax mixed with sulfur**, as is said, because it leaves nothing in the **mold** & melts quicker. Wet it in **warm urine**, & once softened enough, make an imprint with it on the half of the **lead** figure, and ~~it~~ you will have a very neat hollow form. Shape next the hollow **wax** form in a square shape, as you please, with sufficient thickness & smooth it well on all sides, & ~~thus~~ next, mold this hollowed **wax**, imprinted on one part & flat & smooth on the other, in the same fashion that you mold flat medals of **wax** or ~~other~~ **metal en noyau**. And the **mold en noyau** will render in **silver** or such **metal** as pleases you ~~the m~~ a similar figure to the **wax**, that is to say flat & smooth on one side & hollow on the other. And having cleaned & put this hollow form to be whitened, if it is **silver**, you will be able to mix there some works of **sugar**,

^{#[c_112r_03]}

having made a hole in your **clay** slab & having ~~en~~ packed in it half of the figure of **wax**, a little **oiled**, to pull it out better.

Transparent wax is not good, but rather the one which has body, to make an imprint well.

[Figure: fig_p169v_3]

As you have molded with **plaster** & **wax** one half, you can mold the other the same.

perfume & suchlike. But take heed that it is necessary that the **black wax** with which you mold be hard, in order that, quickly & ~~du~~ more dryly, it retracts, in order to see if it is well imprinted. It is rendered harder by adding into the already melted one more **melted sulfur** & a little **rosin**.

[Figure: fig_p170r_1]

[c_170r_01] & join & **solder** a tail of **latten wire** with **solder**. The lumps on a flower are a small matter, for this can be removed with the *chape*, but let the leaves come out well, then the **paint** covers everything.

Currency medals

One makes the relief puncheons of **untempered steel**, [c_170r_03] then one tempers them, & with these one strikes on **matrices**, not reddened in fire, as some think, but on **steeled iron**, reheated & softened, [c_015r_01] which one quenches afterward.

Casting

Do not cast in one go, for in doing so, the **metal** is regurgitated, & ~~in~~ & the **metal** gets cold before it goes down. But cast bit by bit & taking your time.

Clamps

When you put them back the second time, make sure that the **mold** does not shift.

Molds

Those of *noyau*, in being reheated, want to be set on **charcoals** a little spent, without the air touching them, like the **frame molds** want to be ~~reue~~ dried **in the open** & uncovered.

Thick works of **tin**

They do not want to be cast in **lead** or **red tin** like thin & delicate things. It is enough if it is *f* well melted & hot. Thin things want to be quite hot & of **red tin**.

Cleaning closed molds

One needs to let them cool rather than blow inside to clean them, for when hot, they retain the **ash**. When cold, they are cleaned better. Take a **thin wire of latten** or a **delicate straw** to clean the tail completely, for this is what makes the gate. Blow into it & suck, drawing it to you. Before molding, thicken the tail with **wax**, then cut it,

[Figure: fig_p170r_2]

[c_170r_02]

Original first page (1578–1579)

[c_170v_12] In the *year* fifteen hundred seventy-eight, the second of *July*, the heirs of the e[c_170v_29] late **Sieur Ouvryer**[c_170v_13] received ~~two hundred and five~~ **écus** the rent of **Saint-Frajou**,[c_170v_14] amounting to twelve hundred and thirty **livres**.

They have also received, as part of the revenue of the *year* fifteen hundred seventy nine, ~~two~~ three hundred forty three and one third **écus** ~~on-qu~~.

And for the first year, eighty **livres** and fifteen

[Figure: fig_p170v_2]

[c_170v_03] remain to them, and for the second settlement, they have not yet received anything.

Against plague

Take, **against pestilential fever** or **poison** or **plague**, an **écu**'s weight of your **opiate** soaked in **scabious**[c_170v_15] or **bugloss water** or **thoroughly tempered wine**, if one is afflicted. After taking it, one needs to make oneself sweat.

Othonis *episcopi*

Frisigensis[c_170v_30]

ab orbe condito[c_170v_25]

For preserving

Acetum paratum ex *ruta baccis juniperi* simul tuis. Eo *aceto* extinguantur lateres igniti et vapor excipiat *ore* & *naribus*.^[c_170v_16] This is to preserve oneself when one goes into infected air.^[c_170v_17] a garment can be thus perfumed & removing its infection, the room, house, &c. If you find yourself in a place where you do not have this preparation, carry rue & seeds^[c_170v_19] pestled together, then, according to your need, boil them in vinegar and use as above.

Abbatis

Urspergensis^[c_170v_31]

Chronicon^[c_170v_26]

Hieronimus

Mercurialis,^[c_170v_32]

Variarum^[c_170v_27]

List of books

^[c_170v_04]*Rerum scoticarum historia*,^[c_170v_20] **Georgio Bucanano**^[c_170v_33] authore

Rembertus Dodonæus, Mechliniensis *MEDICUS*,^[c_170v_34]

De stirpium historia^[c_170v_21]

Des Ormes,^[c_170v_35] *De l'invention de bien bastir, and other works*^[c_170v_22]

Tilesius,^[c_170v_36] *De coloribus, Vascosan*^[c_170v_23]

Marmodæus,^[c_170v_37] ꝥe *De lapillis præciosis*^[c_170v_24]

Albertus Magnus,^[c_170v_38] *De mineralibus*^[c_170v_28]