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FIRST EDITION IN ENGLISH of this
 work containing a collection of
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 plates of machines, handlay tools
 and instructions of how to make
 GLASS EYES IN ANY COLOUR

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Duresson 261

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Duncan 300

THE
ART
OF
GLASS.

A

Art of Glass

THE ART OF GLASS
BY JOHN WILKINSON
LONDON: PRINTED BY J. JOHNSON, ST. PAULS CHURCH-YARD, 1771.

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THE
Art of Glafs.

S H E W I N G

How to make all Sorts of GLASS,
Crystal and Enamel. Likewise the Ma-
king of *Pearls, Precious Stones, China* and
Looking-Glasses.

To which is added,

The Method of *Painting on Glafs* and
Enameling. Also how to Extract the Co-
lours from *Minerals, Metals, Herbs* and
Flowers.

A Work containing many Secrets and Cu-
riofities never before Discovered.

Illustrated with Proper Sculptures.

Written Originally in *French,*
By Mr. *H. BLANCOURT,*
And now *first* Translated into *English.*

With an APPENDIX, containing Exact Instructi-
ons for making GLASS-EYES of all Colours.

LONDON, Printed for *Dan. Brown* at the *Black Swan*
without *Temple-Bar*; *Tho. Bennet* at the *Half-Moon,* *D. Mid-*
winter and *Tho. Leigh* at the *Rose and Crown,* and *R. Wilkin*
at the *King's-Head* in *St. Paul's Church-yard,* MDCXCIX.

1872

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T O
My Lord Marquis
O F
VILLACERF,

Counsellour of State,

*Chief Steward of the Household to
the Late Queen; Superinten-
dant and Surveyor-General of
His Majesty's Buildings and
Gardens, Arts and Manufa-
ctures.*

S I R,

THE Knowledge which I
acquired by my Study
and Experience in the *Art of*
A 3 *Glass,*

Glass, has Retriev'd several Important Secrets, which for a long time lay Buried in Oblivion: Of these I at length resolv'd to Compose a Treatise; and I here make bold to Inscribe it to your Illustrious Name, that they may be once more Restored to this Kingdom. If your Honour pleases to look over the Wonders herein delivered, you'll be satisfied I have found out and added several Curious Things of my own Invention, as well relating to the Secrets of Nature, as the most profound Science of the *Adepti*, or Ancient Philosophers.

Hence

The Epistle Dedicatory.

Hence it is, *Sir*, I am to hope You'll Receive this Favourably; that under the Honour of your Protection, it may meet with Acceptance Abroad: For if You grant Your Approbation, the World will not deny it Theirs. Permit therefore, *Illustrious Sir*, that I may Impart the Secrets of this *Noble Art* to the Publick, under your Auspicious Patronage: Which is the Most Humble Request of him who Subscribes himself with all Imaginable Respect,

Your Honour's,

Most Humble, and

most Obedient Servant,

H. de Blancourt.

If I have it in my power, I am to
hope You'll receive this Pa-
perably; that under the pro-
tection of your protection, it
may not be lost. I am, Sir,
Dear Sir, Your Obedient Son,
A. B. C. D. E. F. G. H. I. K. L. M. N. O. P. Q. R. S. T. U. V. W. X. Y. Z.

Your Obedient Son,
A. B. C. D. E. F. G. H. I. K. L. M. N. O. P. Q. R. S. T. U. V. W. X. Y. Z.

T H E

P R E F A C E .

THE Art of Glass, being one of the Most Noble and Curious of all other Arts, and the Wonderfulness of it, both in the Simplicity of the Matter, whereof it is made, and in the Formation of it; as also the Various Colours it is capable of receiving, appearing so Curious and Entertaining, chiefly engaged my Thoughts in the Study of its Principles, and to penetrate into the most hidden Secrets of it.

The Knowledge I had acquired in the Secrets of Nature, both by Speculations, and repeated Experiments, Excited me to a more particular Enquiry of whatever might be extraordinary in it, that I might Impart it to the Publick.

Most People are of Opinion, That the Ancient Manner of Tinging Glass, (with those fine and rich Colours, whereof there are still some Remains to be seen in Ancient Churches) is at present quite lost. It is true indeed, it is lost Publickly, since those who publicly profess the Art of Making Glass, know nothing of it: But to those who set themselves thoroughly to study the true Principles of whatever they undertake, it is not difficult to Retrieve
lost

The P R E F A C E.

lost Arts, and Revive them in their Ancient Splendour and Perfection.

I shall therefore here endeavour to Revive, and make Publick, this supposedly lost Secret, of giving all those Curious and Rich Colours to Glass, which the Ancients did, by shewing whatever has been performed, that is extraordinary and curious in this Science, which I have traced and recovered from the obscure Tracts of Ancient Authors, and confirmed by my own Experiments; and also augmented what was delivered by them, in Preparations of several rare and precious Matters, that cannot but appear very extraordinary.

This Age has been very happy for the Restauration of Arts and Sciences, of which that late Excellent Minister of State, Monsieur Colbert Superintendant, and Surveyor-General of the Buildings, Arts, and Manufactures of France, has been an Assiduous Reviver and Encourager: They seem at present to be arrived at so high a degree of Perfection; that there is not one but has surpassed whatever was done by the Ancients; and those under his Inspection, particularly merit on that account a preference to any others. That of Glass, whereof we are at present to treat, has not been the last that has signalized it self, having already shewn Wonders in the extraordinary largeness of Coach-glasses.

We have divided this Work into Twelve Books, which contain so many different Heads, tho' derived from the same Principles. If we were to follow the ordinary Custom of most Authors, we should Epitomize in the Preface, the Contents of those Twelve Books: But that seems to us a needless Task, since the Reader may please to peruse an Index, which we have for that purpose annexed to the End of this Volume, which will be sufficient for the Reader's Satisfaction therein.

Our Design being not to trouble the Reader with a long Preface, we have resolv'd only to touch very lightly of the Matters contain'd in the Book, and only to hint of some things that are omitted.

Glass has something in it so beautiful to the Sight, and its Transparency is so agreeable, that it is no wonder we find it by several, and even in the Holy Scripture it self, compar'd not only to Gold, the most perfect of all Metals, but also to things far more high and Spiritual. They are Mysteries of deeper Consequences, than at first sight we imagine, since by them we are inform'd, that Vitrification gives a better Being, or Nobler Nature. This requires the attentive Thoughts of Philosophers; not only in the Nature of Metals, where it is easily seen; but also in other things, where Sense and Experience testify the Truth of it.

We have assert'd in our Book, that Glass is a perfect Metal, since it will bear the utmost force of Fire as well as Gold: And that there is but one sort of Fire, more Puissant than the Vulgar, that can consume it: But here we will take notice, that there are two Ways to make Glass, and that it may be made more or less fixed. That the more fixed, which is the least beautiful and the least transparent, resists every thing; no Preparation of Mercury, nor any Species of Aqua-fortis, can Dissolve it, nor the most subtle Poisons, or highest Corrosives, arrive any further than to break it. The less fixed, on the contrary, which is the most clear and transparent, as that of Venice, is less capable of Resistance, being compos'd of a more purified Salt: Thus it will Dissolve in the Earth, or in cold and moist Places, if there be more Salt in it proportionably than Sand; by a Separation natural to those two sorts of Matter: And Poisons Extracted out of Minerals will Dissolve it, by reason of their great cold.

We

We shan't repeat here the *Virtues* Glass is capable of acquiring, (whereof we make mention in several places) by the Grand Elixir of the Philosophers, (which makes it Malleable, and Converts Crystal into Precious Stones) as also by several other ways. We'll only add, That there are several other less and particular Secrets, by which it may be made soft and fusil like Wax, and afterwards reduced to its former hardness in Water; but these are little Curiosities that serve to no purpose.

Glass may receive either within or without any sort of Metallick Colours, which makes it very proper for Painting. Those which we shall teach to Extract from Metals, and shew in this Book for the tinging of Glass, give it a Lustre equal to Precious Stones, and set it off with an unspeakable Beauty.

As we have given you the ordinary Preparations of all sorts of Metals, Crystal, Glass, Rochetta, Soda, Tartar, Manganese, Salt, Sulphur, Vitriol, Aquafortis and Regis, Pastes, Enamels, Pearls, and other things contained in this Work: So we can safely say, we have given you more of them than are common, and some which have never been publick; which we have all along taken particular care to do, to oblige the Curious in this Art, who will apprehend it better by reading the Book it self, than we can tell them in the Preface. But more particularly to shew our Ingenuous and Unprejudiced Impartiality in this Affair, and how little envy we have to the Students and Practisers of this Art, we discover to them such extraordinary and precious Receipts in it, as would have been Industriously concealed by any other Hand, because they point out the Paths to Persons Conversant and Illuminated in these Studies, even to their greatest Secrets, and most hidden Recesses.

The P R E F A C E.

By what we treat of in this Book upon this Subject, one may perceive that there is nothing in Nature which Man cannot imitate: And if we believe what Claudian tells us, of that great Sphere of Glass, made by Archimedes, we shall have reason to be as much surprized, as Claudian's Poem makes the Gods to be. If the Reader would know the reason why that Sphere was made of Glass, he may see it in Cardan's Book, de Subtilitate, where he may see with it, a Quotation of the Verses we here mention.

Besides what relates to the Art of making Glass, we also treat of the Ways of Painting on Enamel and Glass; and we also shew the Way of Extracting Tinctures of several Colours of Herbs, Flowers, Roots, Grain, Wood, Stones, and other things, for this sort of Painting and Tinging of Glass.

Altho' this Art of Painting seems different from that of Glass, yet they ought not to be separated, since this Painting is performed with Minerals, and that they melt in Fire like the Enamels.

One of the most Ingenious we have ever had for Painting on Glass, was one Jaques de Paroy, a Native of St. Pourcain sur Allier, who has Writ upon that Subject. His Genius always leading him that ways, he apply'd himself to it with a great Inclination and Industry, and succeeded in it accordingly: Whereupon he went to Rome to perfect himself, as being the greatest and most general School for Painting and Sculpture; where he studied a long time under the Famous Dominican. After he attained to Perfection, he went to Venice, where he did several fine Pieces.

Return-

The P R E F A C E.

Returning into France, in the Province of Auvergne, where he was Born, he performed also some extraordinary Pieces in the Castle of the Count de Calignac, and afterwards in the Church of St. Mederick in Paris, where is yet to be seen of his, the Judgment of Susannah, which is very perfect and Exquisite, as well as all the other Pieces of the Choir. At length this Excellent Person, died at the Age of 102 Years, in the City of Moulins Bourbonois, where his last Funeral Obsequies were performed in the Church of the Jacobines.

There are likewise more of those fine Paintings, which justly cause Admiration in all Learned Beholders, to be seen in the Church of St. Gervais at Paris, and in the Wooden-Chappel at St. Vincent's, in the Great Church of the City of Metz, in that of St. Owen at Roan, in the Castles of Gaillon and Annet; and in several other places, which would be tedious to relate, where in all of them are to be seen some of those Prodigies of Art.

The Way to become perfect in any Art, is wholly to devote and give ones self up to't; but the most part of those who have so Zealously apply'd themselves to it, and become Excellent therein, have left no other Patrimony to their Heirs, but their own Empty Fame, which they always pursu'd when alive, with far more Vigour than the Goods of Fortune. Witness Lisippus, that Incomparable Engraver, who Died of meer Poverty, because instead of seeking whereby to Live, he continually employ'd himself about his Art. And Miron, who seem'd to have animated his Statues, cast them so happily in Brass, left so little behind him, that no one would take the pains to be his Executor to look after it.

The P R E F A C E.

We might give a Thousand Examples of these Truths, and in what Esteem those who have excell'd in these Arts, have been had by great Princes all over the World, but the Subject would require a larger Discourse than we have allotted to this Preface, which obliges us to come to a Conclusion; only further desiring the Reader not to expect any Quaintness of Expression, or Politeness of Stile, but rather to content himself with the Exactness which we have always taken care to observe in giving him the Preparations we pretend to shew, with all the Truth and Fidelity possible.

O F

The White Oak is a tree of great utility and beauty. It is one of the most common trees in the United States, and is found in all parts of the country. It is a hardy tree, and is able to withstand the most severe winters. It is also a long-lived tree, and is often found in old fields and woods. The wood of the White Oak is very strong and durable, and is used for many purposes. It is especially valued for its use in the construction of ships and bridges. The bark of the White Oak is also used for medicinal purposes. It is a rich source of tannin, and is used to treat a variety of ailments. The leaves of the White Oak are also used for medicinal purposes. They are rich in flavonoids, and are used to treat a variety of ailments. The White Oak is a tree of great value, and is one of the most important trees in the United States.

OF THE
A R T
O F
G L A S S .

P A R T I.

C H A P. I.

Of the Original, Antiquity, and Use of Glass.

IT has not been without Reason, that several Learned Persons have compared Man to a Microcosm, or Little World, since he contains in himself all the Excellencies of the Greater; and that God, having created him after his own Image, has given him an Absolute Dominion over all Creatures in this World: Not only over Animals and Vegetables, and those other visible mixt Bodies, among which we are immediately conversant; but also over Metals, Minerals, Semiminerals, Precious Stones, Pearls, Corals, and whatever Treasures

B

tures are hid in the Bowels of the Earth, or Bottom of the Seas; that he might make use of them for his own Pleasure, and that by the Understanding God has given him, he might know their Properties, to make them usefull for his particular Occasions.

The Power of Nature is limited in all her Effects, and Man alone can augment and enlarge by Art, the Virtues and Powers which she has produced, by separating the Pure from the Impure, that which is more Subtil and Spiritual, from the more Gross and Earthy; which Nature her self cannot do, by reason she has no Tools nor Instruments proper for such Separations; especially of those Impurities, which by proceeding from the Corruptions of the Matrixes, where all her Generations are made, perpetually mix themselves with all her Productions: Besides that the Universal Seed (or Spirit) of the World, which contains in it self the three Principles and four Elements, whereof every thing in Nature is compos'd and nourish'd, is it self not free from Impurity; for in making its Circulations from Heaven to Earth, and from thence again to Heaven, where it is impregnated with all the Virtues of the Constellations and Planets, it returns again, and descends even to the Center of the Earth, there to be impregnated with a Body and Salt, and acquire the utmost Elementary Perfection; whence the Central Fire forcing it to repass to the Surface, and thence into the Globe of Water and Air, after having produced, in its passage, in all the Elements, an infinite Number of Mixtures, it ascends again into the Heavens, whence it penetrates and animates the whole Universe. It is by all these Circulations that this Seed or Soul of the World becomes invested with Impurities, whereof the general or universal Spirit is tainted, so that the Pure and Impure ascend
and

and descend together in Confusion; infomuch, that only the Industry of Man can separate them, by ejecting the unprofitable excrementitious Parts, and separating and purifying its Principles, and then reuniting them, to make a Compound of a greater Virtue; so that of that Compound you may make a Species capable of producing its *like: For the Nature of one Mixt or Compound, cannot produce or be chang'd into a Mixt of a different Nature; We must always sow Wheat to have a Crop of Wheat.

Hence it is that so many great Philosophers have told us, That Man, by the means of Art, might begin where Nature left off, by purifying its Matters, and reducing them to their first Principles, and thence raising them to the utmost degree of Perfection; whether the End be to prolong Man's Life, or curing his greatest and most inveterate Diseases, as also of other Animals; or for Metals, Minerals, Pretious Stones, Plants, and other Vegetables. Now such Separation and Purification of Substances is not impossible, as long as you destroy not entirely the Subjects: But it must be perform'd by something that specifically agrees with their own respective Natures; then (by it). you may make a perfect Reduction of their Substances, wherewith by means of Art, Man may perform all those things I have now mention'd, as to cure the most inveterate Diseases, convert what is imperfect into the most perfect; and it is hereby that you have display'd, that absolute Dominion which God has given him over all the Creatures.

It is not my present Design to enter into the depth of the Mysteries of this sublime Science, which I

* Without doubt the Author has an eye in this Expression to the Multiplication of Gold.

leave to thofe true * Philofophers, who are the only Creatures to whom God has reveal'd them, and whereof all other Men, like my felf, are unworthy: but only to fhew by fenfible Demonftration, That Man, in many things, is capable of imitating Nature by the Affiftance of Art; and of performing feveral things by his Induftry, and the Work of his hands, which look more like Miracles, than the Effects of Art. Thofe which make the Subject of the following Difcourfe, would be no lefs furprizing, if they were lefs common; but from the time our Eyes become accuftom'd by conftant ufe to any Object, the Esteem of it begins to be leffen'd, and fall; Witnefs Nature her felf, whofe Annual Renovation, tho' we are accuftom'd to it, ought to be a perpetual Subject of Admiration.

Of all the Works of Art, that of Glafs is not the leaft confiderable, whether it be Natural or Artificial; it melts in the Fire without confuming, and is therein perfected or made fine like Gold, which is a perfect Metal, and there leaves behind it its Dross, becoming purified and whitened, which renders it more proper for making Difhes, Glaffes, and other Veffels for Man's ufe, than any other Metal, or Matter whatfoever. Nay, I may yet go farther, and fay, That Glafs not only purifies it felf in the Fire, but alfo affifts to purifie and melt all other Metals, and render them more plyable and malleable, and fo more eafie to work upon to the ends they are design'd for.

In the *Spagyrick Art*, in Phyfick, in Chymiftry, it is impoffible to be without Veffels of Glafs, whether for Sublimations, Diffillations, or Putrefactions, Digestions, Circulations, or other Operations to which they are neceffary for feveral Reafons; one

* *Alepti.*

whereof is, That all the gradual Alterations, of the Matter therein contain'd, and what is done in it on the Fire, are visible to the eye; and another, That those Matters can neither be imbib'd by the Vessel, nor transpire thro' its Pores, nor it communicate any ill Scent or Taste, which might be noxious to the Health, if the Matter be prepar'd for Medicine: Moreover the Philosophers make use of no other Vessels for their curious Operations, whether it be to extract the Philosophick *Mercury*, or purifie it, or for the Decoction of their Grand *Elixir* and *Panacea's*, which they cannot perform without Glass; for otherwise they would labour in the dark, and could never well regulate their Operations: Besides the Volatility of their Spirits, which they must preserve, is of so subtile and quick Penetration, that no other Vessels could hold them.

Churches, Palaces, Castles, and Particular Houses, owe their chiefest Ornaments as well as Conveniences, to Glass; for that transparent Substance guards them within from too great Heat and Cold, without hindring the Intromission of the Light. Looking-Glasses, and other great Plates of Glasses are as so many surprizing Objects to our Eyes, representing so distinctly and naturally all even from the least to the greatest Actions of the Objects before them; whereby also one may always keep himself in a neat and agreeable dress. Notwithstanding not one in a Thousand of those who have them, ever reflect on the Admirableness of the Work, which is beyond doubt, one of the chiefest, and most perfect Pieces of Art, and than which Man can make nothing more wonderful.

Moreover, *China-Ware* for adorning Cupboards and Tables, Dishes, divers sorts of Glasses, and Figures, and a thousand other Curiosities, of all sorts, of Colours, which serve both for Pleasure and Use,

and employ the Poor all over the World; are they not well worthy of Admiration?

But if we consider the Painting and Representations in the Glasses of Churches, we must at the same time admire, that the Colours which we extract from Metals for that End, can be so very lively, as to resemble so many pretious Stones. If any of this Glass be cast into a Furnace, you may see what a vast number of Colours it is susceptible of, even beyond Comparifon.

* Glass is called by that Name, because it is a transparent Metal, while other Metals are opaque, there being only Glass that can shew what it contains within. The Name of *Glass*, which the *French*, *Germans*, and *English* have given it, seems to be taken from its resembling or approaching somewhat in its Colour to † *Azure*, or *Sky-colour*. The Word *Glass*, also seems to be deriv'd, from its Resemblance to Ice (from *Glacies*), while the Fire does much the same thing in Glass, as the Frost in the Water: Thus all Glass looks like Frozen Water; which made a modern Author merrily say, *That it made Wine smile to see it self cherish'd in the bosom of its most Mortal Enemy.*

Monzerus tells us; That when Looking-Glass was first invented, they were sold very dear, as if they had been made of some pretious Matter, and also by reason People took so much Pleasure in seeing themselves so lively pictured. To this we may add, That it is not above 200 Years since they came first to be in use, and that the way of making them was found out by a certain Person, who, melting some Glass in a Crucible, chanc'd to spill it on the ground,

* From the Latine *Glastum*, which is called *Vitrum* by *Cæsar* in his *Comment.* lib. 5.

† It naturally hath a Blueifness.

where it running under a great Square Tile, where-with the Floor was pav'd, oblig'd the Workman to take it up, where he found it in Form of a Looking-Glass-Plate, (which could not have been so form'd by the ordinary way of blowing), which began to employ his Thoughts all that Night, and thence he conceived, That Glass might be run into Plates like Metal, which he began to experiment from that day forward; and so he found out the way to those Consequences which meer Chance was the first occasion of; as it had been also before of the very Matter whereof this Metal is compos'd, as we shall hereafter shew.

The use of Glass is so Antient, that it is difficult to assign the time of its first Invention: *Pliny* pretends, that it was in the City of *Sidon* that the first Vessels of Glass were made, as may be seen in the 26th Chap. of his 36th Book.

Others affirm its Origin, must be as antient as Bricks, by reason one can scarce make the one without the other; this is the reason that has made some assert that this Art was known at the time of the Building of *Babel*, that being made of Brick, and that way of Building continu'd in *Egypt*, since we read, it was the sole employ of the Children of *Israel* in their Captivity to make them. This might be strengthen'd by a convincing Proof out of the Bible, whereof *Moses* was the first Author, where you read of Glass, which would not have been mention'd if it had not been in use in those Days.

The Passages we find of *St. John* in the *Apocalypse*, seem to put a very high esteem on Glass; for in speaking of the Throne of God, Chap. 4. ver. 6. he says, *And before the Throne there was a Sea of Glass like unto Crystal.* And speaking of the Heavenly City, whereof he gives the Description Chap. 20. Ver. 18. he says, *And the building of the Wall of it, was of Ja-*

ſper, and the City was of pure Gold, like unto clear Glafs, and at the 21. verſe, *And the twelve Gates were twelve Pearls, every Gate was of one Pearl, and the ſtreet of the City was pure Gold, as it were transparent Glafs.* That is to ſay, a Glafs of Gold, or more properly, Gold Vitrifi'd, which is that *Electrum* of *Ezechiel*, whereof *St. Jerome* makes mention. I may ſtrengthen it yet further, by a paſſage out of *Job*, Chap. 28. ver. 17. where ſpeaking of the Wiſdom of God, he ſays, *The Gold and Crystal cannot equal it.* Which does not only ſhew us the Antiquity of Glafs, but alſo in what eſteem it was had in thoſe days, being always equall'd to Gold. This laſt paſſage is alſo Cited in a Tranſlation of *St. Jerome*, and in ſeveral other Authors, among whom, ſome have chang'd the word of Gold and Glafs, to that of a *Stone more precious than Gold.* Others to a *Carbuncle, or ſome other precious Stone.* But, (ſay they,) all theſe names are underſtood of only one and the ſame Stone, which the Antients believed gave Light by Night, and which is no where to be found. This laſt Opinion is very Myſterious, and that one only Stone, according to *St. Paul*, in the Epistle to the *Romans*, ought to be underſtood of the Divine Union with our Nature, by the Myſtery of the Incarnation of the Word.

The great *Hermes*, the Father of the Philoſophers, call'd that Stone, the Image of the Inviſible God, which *Mofes* (alſo) ſhut up in the Ark of the Covenant, and which was call'd the Glory of God, ſhining in the Night like a burning Fire, or like a bright and ſhining Star which gave light by Day, as you may ſee in *Numbers*. This it was, which theſe Authors meant and underſtood, but which no others can comprehend, unleſs it be the true Philoſophers. We deſign to treat more largely thereof in our next Work, Entitled, *The Myſtical Characters of Antiquity unveil'd and laid open*, wherein we will make it appear

pear, that of those Characters were Compos'd the Two Tables of the Law, which were afterwards put into the Ark, and which are the two Pretious Stones which serve at present for Guides to the wise among the Philofophers, as they did heretofore for Figures to the Antients.

We might fetch the Origin of Glass from *Tubal-Cain*, the Son of *Lamech*; for he being the first Chymist that found out the way of melting Metals, and the uses of Iron and Brass, whereof he forg'd Arms for War, as is noted in the *4th. Chap. of Gen.* it is not improbable, but that he might be the first Inventor of Glass, because one can scarce avoid reducing Calcin'd Metals into Glass, especially when the Fire is more than ordinarily violent, and the Matter remains longer in it than it ought. It was this which made *Ferrandus Imperatus*, say, that the Origin of Glass came from Fire, or from its Reverberation alone in those Furnaces where Fire was preserv'd in its full force. We own Fire to be the first Agent both of Nature and Art; but with this distinction, that that of Nature vivifies or enlivens, and that of Art resolves and destroys, especially when it is too vehement: But he who knows how to direct and manage it, may make good use of it for the Separation and Perfection of the Matters wherein he works; whence it very often happens that several Persons seek that which they cannot find, and find that which they did not seek; wherefore we may truly say, that most part of our best Inventions and Secrets, have been found out by meer chance, and as it were hazard of Art.

The great *Hermes* was not ignorant of the Art of making Glass, since he taught the Knowledge of it to the *Aegyptian* Chymists, but not that of the Transmutation of Metals, tho' he possess'd it, as *Kircher* tells in his *Oedipus*; That since that time, that People

ple have always profess'd this Art, in which they were so Expert, that *Flavius Vopiscus* speaking of *Alexandria*, tells us, it was very Rich, and Fruitful in Corn, and that no one is there idle, one part of the Poor making Glass, and the other Paper.

We have another Evidence of the Antiquity of Glass, in the 4th Book of *Lucretius*: But the most part of Historians attribute the Invention of it to the Alchymists, who by endeavouring to counterfeit Pretious Stones, found out this Secret. It is to these great Men, indeed, we are oblig'd for almost all our Modern Knowledge of the most curious Secrets of Nature, they having unveil'd her most hidden Mysteries. The Profession of an Alchymist in those Days, was not Vilifi'd as it is now, it being esteem'd very Honourable, Kings themselves exercising it. We shall discourse thereof in the Work we have promis'd, and whence the word *Chymistry* is deriv'd, where we will prove its Antiquity by several passages out of the Holy Scripture. But we will here add, that the Chymists of this present Age are very far remov'd, both in Knowledge and Probity from those Antient ones, who never practis'd those base Sophistifications, and a thousand other Tricks of that Nature, which the Modern do; which is the reason that this Art, so Noble and Sublime in its Principles, is now a-days so much Vilifi'd, that to have the name of a Chymist, (of that sort,) is enough to render a Man detestable among honest Men. Also most part of those who set up for that Profession, are nothing but a sort of Quack Collectors of Recipe's, with which, under the false appearances of Fixation, of Augmentation of Gold and Silver, which they call *Powders of Projection*, &c. and which they pretend to do with common *Mercury*, the Imperfect Metals, Minerals, Salts, Powders, and other Ingredients, Heterogeneous to the principal

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Matters, with these, I say, they abuse Credulous Persons by their fair words often to their Ruine. It is not with common gross Matters that Philosophers work, nor can they bring any thing to Perfection, before they have converted their Matters into Fluid, Volatile, and Spiritual Substances, such as they were before their Coagulations; not by the means of *Aque Fortes* and Corrosives, which the Antients knew nothing of; but by means of the same Liquors that engender'd and nourish'd them, which is as it were their Parent, Homogeneous to them, and that Water of Life of the Philosophers, or rather the Key of Nature, without which, you'll always work in vain. That which seems to the Eyes of the Credulous to be Augmentation, will never undergo the true Proofs of Silver and Gold; if it should chance to undergo some one tryal; you may be sure the second will make all the hopes of the pretended profit vanish in Smoak, and on the contrary, make you sensible of considerable loss, both by the waste of the Matters, and the Charges expended on the way of managing them. Thus those who have so little Sense as to engage in these Matters, may one Day find themselves drawn in to their loss.

But let us return to the Origin of Glass; the Author of the *Essays of the Wonders of Nature*, tells us, That the *Limon* of *Lac Cendevia*, which is found at the Foot of *Mount-Carmel*, was the first Matter wherewith Glass was made. That some Mariners being about to make a Trevet for a Kettle, went ashore in a place where they found this *Lac*, that they took some of the Sand, and mix'd it with *Nitre*, wherewith their Ship was laden, and that making a Fire under the Kettle, they saw a Noble Stream as it were of running Crystal, or melted Jewels, whence they learn'd to make Glass of those two Matters, since which time, (says he,) they have also mixed
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Load-Stone, seeing that will attract Glass as well as Iron; thence following they made use of certain fine Stones, and also of Sand, as the *Indians* also did of Crystal; but that in his time they made use of a Glassy Substance, extracted from an Herb, call'd *Soda*, wherewith they mixed Sand to fix it. *Pliny* tells us something like this, in his 5th Book, *Chap.* 19. where he also asserts, that we were indebted to Chance for the first Invention of Glass, which was on the Banks of the River *Belus* in *Syria*, where certain Merchants being drove a-shore in a Storm, were obliged for sometime to stay and make Fires and to dress their Provisions; that the place abounding with a certain Herb call'd *Kali*, which, by the great Fires they made, being reduc'd into Ashes full of Salt, and joyn'd with Sand and Stones proper for making Glass, which are Natural and plenty thereabouts, run down into a sort of melted Glass: Which shew'd them not only the manner of making Glass; but also Crystal, and several other fine things, which had not been found out without the Invention of Glass; the use whereof is so necessary to pass away Life with Pleasure and Satisfaction, that Divine Providence has taken peculiar care that no place on Earth should want Materials to make it, all being stock'd with them in such abundance, that they seem inexhaustible. Which once made a certain Artist pleasantly conclude, That the Art of Glass would last throughout all Ages; for the general Conflagration in reducing the Earth into Ashes, by reason of the vast quantities of Salts that are mixed with it, would at last vitrifie the whole Mass into a lasting Monument of the Art. It is true, the end of the World, according to the Holy Scriptures, is to arrive by Fire, not by that material Fire we use in our Chimneys; but by that which we call Elementary and Central, whereof God will only augment the heat, which will so dry up and parch
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the Earth, and exhaust all its humidity, that it shall not only be Calcin'd, but chang'd into a better Nature; afterwards to be inhabited by a new World of a Spiritual, Incorruptible and Glorious Nature, no more to be subjected to any change. What the two Authors we have just cited tell us, concerning the Origin of Glass, is far better clear'd, and more particulariz'd by *Josephus*, in the 9th Chap. of his 2d Book of the Wars of the Jews, wherein he acquaints us with several surprizing things concerning the Sand for making Glass, whereof we have been speaking. He takes notice that the River *Belus* arises out of *Mount-Carmel*, and passes between *Ptolemais* and *Tyrus*; that it is not above 2 Furlongs from *Ptolemais* that near this River is the Sepulchre and Statue of *Bel* or *Belus*, Father of *Ninus*, first King of the *Assyrians*, whom the *Babylonians* worship'd for a long time, and Sacrific'd to, by the order of *Ninus*, who was the first Author of the Idolatry and Priesthood of the *Chaldeans*, according to *Eusebius*, lib. 1. and *Isidore*, lib. 8. That that Statue of *Belus*, whom the Pagans call'd *Jupiter*, was almost 100 Cubits high, (which is very remarkable,) and that in that place there is a Valley almost round, full of a clear Sand very fit for making Glass: And if the Ships which come thither for their Lading, chance to empty the place, it is immediately fill'd again, by the Winds driving it down from the Precipices of the Mountains which environ the Valley round; insomuch, that having for many Ages past, made use of this Sand, it still always remains in the same abundance. He also tells us in the same Book, Chap. 17. that this Sand has a strange Nature above any other, which is, that it will change any Metal into Glass that is thrown in among it; and that which is yet more strange, that all the pieces of Glass made of this Sand, and cast again upon it, are

are immediately converted into Sand again: That there is also found among this Sand a Pretious Stone about the bigness of an Acorn, very fine and transparent.

Tacitus in the 5th Book of his *Annals*, makes also mention of this River *Belus*, telling us it enters into the Sea of *Judea*, at the Mouth whereof, the Sand that is gather'd up, by reason of the great quantity of *Nitre* contain'd in it, is easily chang'd into Glafs in the Furnaces. And altho' the Shore is but small, that the Sand is notwithstanding inexhaustible. *Strabo* tells us the samething in his 12th Book, and *Pliny* in his 6th, and also *Agricola* in his Treatise of *Fossils*: And one may say, that generally all Authors, who have spoke of Glafs, have made mention of the place where this Sand is gotten, whereof Glafs is made without any other mixture, wherein the Effects of Nature are to be admired, in affording us so fine and pretious a Metal in so base and common Matter. This ought to be an example to the Curious, and teach them, that those who seek for the prime Agent of Nature only in rare and pretious Matters, may be grossly mistaken, seeing it may often be found in the most Simple and Common; and often even in those things we tread under foot: So true it is, that Wise Nature, or rather the infinite Goodness of God, has so ordain'd the Business, that the Poor as well as the Rich, may partake of the most pretious and valuable Treasures, and as easily arrive to that Sovereign, Universal Medicine, to cure all Diseases; otherwise God could not be said to have dispens'd his Benefits to all Mankind, and his Word, which is infallible, would not be true, when he says, *That he is no respecter of Persons, but that everyone who loves and fears him, shall be accepted by him.* Which shews us, that it is his Will to be known by all Men, and that all those who live in his Laws, may hope to be possess'd of this hidden

den Treasure, to employ the fruits of it to his Honour and Glory, which are the true Sentiments all good Christians ought to have; otherwise they ought never to hope for that Divine Treasure, which God only manifests to his Elect.

Several Authors have written, and among the rest *Pliny*, *Cassius*, and *Isidorus*, That in the time of the Emperor *Tiberius*, who reigned in the time of our Saviour, a certain Person, but Anonymous, an Architect by his Profession, having by an admirable Piece of Skill, set upright again in the City of *Rome*, a great Portico that lean'd to one side, and made the Foundation firm and immoveable: *Tiberius* paid him, and banish'd him the City, forbidding him to return. In the mean time this Person had found out the means to make Glass malleable, and came again to *Rome*, and presented one of these Glasses to the Emperour, who, being angry with him for returning without his Leave, flung the Glass against the ground, which only bruised: That this Workman taking it up again, immediately mended it with a Hammer upon a little Anvil he had brought on purpose, expecting for it the Emperour's Pardon; but it happen'd quite contrary; for that Prince asking him, if there were any other that knew the Secret, he answering no, the Emperour immediately caused his Head to be cut off on the spot, for fear the Knowledge of this Secret, should come to be propagated to Posterity, and that Gold on that account should come to be no more valu'd than Dirt, and consequently all other Metals lose their Esteem and Value. In short, Glass would be more valuable than Gold, if it were malleable, by reason of its Transparency.

Our Age, fruitful in great Men, has had no less Advantage in the Reign of the late King *Lewis* the *Just*, than that of *Tiberius*; since we are assur'd, That a certain Learned Man having found out the same Secret

cret, made a Present of a certain very fine Image to Cardinal *Richelieu*, the then great Patron of Learning, which that great Minister going to take into his hand, the better to contemplate its Composure, the Gentleman who presented it let it fall on purpose, whereupon *Richelieu* seem'd displeas'd; but the Gentleman having taken it up again, mended every thing that had been hurt in the Fall, with that Art, that it appear'd as if it had not been at all bruised; which very much surpriz'd that Learned Minister, as being not ignorant of the Reason; But the Politick Reasons which it is believ'd he entertain'd from the Consideration of the Consequences of that Secret, made him commit the Author of it to Prison. Thus the Fortune he hop'd to make by that important Artifice, ended in perpetual Imprisonment.

Pancirollus, and the whole Cabal of Philosophers and Chymists, attribute that Malleability to the *White Elixir*, which takes away the Frangibility of the Glass, and gives it Extensibility like other Metals: This is what we believe very possible, by reason of the infinite Virtues we are assured that *Elixir* must needs contain; with which also Crystals may be converted into very fine Diamonds, giving them both Lustre, Weight, and Hardness; and also many other Miracles be performed, whereot we shall say no more at present, since they may be seen in all the Books and Writings of the *Adepti*. We will only add, That the *White Elixir* having the Power to change Crystals into Diamonds, the *Red* can convert them into fine Rubies and Carbuncles, and other sorts of Pretious Stones; and equally give to Glass the Malleability, Hardness, and Extensibility of Metal, as we are assured by the Learned *Raymond Lully*.

We will conclude this Chapter, with a particular Secret, which will no less surprize, than appear singular to the Curious, no Philosopher having yet made any mention of it; which may serve to whet their Curiosity to find the Cause of it. Every one knows that Glass is a perfect Metal, because Fire can no more consume it, than it can Gold (as we have heretofore noted,) and that it is impossible to destroy it, or change its Nature, as all those testifie who have writ concerning it, and whereof, most affirm it is the last (Action of Fire or) Work of Art, since every thing may be vitrifi'd, or turn'd into Glass, even Gold it self, tho' it be the most perfect Metal in Nature: Notwithstanding, we can here assure the Reader of the contrary, for we have seen some of the Secret Writings of the Philosophers, which affirm, that by a Fire a little more puissant than the common ones Glass may be perfectly destroy'd, which they have found by diverse Experiments they have made of it with their *Elixir*, whereof they give you some Cases, wherein there has remain'd no Foot-step of the Metal. This will seem a Paradox to many who have read their Books, wherein they have learn'd (as I have said,) that with the *Elixir*, Glass and Crystals may be converted into Precious Stones, and it may seem, as if what I advance, ought either to contradict those Writings, or it self to fall; but to leave no Scruples in the minds of the Reader in so important a Case, I will tell him that they are all in the right; but this Case depends on the different ways the *Elixir* is to be made use of, which may either perfect or destroy the same Subject, according as it is appropriated after particular manners, known only to the Philosophers, who know how to apply it with Judgment. It is the same thing in the Case of curing Diseases, which may be Eradicated by the *Elixir*, how dan-

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gerous, how great, and incurable soever; on provision, that either he that administers it, or he that takes it, knows well the prerequir'd Conditions for making use of it, in making the Dose always proportional to the force and circumstances of the Patient: For otherwise it will be so far from being Sovereign Remedy, that it would totally consume the Radical Moisture by its great heat, and destroy the Body, instead of curing the Disease. This the true Philosophers very well know, who use it only with prudence, knowing in what Circumstances, and with what Caution it is to be Administred, to become a true Antidote against all Diseases, and so prolong Man's Life; which, by this extraordinary and preternatural Remedy may be often snatch'd out of the Jaws of Death, to which ordinary Remedies had betray'd it, which have not vertue enough to re-establish the intemperature of the Elements within us, which this precious *Elixir*, or rather Universal Medicine might do, whereof the Effects seem to be rather Miraculous than Natural, both for its speedy Operation, and (if I may so say,) a sort or species of Resurrection which it performs, by establishing those Persons in a perfect Health, who were just before given over by their Physicians, and in the extreme Agonies of a speedy Death. Wherein we ought to admire the infinite goodness of God, who bestows on the Industry of the Wise and Studious so Sublime and incomparable a Knowledge, to manifest his Power, and immense Love to Mankind.



C H A P. II.

The manner of building Furnaces for making Glass.

BEfore we begin to shew the way of making Glass, it will be necessary to shew the Construction of the Furnaces for that Work. But because it would be impossible to explain the Terms without a great deal of Circumlocution, we have taken care to have the Figures of 'em cut in Copper, and inserted in their respective proper places, that so we may avoid a long Discourse, which when all was done, would not shew 'em so plain as these Figures make 'em.

Agricola mentions three sorts of Furnaces, the first he calls *Fornax Calcaria*, or *Calcar*, which is that where the Fritt is made; this Furnace is made in fashion of an Oven, ten Foot high, and seven broad; this Furnace has two Vaults, the one A. is that wherein the Fire is made, having a hole on the top through which the Flame passes into the upper Vault mark'd B. where it is Reverberated from the Roof upon the Ingredients that make the Fritt, which are laid on the *Area*, or Floor of this Oven or Vault, wherein the Workman takes care to stir them about till they are Vitrifi'd and fully prepared; this upper Vault ought to have a very great Mouth, that the Workman may easily stir about the Fritt, whereas the under Vault ought to have but a little one, as serving only to put in the Wood to maintain a continual Fire, and take out the Ashes.

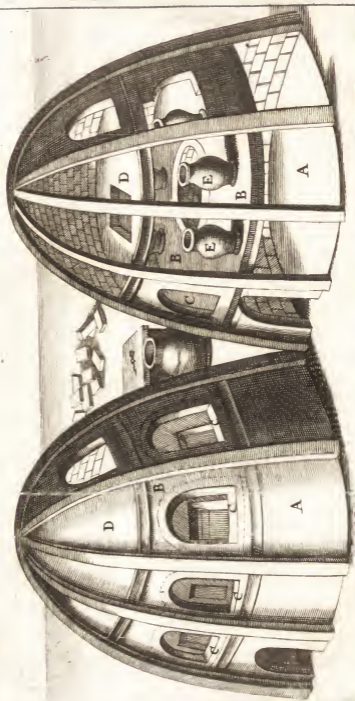
In the time of *Agricola*, they made use only of Coals in the Glass-houses; but the use of Wood, which is among the Moderns, is much better: For

being first of all throughly dry'd, it does not Smoak like Coal, which always makes the Glafs dull and obscure.

The Lumps which lie by the Furnace mark'd C. are the Fritt, which they break when they are too big, to make them fit to go into the Pots for the great Furnace, there to be purifi'd and render'd fit to be employ'd as occasion shall require.

The second Furnace, or rather Oven, *Agricola* mentions, is that where the Workmen labour, or the working Furnace; but the description he gives us of it, is not just; for he makes all these Ovens round, whereas they ought only to be round within, but oval without. Moreover, he adds two Mouths in form of Chimneys, wherein a Servant throws Coals day and night, which is no more now in use, since we only use dry'd Wood, as I have observ'd; which also makes the Iron Grates he mentions, for the Mouth and Ash-hole, of no more use amongst us.

This Oven, whose Diameter ought to be always proportional to the height, is divided into three parts, each of the three parts being Vaulted. That below mark'd A. is the place where the Servant flings in the Wood to keep a continual Fire, and without Smoak; and this lower Oven is call'd the Crown, and the Mouth, the *Bocca*; but there is neither Grates nor Ash-hole, the Wood being cast in on the Coals, care being taken to take them out when there are too many, with a great Iron hollow Shovel. This Oven made like a Crown, to which *Agricola* allows but one hole in the middle of its height, about one Foot Diameter, has notwithstanding, several holes all round it for vent of the Flame, which ascends into the second Oven thro' the middle, where are plac'd the Pots fill'd with
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the Ingredients that make the Glass mark'd E. upon which that Flame perpetually Reverberates.

The second part of this Oven mark'd B. whereof the Vault is round, serves for the Work-men. *Agricola* allots to each of these Ovens eight Arches, nevertheless, we commonly make but six; between each Arch there is an opening or hole, made in fashion of a Window Arch-wise, mark'd C. call'd the great work hole, through which, the Pots are put in, and taken out, which contain the Metal; these great holes are stopp'd each with a Cover, made of the same Lute and Brick that the Oven is, to preserve the Work-mens Eyes from the too vehement heat, and likewise to keep that the stronger in the Oven: In the middle of every one of these Covers, there is a hole somewhat more than a Palm wide, which is call'd the little working hole, through which the Workmen take with their hollow Irons the colour'd, or finer Metal out of the Pots, where-with they make what sort of Vessels they please. It serves also to scald their Vessels when they have occasion, and which rest upon Hooks made on purpose on the sides of those holes, which are call'd according to their Terms, the little working holes.

The Place where they put the Pots in the Oven, is call'd the floor or ground, there are always two to each working hole in the little Glass-houses, the distinction between which, and the great ones, we will give at the latter end of this *Chap.* and in the next. The one, which is the least, is full of fine Metal fit to work; and the other, which is the greater, is fill'd with Metal that is to be Purifi'd or made fine, as we will explain in its place; the little Pot being empty, it is forthwith fill'd again with Matter from the greater, when it is refin'd, with an Iron Ladle; the great Pot being empty, they put into it new Matter to melt and be refin'd,

which is done alternatively that the Workmen may not stand still, and that they may always have wherewith to be employed.

The upper Vault of this Furnace, marked *D*, which is above that where the Metal is melted, and the Workmen work, serves to put the Vessels, that are new made, upon, there to cool by degrees, that place having only a moderate heat; otherwise the Vessels would break if they were too soon exposed to the cold Air. We might also divide that upper Vault into Two, the half of it being enough for cooling the Vessels; and on the other might be made *Balnea Maria*, of diverse degrees of Heat, Sand-Furnaces, or of Ashes, for Purifications, Digestions, Distillations, and other Uses, and may serve for the Preparations of the Ingredients wherewith we make Tinctures for Glass and Crystal, whereof we shall treat in the Sequel of this Book.

The third Furnace which *Agricola* mentions, which he makes of a Square form, and which serves (says he) for making green Glass, is now no more in use, since they are all round within, as we have shewn. The same Author gives diverse forms of Furnaces in his Treatise *De Re Metallica* whither we refer the Curious.

The Ovens of the great Glass Houses are round within and oval without, like those of the little Glass Houses whereof we have already made mention; But there is this difference; that any Ingenious Work-Man can build those of the little Glass-Houses, but there is only one race of Masons in all *France*, who have the Secret of building the great ones, they came from *Caule* in the County of *Eu*, and those only can succeed in it, what, and how nice Observations soever others have made to imitate them, there was never any one yet could arrive to it, insomuch that all those who have any great Glass-Houses

Houfes throughout the whole Kingdom, are obliged to have recourse to that Family to build their Furnaces; and that for want of a due proportion which must be observed, because they must have three degrees more of heat than the little Glass-Houfes, and one inch difference in the Arch and Body of the Oven is enough to spoil the whole process.

These Ovens are built like those we have before mentioned, except as to the proportions which augment the heat three degrees beyond the others: they have Six Arches; two, which serve to heat the Matter before you put it in the Pots, and another to heat the Pots before you put them into the Oven, when there is occasion to change them.

In this Oven each Working-hole has but one Pot in it, and in the further end of the Oven on the other side of the Work-Men, there is a great Pot wherein the matter (or ingredients) is prepared, out of which you take it with an Iron Ladle of Ten or Twelve Foot long, to fill the Pots of the Gentlemen, who Work at the rate the Pots are emptied; after that the great Pot is filled again, with other matter to be refined and prepared as before.

The Materials which serve for building these Furnaces are Bricks for the outward Parts, and for the inner Parts a sort of Fullers-Earth which is gotten from *Beliere* near *Forges*, and which is the only Earth in *France*, which has the property of not melting in this Excessive heat: and it is of this same Earth that the Pots are also made, which will hold the melted Metal for a long time.

The worst and roughest Work in this art, is the changing the Pots when they are worn out, or crack'd: for you must take off the Cover of the great hole of the Oven, or great Working hole, and then take out the Pot which is faulty, and put a New one in

its place through the Flames, and that very speedily; the one is done with only the Hands, and the other with Iron Hooks and Forks. But before they enter on this rough Work, those who do it Cloath themselves with a Garment made of skins in shape of a *Pantaloen*, which they make as wet as possible, and which Covers them all over except the Eyes, and for them you make use of Glafs to see to guide your self: and without this sort of Cloathing which Guards them from the force of the Fire, it would be almost impossible to manage this Change of the Pots by reason of the long time you would otherwise be obliged to employ to that end, and which would be yet more incommoded by the vast and intense heat proceeding from the great Mouth of the Furnace.

Altho' all these Furnaces are Oval without as we have already said, yet I have caused some to be made round in imitation of *Agricola*, thereby the better to distinguish the parts within, which is not so easily done in Oval ones.

C H A P. III.

Of the way of making Glafs, and the Privileges of Gentlemen who make it, and of the Instruments necessary for that Work.

IN the making of Glafs we will distinguish between two ways in that Art, the one of great Glafs-Houses, the other of less; we will begin with the great, altho' the last in use, which is only for making Glafs for Windows, and bottles for Wine or other Liquors, which are afterwards covered with Wicker for Transportation.

The Working of these two Arts is very different, as may be seen in the Sequel of this Chapter: The Gentlemen of the great Glafs-Houses Work only
Twelve

Twelve Hours, but that without resting, as in the little ones, and always standing and naked. This work passes thro' three hands, the first thro' the hands of Gentlemen Apprentices, who gather the matter with their hollow Iron that is in the Pots in the little Working holes, when it is fit to be used or worked, and that till three heats, then he puts it on a Marble. Then a second Work-Man more advanc'd in the Art, takes the Iron and gives it yet three heats more, and setting it on the Marble, makes it into a Lump. Then the Master Work-Man takes it and makes it perfect by blowing it, and making it ready to be Worked: then there comes a Servant with a sharp Tool of Wood, which he thrusts into the end of the Lump or Mass, and the Master Work-Man with an almost inconceivable Address and Art works it at the heat of the Mouth of the great Working-hole, then casts the Plate upon a place prepared on the ground with live Coals, to give time to a Servant of the Glass-house to take it, and carry it to a Furnace which is at some distance from the body of the Oven; whence you take it out again when it is cold. And it is of these Plates they make Window-Glass for the Glasiers.

If the Work of the great Glass-Houses is more rough, than of this less, it is also less Laborious, its Matter being more easily prepared: for without more ado they take their Matter, which is the broken Glasses of the Glasiers, &c. and when it is well heated they put it in the great Pot in the Oven, with Soda, and Fern Ashes, and that of the *Lixivium* or Lye of the Whitsters in a moderate quantity, and when those ingredients are vitrified, and infusion, you must skim them to purifie them, afterwards you distribute this Metal into the Pots of the Work-Men with a great Iron Ladle, as we have said, and after that fill the Pot again with the same Matter, and reiterate the same continually. In

In the little Glafs-Houfes where they make Coach Glaffes, Drinking Glaffes, Cryftals, Difhes, Cups, Bottles, and fuch like forts of Veffels, the Work-Men Labour but Six hours together and then Six more come and take their places, and after they have Labour'd the fame time they give their places again to the firft, and thus they Work Night and Day, the fame Work-Men fucceffively, as long as the Furnace is in good Condition and the Pots don't break, or the Metal run over: for if any of thefe mifchances happen, thofe that are at Work muft leave off till repairs are made.

The Metal in the Pots being ready to Work ought to ftick or be clammy like Glutinous, Vifcous matter, then the Work-Man takes out as much as he has occafion for, with his hollow Iron (which fticks to it as he turns it about in the Pot) this he rouls to and fro on a Marble, the better and more firmly to unite the parts thereof, then he blows gently into his hollow Iron, which raifes the Metal juft as blowing does a bladder; but when he takes breath in the Intervals of blowing, as he muft do often, when the Veffel is large, he muft take care firft to take the Iron out of his Mouth, for fear of drawing in the heat, and apply it to his Cheek. After which he takes the Iron and Whirls it feveral times about his Head, which lengthens and cools the Glafs, and if it be needful he flats the bottom (by preffing it on the Marble) then he gives it to the Master Work-Man, who gently breaks the Collet, or that part of the Glafs which cleaves to the blowing Iron, and cafts it by, among the Common Glafs. Then he takes up this Glafs by fticking it on another Iron rod, to heat or fcald it at the mouth of the Working hole, then with his *Ponreglo* he make fit into Glafs, and with his *Passago*, makes the bowl of the Glafs, and then with his *Procello* he Widens it and makes it more hollow and Capacious.

Then



Then making it plain and even with the Shears, he cuts off what's superfluous, and thus with Blowing, Pressing, Scalding, Amplifying, and Cutting he forms it into what shape he pleases, putting or fastening on Feet when need requires, and with the *Spiei* puts on Rigarines and Marblings. After that a Servant takes them with an Iron Fork, and puts them into the Superior Oven marked *D*, to anneal them. If he does not take special care, he will break the Glass instead of annealing them, this Ware being extreme brittle.

Thus the Workman may make all sorts of Vessels and Figures of Glass or Crystal whatsoever: For it is tractable at pleasure while it is hot, you may mould it, polish it, flower it, piece it piece by piece, and, in short, make all sorts of imboss'd Works, as if it were Wax. You may also paint any Stories on it, either in *Bass* or *Relief*, and tinge it with any sort of Colour even in the Furnace; insomuch, that you may imitate with it any sorts of Jewels or precious Stones; as we will shew in the following Part of this Book.

The Holes of the Oven having each one Workman, they have each of them a large wooden Elbow-Chair to sit in, fixt and immoveable, on which they hang their Instruments; for they always work sitting, in the Summer almost naked, and very few Cloaths on in Winter, only taking care to cover their Heads for fear of catching cold. It must be own'd, those great and continual Heats which these Gentlemen are exposed to, from their Furnaces, are prejudicial to their health, for coming in at their Mouths, it attacks their Lungs, and dries them up; whence most part of them are pale and short-liv'd, by reason of the Diseases of the Head and Breast, which the Fire causes: Which made *Libanius* say, they were
of

of weak and infirm Bodies, thirsty, and easily drunk; this Author assures us, this is their true Character. But I will say this in their Favour, that this Character is not general, having known several of them my self without this Fault.

The Workmen who are employ'd in this Noble Art, are all Gentlemen, for they admit of none but such. They have obtain'd many and large Privileges, the principal whereof is, to work themselves without derogating from their Nobility. The first who obtain'd these Privileges, according to Historians, were the Workmen of the great Glass-houses, and altho' they were not in use till long after the little ones, yet they have out-strip'd them in this point of Honour. It has been a vulgar Error among most People, that this Art Ennobled those that work'd in it; on the contrary, those who obtain'd these Privileges first of all, were Gentlemen by Birth; and their Privileges running, That they may exercise this Art without derogating from their Nobility, is a sufficient Proof of it; which has been confirm'd by all our Kings, and in all the Inquiries that have been made into Counterfeit Nobilities, never any one was Attainted who enjoy'd these Privileges, having always maintain'd their Honour down to their Posterities. I could easily give Examples enough of what I say, if it would not be too Voluminous, and besides the Subject: I will notwithstanding, give some Examples, that the Reader may be convinc'd of the truth of what I assert.

Anthony de Broffard Esq; Lord of St. Martin and St. Brice, Gentleman to Charles d' Artois, Count of Eu, a Prince of the Blood Royal, finding this Art so considerable, that understanding it did not derogate from Nobility, obtain'd a Grant from that Prince in the Year 1453. to establish a Glass-house

in his County, with Prohibition of any other, and several other Privileges he had annexed to it.

The Family and Extraction of this *Sieur de Brossard*, was considerable enough to bring him here as an Example. His great Uncle *Anthony de Brossard*, was Knighted before *Furnes*, and Marry'd *Judith de Ponthieu*. This *Anthony* was Born Anno 1290. Natural Son of *Charles* of *France*, Count of *Valois*, by *Helena Brossard* a Mistris of his, whose Name that Prince transmitted with him to his Posterity, and for a more signal Note of his illustrious Extraction, gave him for Arms three *Flower de Luces d' Or*, on a Field *Azure*, a Bend *d' Argent* round, which his Posterity still carry. Ever after, this *Anthony de Brossard* obtain'd this Grant in the County *d' Eu*, the Elder Sons of that Family have exercis'd that Art, till the latter end of the last Age, when it ceas'd after the Death of *Charles de Brossard* Knight, Lord of *St. Martin* and *St. Brice*, who was kill'd at the Siege of *Chartres*, in the Year 1591. commanding a Troop there in the Service of *Henry* the IV. He was Great Grandfather to *Charles Amedee de Brossard* Knight, Lord of *St. Martin*, Godson of *Madam Roialle*, present Dowager of *Savoy*, first Married to *Francis Chevalier*, by whom he had four Sons; a second time with *Margaret Crespin*, Widow of *Lawrence de Boessel* Esq; Lord of *Tocqueville*, and of *Charles de Brossard* Esq; Lieutenant of Horse in the Regiment of *de la Valliere*, also twice Married, first to *Elizabeth de Monsures Sully*, and the second time to *Mary Margaret le Roy-Cerisy*, both of an Antient and Noble Family of *Picardy*, whereof we have made mention in our Catalogue of the Nobility of that Province.

This Right of making Glafs being so Honourable, since the Elder Sons of the Family of *Brossard*

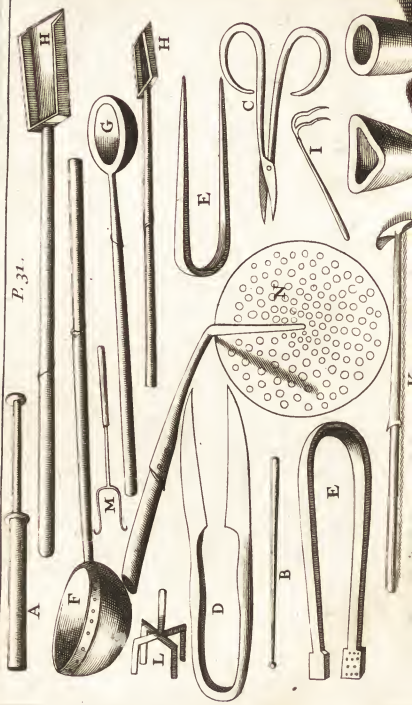
left it off, the younger have taken it up, and continue it to this day.

Messieurs *de Caqueray*, also Gentlemen of Ancient Extraction, obtain'd a Right of Glass-making by an Alliance, which one of their Ancestors contracted by Marriage, in the Year 1468. with a Daughter of *Anthony de Brossard*, Lord of *St. Martin*, who first obtain'd the Grant. That Gentleman giving half his Right for part of her Portion, he was afterwards confirm'd in the Chamber of Accounts.

Messieurs *Vaillant*, an Ancient Family of Gentlemen, obtain'd also a Grant of a Glass-House for Remcompence of their Services; and for Arms, a *Poignard d' Or*, on *Azure*; which agrees with their Name and try'd Valour.

Besides these three Families who still continue to exercise this Art, there are the Messieurs *de Virgille*, who have a Grant for a little Glass-House; Messieurs *de la Mairie, de Sagrier, de Bongard*, and several others have been Confirm'd in their Nobility during the late search in the Year 1667.

We have, moreover, in *France*, several great Families sprung from Gentlemen Glass-makers, who have left off the Trade: among which some have been honour'd with Purple, and the highest Dignities and Offices; but it is not our design to descant further on this Subject, that of our present Treatise being to shew the Art of making Glass; with all its Dependencies, which we will now pursue in the following Chapters.



The Names of the principal Instruments that are used in this Art.

THe hollow Pipe mark'd A. serves to blow the Glass; it ought to be of Iron, with a little Wooden handle on the top.

The Rod mark'd B. ought to be of Iron, but not hollow; this serves to take up the Glass after it is blown, and cut off the former, so that there remains nothing to do to it, but perfect it.

The Scissors mark'd C. are those which serve to cut the Glass when it comes off from the first hollow Iron, when it is given to the Master-workman.

The Shears mark'd D. serve to cut and shape the great Glasses, as also the lesser, to open them and make them more capacious.

The Instruments mark'd E. serve to finish the Work, which the *Italians* call *Panteglo*, *Passago*, *Procello*, *Spiei*, and also *Borsello*, whereof we want the Figure.

The great Ladle mark'd F. is of Iron, the end of the handle being only done over with Wood; it is with this you take out the Metal of the great Pot when it is refin'd, and put it into the little ones for the Work-men.

The little Ladle mark'd G. is also of Iron, and cover'd with Wood at the handle; this serves for skimming the Metal, and taking off the *Alkalick Salt* which swims on the top, as also to take the Metal out of the Pots, and cast it into Water to refine it after a method we shall hereafter treat of in its place.

The great and little Shovels, or Peels mark'd H. and which are hollow, having the edges turn'd up
all

all round except at the End, serve only to take up the great Glassés. The less is called the Little Shovel, and they make use of one like this to draw out the Coals and Ashes of the Furnace where the Fire is made.

The hooked Fork marked I. serves to stir the matter in the Pots; it ought to be all of Iron except the handle.

- The Rake marked K. is also of Iron, and the handle of wood; it serves to stir the matter; as also to move aboutt the Fritt in the first oven.

The Instrument marked L. is for making Chamber-pots.

The Fork marked M. is made also of Iron, and the handle of wood; there are of them of several bignesses, they serve to carry the Glàss-works into the upper Oven to cool them. They make use also of Forks in the Glàss-houses, when they change the Pots in the Furnace.

The great Ladle marked N. is of brass and hollow, full of holes about the bigness of a Pea; its handle towards the bottom is of Iron, and the top of Wood. This Ladle serves to take off the *Alkalick* salt from the Kettles, as fast as the Lee evaporates, as we will shew in Chapter V.

There are also several Moulds both of Marble and Brass and also of Copper, which serve to make their Forks of several Figures, accordingly as the Workman designs them in blowing, which would be too tedious here to describe.

If there be any thing remaining necessary to say of these Instruments farther, or of any others we shall have occasion to treat of hereafter, we will annex them at the End of the Book whither we refer the Reader.

CHAP. IV.

Of the Places whence Polverine, Rochetta, and Soda are gotten which serve for making Glafs and Cryftal, and their differences.

After having delivered the Manner of making Glafs, it will be neceffary to explain whence the Salt that ferves to make it is extracted, fince that is the foundation of the Art, and without it Glafs cannot be made, except it be with the Sand we have mentioned in the Firft Chapter, which will do the bufinefs without any other help, becaufe it contains in it a great quantity of *Nitre*.

It is common to call all Afhes or *Polverine* that is ufed to make Glafs, by the name of *Rochetta*. Heretofore it ufed to be brought out of *Syria* from the Eastern Parts of it, where it grew in great abundance; but at prefent it comes from *Alexandria*, from *Tripoli*, and from *Spain*, where it equally abounds, but is fomewhat different in quality: which we will here acquaint the reader with, for the fake of thofe that are curious and inquisitive. The *Polverine* and the *Rochetta* come from *Syria*, they are the afhes of a certain herb which grows there in great plenty, called *Kali*; the Salt which is extracted both from the one and the other is far whiter than that of *Soda*; hence the Salt of it helps to make a very good Cryftal, but fomewhat verging towards Sky-Colour, the Beautifulnefs whereof is owing to the *Oriental Polverine* (or that of the *Levant*); whereas that of *Soda*, which is more plentiful, makes the Cryftal more blue, and has not that fhining Brightnefs, nor the fame Whitenefs and Beauty.

The difference between the *Polverine* and *Rochetta*, although made of the same Herb, comes from the methods of Preparing them. All sorts of ashes which come from the East for making Glafs are called *Polverine*; because the ashes are truly pulveriz'd, or in powder: And on the contrary, the other is called by the name of *Rochetta*, because it is brought in hard lumps like Stone. The Glafs-men know by Experience that this last is better than the ashes: for those lumps when they are great and hard yield a whiter and sharper Salt than the powder, or pieces that are Less. We should be apt to think that might proceed from the difference of the Plant, or from the different places where it grew, or from some sophisticated Mixtures of *Heterogeneous* Salts, proceeding from Salt Sea-Water, or other damps that might be mixt with it and noxious to it, if we were not assured that it is the preparation only that makes this difference.

It is certain, that to extract a very sharp and poignant Salt from *Rochetta*, there must be a great deal of care taken in its preparation: Those who make it in the *Levant*, first of all make a *Lixivium* of the ashes they have made, with which they sprinkle the herbs they are to burn, after having dry'd them; and thus continuing to sprinkle them each time with new Lee, they make very sharp ashes, which Congeal into great lumps hard as flints, by reason of the abundance of Salt wherewith the herbs are impregnated by the *Lixiviums*; and it is hence that there is more Salt Extracted out of the *Rochetta*.

Polverine, on the contrary, has no such preparation; the herbs are only burnt on Iron hurdles or bars; afterwards, when cooled, they are gathered up and laid by; whence they have less salt than the *Rochetta*; but this Salt has no less virtue or goodness. These two matters are now no more in use in *France* as heretofore;

tofore; but they use them still at *Muran*, where the *Venice* glass is made.

Soda, which comes from *Egypt* and *Spain*, derives its name from the abundance of Salt it contains; it is made of the same herb as the *Polverine* and *Rochetta* of the *Levant*, that is of the same sort and nature with that; and though this herb grows in great quantities in many places, and comes naturally among water, and commonly flourishes near lakes, yet it is planted on the banks of the Mediterranean in *France*, in *Spain*, and *Egypt*, where, by reason of the heat of the Climate, it grows in great quantities; but it has the most Sharpness and is strongest in *Egypt*, where there is never any rain. It is green all the Winter, but they commonly cut it in the middle of the Summer when it is in its full Vigour: After it has been dry'd in the heat of the Sun, they gather it in heaps, and burn it on Hurdles or Grates made of Iron, the ashes falling through into a Pit made underneath on purpose, there they grow into a hard Mass or Stone, and are gathered and laid up for use, and are called *Soda*, as *Lobel* affirms, and their Salt *Alkali*. This Herb called by most *Kali*; has yet diverse other names. The same *Lobel* calls it *Soda*; *Gesner*, *Alkali*; *Dodon*, *Salicornia*; *Thalium*, *Anthilloides*; *Merret*, *Kelp*; *Columna*, *Antillis*, and also *Kali*; of whom this last, says he, found it at *Naples*, and gives a Description of it, and assures us of its fitness for making Glass. In *Languedoc*, where it is found on the Sea shoars, they call it Flour of Crystal, and in *France*, *Salsola*; which *Matthiolus* refutes in his Apology against *Lusitanus*, who saw this Plant grow at *Tergestum* in *Mauritania*, and that there grows great quantity of it near *Salines de Triesse*, in the State of *Venice*; whereupon the same *Matthiolus*, following *Dioscorides*, calls it the common *Alga* of *Venice*, and says that the *Venetians* cover their Glasses which they trans-

port beyond the Seas, with this *Alga*. *John Bauhin*, l. 39. Ch. 2. of his History of Plants, speaks also of this *Alga*; and *Dr. Turner* in his Herbal, gives us an Account of the first knowledge of this Plant, and what names were given it; briefly, those which it has of *Kali*, *Soda*, *Kelp*, *Salicornia*, and *Salsola* and others, are for the most part derived from *sal* Salt. The true name of this herb is *Kali*. There are several sorts of it, but most of them are good for nothing, flying all away in smoke; as does the knotty and thorny sorts of it, or *Kali Spinosum*, which is found in several places about the River *Thames*, and in other Maritime places in *England*, which is the reason that the *English* never make use of it for Glass: for if it be put upon an Iron heated red hot it smokes all away, leaving little or no Ashes thereon; and on the contrary, if that from the *Levant*, be put on the same Iron, it will be soon converted the most part of it, into black and salt Ashes, contracting it self in burning like Worms, flaming a long time, and yields a very white and strong Salt. The *Kali* therefore of the *Levant* is the best of all, according to the Sentiments of most Authors; and that which is found in *Egypt*, which has long leaves and very hairy, has no less virtue.

Lobel thinks that we owe the Plant, name and way to make the Salt, to the later *Gracians* or *Arabian Philosophers*, *Chymists* that wrought in Glass. The name *Kali* that they have given to this Plant comes from its reduceableness into Salt: For *Kal* signifies Salt, whence the name of *Alkali* Salt is derived, which is purely *Arabick*, as the first particle of its name *Al* sufficiently denotes, which makes us of opinion that the *Arabians* were first acquainted with it; the *Chymists* calling that *Alkali* or *Alkalick* Salt that can endure the most violent heat of the fire, without being dissipated.

Amongst

Amongst the *Arabians*, who have written of the virtues of this Salt, we find that *Serapio*, and *Avicenn*, very Learned Physicians, have recommended it as useful against the *Stone*, *Ulcers*, and Diseases of the Eyes: So that it is not only serviceable for making Glafs, but also for Diseases of Humane Bodies.

C H A P. V.

To Extract the Salt of Polverine, Rochetta, and Soda, for making Glafs.

Those who undertake to make Glafs, must begin by providing good *Rochetta* or *Soda*, to Extract the *Alkali Salt* of it, which is the Basis or Foundation of their Work. The best, and that which contains the most Salt, may be try'd by touching it with the Tongue, and tasting what Salt it contains. But the most sure way of all is, to make an Essay of them in a melting Pot, a thing common in this Art, and which the Work-men very well know.

To extract the Salt of *Rochetta* or *Soda*, which is commonly in lumps, you must first reduce it into a fine Powder: Heretofore, Stone Mortars were in use for that end, with Iron Pestels; after which, they sifted it through a fine Sieve, and put the pieces that remain'd in lumps behind, into the Mortar to be pounded again, and so till the whole was sifted off; but at present we make use of Mills, which do the business with more Expedition and less Charge; besides this way it is immediately reduced or ground to a fine Powder, which is notwithstanding, afterwards sifted, and the lumps that remain put into the Mill again, until all be ground

into a fine Powder: for in this consists the Art of Extracting more or less Salt.

And as Salt cannot be Extracted without the help of Water, you must set up Coppers with their Furnaces like those of the *Dyers*, bigger or less, according to the greater or less quantity of Salt you design to make. Then you must fill these Coppers with fair Water, and make a Fire with dry Wood, that you may not be molested by Smoak: and when the Water begins to boil, you must put in ten Pound of *Tartar* Calcin'd to a white Colour, (for reasons we will shew hereafter in the Preparation of this *Tartar*) to every hundred Pound of *Soda*, you put in, according to which proportion you are always to regulate your self; then you must stir it with a long wooden Ladle that it may dissolve apace; after that, you must put in as much Powder of *Rochetta* or *Soda*, as it can contain, regulating your self according to the greatness of your Coppers, and the quantity of Water in them; you must continue the Fire, and stirring with the Wooden Ladle in the Copper till all the *Polverine* is Incorporated with the Water, and the Salt extracted all out of it. The Water being one third part boyl'd away, you must fill the Coppers again with fresh Water, and continue to make them boyl till half be consum'd; then the Lee will be made and the Salt extracted.

Your Lee being thus made, slacken the Fire under the Copper, and set in order as many Earthen Pans as you shall have occasion for to contain it. Those Pans must be very well glaz'd, or first stand fill'd with common Water for six Days. Then you must fill those Pans with the Lee and Ashes together with great Brass Ladles; then let them stand so six Days, that the Ashes may settle to the bottom, and the Lee become clear. Then again
pour

pour off that Lee into other Earthen Pots, leaving the Ashes behind, and let it stand so two Days longer, and the Lee will become very limpid and clear, for all the Earthy Fæces will precipitate, and settle at the bottom. You must continue to do thus three diverse times, to have a most clear and limpid Lee, which will yield a very fine and perfect Salt. You might avoid these three times shifting it, if you filter'd it off, but that would be very troublesome, by reason of the great quantity of Water you would have to Filter.

The Coppers being empty, if there remain yet any Materials to extract the Salt from, you must fill them again with Water, putting in each ten pound of *Tartar*, as before, and after that a proportionable quantity of *Polverine* or *Soda*, and continue to work as we have explain'd, till all the Salt be Extracted. After which, you must wash the Coppers well with fair Water, then fill them with the said refin'd and clarifi'd Lees in the Pans, which you must cause gently to boil to evaporate the Water till it begins to thicken and shoot its Salt; which it commonly does in about twenty four Hours time, so that the Salt begins to appear on the surface of the Copper all white. Then you must take a great Skimmer full of holes, and put it down to the bottom, and the Salt will fall upon it, which Operation must be repeated, letting the Lee all drop out of it again into the Copper before you remove the Skimmer from it. Then must you put this Salt into the same Earthen Pans you made use of before, the better to drain the Lee that remains, which must be sav'd and put into the Copper again, then dry the Salt; continue this work till all the Salt be gotten out of the Copper.

I must here acquaint the Reader, That he must make a gentle and easie Fire as soon as the Salt begins to shoot, for fear the Salt should stick to the Copper, the which a great Fire will cause it to do, and so burn it, which often happens to those that don't take such precaution. This reason ought to oblige those who work in this Art to procure Vessels well lin'd within with Lead, such as they use to boil *Alum* in; besides these Lees being sharp and corroding, destroy and consume the Brass by degrees, or the moisture cankers it, and so it spoils the colour and beauty of the Salt.

The Salt in the Earthen Pans or Pots being well drain'd, must be put into little wooden Tubs or Fats, the better to dry out all the moisture, according to the Season wherein it is made; then beat it grossly, and put into a Furnace moderately heated, there gently to dry. It being thus thoroughly dry'd take it out of the Furnace, and pound it in a Stone Mortar, or grind it in a Mill, and afterwards sift it through a fine Sieve, the holes whereof are not bigger than grains of Wheat. This Salt being thus prepar'd, ought to be kept in a dry and convenient place where there is no dust, to make Fritt of Crystal, as we shall teach in the following Chapter.

The goodness of the Salt depends very much on the *Tartar* that is mixed in it, which serves not only to make the quantity greater by attracting more Salt from the Matter, but also to make it whiter too; which also makes the Crystal finer, and more transparent; and by its means we commonly get eighty or ninety pound of Salt from three Hundred pounds of good *Polverine* of *Levant*, without which it could not be done.

Tartar is made by Wine; it sticking round about the Hogsheds and Pipes, in little hard lumps,
and

and never among the Lees of the Wine, which are always moist and at the bottom; that of red Wine is extraordinary for this use, containing much more Salt, and that more sharp than the *Tartar* of White-wine. It must be Calcin'd for the space of six Hours in the second sort of Furnaces we have mention'd, in a moderate heat, that all Heterogeneous parts may be consum'd, and that it may become whiter, and more easily dissolvable in Water. Experience testifies, that this way of Calcining *Tartar* is better than when less time is bestow'd on it. The secret manner some *Chymists* proceed herein, shews us of how great importance it is for the *Tartar* to be thoroughly dry'd: They powder it grossly, afterwards gently Calcine it, or rather dry it in the Furnace on Tin Shovels, which makes it cream far better than any other way. By this Preparation the *Tartar* more thoroughly dissolves in the Water, and you Extract more easily, and in greater quantity the Salt of the *Polverine* or Powder of *Rochetta* or *Soda*, for it opens the Body of it, and by penetrating into it, becomes united perfectly with it, which would not otherwise arrive so well. After the same manner the Body of *Nitre*, in making *Aqua Fortis*, or Spirit of Salt is open'd by the *Alum* and *Vitriol*. It is for this reason also, that we have taught to dissolve the *Tartar* in the Water in the Furnace before you put in the *Polverine* or *Soda*.

C H A P. VI.

The way to make Fritt for Crystal.

THe name *Fritt* is generally known in all Glafs-Houfes, for the firſt Preparation of Matter to make Glafs and Cryſtal, and which is made in the firſt Oven, call'd *Calcar*. To ſeek the Etymology of it, will not be neceſſary to our preſent purpoſe. It is apply'd to the drying the Matters in this Furnace, where they are reduc'd into great and little lumps.

We think it ſufficient to ſay, That to make fine and perfect Cryſtal, there muſt be had Matter Fuſil and capable of being render'd white and transparent in the Fire. We have already told you that Salt is the firſt and principal Matter for this Work. Here we will add that the next, and which gives Glafs its conſiſtence, body, or hardneſs, is Sand or ſome ſorts of Stones; juſt as Copper gives conſiſtence to *Roman*, *Dantzick*, and *Hungarian* Vitriol and others: which would otherwiſe run into Water in moiſt places. Whence it comes to paſs that the cleareſt and moſt transparent Glafs, made of the fineſt and moſt pure Salt, will diſſolve in Earth, or in moiſt and cool places, if there be more Salt proportionably than Sand or *Tarſo*, by a ſeparation natural to thoſe two Matters; it is for this reaſon that ſome aſſert, that putting Poiſon extracted out of Minerals, into *Venice* Glafs, the great cold of it will diſſolve the Glafs. All this depends on the Compoſition of the Fritt, wherein the quantities of Salt and *Tarſo* ought to be rightly proportion'd to one another to make the Glafs more or leſs fixed.

Several

Several Authors have given the name of *Tarso* to all the Matters which give consistence to Glass when they are Calcin'd. *Agricola* in his 12th Book, says, That white Stones when melted, are the best Ingredients in this Art; for this reason they ought rather to be employ'd than any others for making Crystal. *Pliny* says, that Authors affirm, that of these Stones in *India*, Glass is made so excellently transparent, that no other is comparable to it.

The *Venetians* who make Glass in the Isle of *Muran*, as well as those in *Italy*, make use of a white Flint, which they have out of the River *Ticinus*, where there is a great abundance of them: As also in the River *Arnus* both above and below *Florence*, and in other places. They use also a rich Sand full of Salt, which they find in *Tuscany*, and in the Vale of *Arnus*; as also a sort of hard white Marble, which is found in *Tuscany*, known to every Body; it grows at the foot of the little Mountains of *Pisa*, of *Sarvavezza*, *Massa* and *Carrara*; that ought to be chosen out which is very white, which has no black Veins, nor yellow or red stains in it. Of all of these Materials may be made very white *Tarso*, and also very fine Glass and Crystal.

Ferrandus Imperatus, l. 24. c. 16. makes mention of *Quocoli*, and thus speaks of it: The Glass Stone is like in appearance to white Marble, being somewhat transparent; but hard as a Flint, whence being struck, it will sparkle, and put into the Fire turns not to Lime; that it is of a Light green, like the Serpentine Stone, having Veins like *Venice* Talke; that being cast into the Fire, it ceases to be transparent, and becomes white and more light, and at length is converted into Glass.

It is certain that all white and transparent Stones, such as will not become Lime are very fit for making Glass: That all Fire Stones, and those which strike

strike Fire when they are Calcin'd, and reduc'd to an impalpable Powder, and sifted through a very fine Sieve, make an incomparable, pure and fine Cryſtal: And all the Art conſiſts in reducing the *Tarſo* to ſuch fine impalpable Powder; but the great trouble of doing it, has made the Glafs Men give it over.

They make uſe now a-days much more of Sand than of Flints, becauſe there is little or no expence in its Preparation, which only conſiſts in waſhing it clean, and afterwards drying it, and ſifting of it before you uſe it, and that is all; this is the firſt Matter or Ingredient for making Glafs; but Flints being found better, and more fine, they afterwards made uſe of them; nothing but the *Parcimony* and *Covetouſneſs* of the times, has brought the other in uſe again, becauſe Glaſſes made of that may be afforded cheaper.

Cryſtal requires a ſoft and white Sand, common Glafs one more rough, hard and grating like a File. Sands differ very much from one another: For ſome will melt quickly, and mixing with the Salt immediately be converted into Glafs; others again will endure a ſtrong Fire; but in general, there is no Sand but what may be made into Glafs.

To make Fritt, you muſt have two Hundred pounds of *Tarſo* prepar'd as we have ſhewn, or of fine Sand; and mix therewith about one Hundred and Thirty pounds of Salt, alſo prepar'd after the manner we have ſhewn in the precedent Chapter. Care muſt be taken to mix theſe two Materials well together, then to put them into the Furnace to be Calcin'd, after it has been well heated, to make the Fritt. During the firſt hour the Fire muſt be moderate, and the Fritt continually ſtirr'd about with an Iron Rake, that the Materials may the better incorporate; then the

Fire

Fire must be encreased to a very strong heat, for the space of five hours, continuing always stirring the Fritt with the Rake, which is very necessary to the Preparation of it. After the space of five hours the Fritt (having had sufficient Fire,) will be made and reduc'd to lumps about the bigness of a Filberd, which (if it be enough,) in breaking will be light and white, without any yellow: for if you find any of that, you must put it into the Furnace again till it loss that yellow Colour which it will infallibly do. By how much the more the Materials are stirr'd and Calcin'd in the Furnace, they will be so much the more refin'd, and melt more easily in the Pots. After this, you take it out of the Furnace and let it cool, then you lay it on Boards in a dry place, otherwise, the moisture would cause the Salt to melt into Water, and only the *Tarso* would remain behind, which of it self could never be made into Glafs. After this you cover it well for fear of dust; for you must take a great deal of care and caution to have a fine Crystal.

The Fritt thus made, ought to be as white as Snow; but during the time it is making, you must try whether the quantities are well proportion'd or not; which may be done by putting some of the Fritt into a Crucible, and afterwards on a clean piece of Glafs, where it may be seen whether it be well made, by its joining together, and being clear: If it be too hard, or too soft, you must encrease or diminish the quantity of Salt in it, which those experienc'd in the Art know very well how to do at first sight. This being well prepar'd, and kept in a dry place, will last three or four Months, nay, it will grow better, and more fit to unite together speedily.

C H A P. VII.

Another way to extract the Salt of Polverine or Rochetta, which makes Crystal as fine and transparent as natural (or Rock) Crystal.

THIS way of Extracting the Salt of *Polverine* is far more laborious and troublesome than that we have taught in *Chap. V.* and yields less Salt; but it makes a very noble Crystal, nay finer than the natural, so that it is fit for the finest, most nice and exquisite uses.

To make it, take *Polverine* of the *Levant*, well ferced, and put it into Glass Cucurbits, or Bodies luted at the bottom the height of four Inches, fill them with common Water that is very clear, put them on a Sand Furnace, or of Ashes, and let them have a moderate heat for some hours, till half the Water be evaporated: After that you must put out the Fire, and let them cool, then decant off the Water gently into glaz'd Earthen Pans. Then pour fresh Water on the *Polverine* remaining in the Bodies, and let it digest as before, on a Sand Furnace in a moderate heat, and repeat this till the Water has extracted all the Salt: Which will appear to the Eye when the Water is void of all Colour, and to the tast when it is no longer Saltish.

Then take these Lees, and filter them into other glaz'd Pots, and let them stand five or six days, that what ever is Earthy in them may settle to the bottom; then filter these Lees again; then they will be purifi'd and separated from most part of their Earthy Matter.

After the Lees are thus purifi'd put them again into Glass Bodies luted at bottom, as before; and

and set them in a Furnace of Sand, or Ashes, there to evaporate all the Water over a gentle heat; taking notice, that when the Matter begins to dry, you must still make the Fire more gentle, for fear the Salt should be burnt. This Salt being dry, you must take it out of the Cucurbits or Bodies, and see whether they are not cracked, which often happens, by reason of the strength of the Salt: In that case you must put the Salt into other Cucurbits, luted at bottom as the former, and fill them again with common water, and place them again as before in a furnace of Sand or Ashes with a gentle fire, to dissolve the Salt, and that till an Eighth part of the Water be evaporated: then put out the Fire, and let it cool, then Empty this Water impregnated with the Salt, into glaz'd Earthen Pans; and let it stand 24 hours, afterwards filter it diligently, that it may be the better Purified, and separated from its *faces*, and the rest of the dregs, or terrestrial particles.

Then you must again put these filtred Lees into the same Cucurbits if they are not cracked, and if they are, into others; then put them on the Furnace to evaporate the water over a gentle Fire, which you must still make more gentle when it is almost evaporated and the Salt begins to dry, lest it should burn. Then after it is dry pour upon it fresh water to dissolve it, then filter it again as above and reiterate these processes till the Salt be perfectly purified, and there remain no *faces* nor Earthy matter left in it.

With this Salt, and some very white *Tartar Serc'd* to an impalpable powder, may be made so fine and transparent a *Crystal*, that it will surpass the natural as we have said. This will not be deny'd by the curious who know that all depends on the purity of the materials which are made use of, and that nothing can be brought to perfection without it.

C H A P. VIII.

Some Observations for a Golden Colour in Crystal.

Cold being the purest and most perfect Metal in nature, must needs require Materials very pure to imitate it. This obliges us here to note, that to make a *Crystal* of a fine Gold Colour, the Fritt must be made with fine Salt of *Polverine*, prepared and purified after the way above delivered, which is the only means of obtaining it: For if there should be mixt any of the Fritt made of the Salt Extracted after the common way by help of *Tartar* as in Chap. 5. the colour would be very imperfect, wanting the true Splendor and Beauty. We will treat further of it in *Lib. 3.* where we will also shew the way of Tinging *Crystal* and Glafs of all other sorts of Colours, for which the ordinary Fritt will serve.

C H A P. IX.

The way to Extract Salt of Fern, which will make a fair Crystal.

THe daily Experience of Salt of Fern in the Glafs-Houses, assures us of its usefullness in making Glafs. It grows (in *France*) in great abundance in the Woods and among the Mountains. It ought to be cut from the End of *May* to *Mid-June*, in the Encrease of the Moon; For then it is best, and yields more, better and whiter Salt than at any other time: For if it be let alone till it dry of it self on the Ground, it will give but very little Salt, and that not good neither. It must therefore be cut in the
full

full Growth, just as it is run to seed which is about the time we have mentioned; then let it dry and burn it. You will have from it very good ashes, from which observing the Rules we have given before for the Salt of *Polverine*, may be extracted a fine and good Salt; which being afterward purified, with it and *Turfo*, or very fine Sand, a Fritt may be made which will yield a very fair *Cryſtal*, much better than the Ordinary, and will be ſtrong, and bend much more than one would conceive the nature of *Cryſtal* would permit; So that it may be drawn into fine threads, as has been often Experimented.

With this Fritt may be made a fine Gold Colour, if you mix no Salt of *Tartar*, as we have ſaid, and which will be as fine as that which is made with Salt of *Polverine*. This is as good as the first to make all ſorts of Veſſels which will be as fine alſo, if the Salt be well purified.

It is a Vulgar Error that *Fern* and other Capillary herbs have no ſeed, for they have it in great quantities, like duſt, and of a dark brown Colour on the back ſide of their leaves: Nay, *Moffes* alſo abound in ſeed: As is evident in an undeſcribed ſort of *Chamaepence*, which is like a *Laryx*, in the branches of the *Fern* and betwixt each Leaf you'll find an abundance of round and browniſh ſeeds, provided it be Cut at the time I have mentioned: For it is very neceſſary to take notice of the times and ſeaſons that all Plants and Trees ought to be cut in, that they may answer the Ends deſigned. For Extracting of Oyls and Spirits of Vegetables in *Chymiſtry* for *Medicinal* uſes, they muſt be cut a little before their maturity, whether you uſe the Stalks or the Leaves: For then they will yield one half more than at another time, as Experience teſtifies.

C H A P. X.

The way to make a Salt of feveral Vegetables, which will produce a Cryftal of a wonderfull Fineneſs.

WE have told you in the 4. *Chap.* that the Salt which ſerves to make Glafs, is Extracted from *Polverine* of the *Levant*, from *Rochetta* and *Soda*: And in the 5. *Chap.* we have ſhewn the way to Extract it; but in this we will further acquaint you that any Vegetable that abounds with *Alkalick* Salt, is proper to make Glafs and *Cryftal*, by preparing its Aſhes according to *Chap.* 4.

Several Plants are good for this purpoſe but thoſe that grow near the Sea ſide are always the beſt, becauſe they acquire a great deal of Salt by their nearneſs to the Sea. *Alga* is one of them which is generally found on moſt Coaſts, ſome call this Sea-Moſs, and which is if I may ſo ſay, a ſort of Excrement or the Refuſe of the Sea. This Herb when gathered, if it be kept freſh and moiſt ſome time, will ſhew afterwards its white Salt on the ſurface of its leaves. The Inhabitants of thoſe parts nigh the Sea commonly gather it together on the ſhore, and drying it by often turning it in the Sun, as Hay is made; After it is dry they burn it, and its Aſhes yield an *Alkalick* Salt fit for making Glafs and Allom. The Engliſh make uſe of it for both, and call the Aſhes *Kelp*.

Pot-Aſhes are alſo proper on this account. They come from *Poland*, *Ruſſia*, and *New-England*; and are Aſhes for the moſt part of Firrs, and Pines, and their Apples. The Salt of all ſorts of Aſhes may ſerve for common (or green) Glafs, notwithstanding that of the Aſhes of the common Thistle

is the best, but all sorts of Thistles are good. Next to Thistles Hops are the best, taking both stem and branch, when the Flowers are gathered. Among Trees the Mulberry is the best, (C. M. says the Bramble-Bush) as also *Gemista Spinosa*, and Hawthorn; and Black-Thorn which bears Blackberries, and among the Sea Plants, *Kali Spinosum*. So that it seems that those Plants which are Thorny and Prickly afford in their kind the best and most Salt. All Rushes also and Reeds which grow in Marshes, and in Pools, and in Ditches of Water, and on Banks of Rivers, yield a great deal of Salt fit for these purposes.

Next to the forementioned are all bitter Herbs, as Hops, Wormwood, *Carduus Benedictus*, Centauries, Gentian, Southernwood, Tanseywood, which they use in dying Wool, the Heads of Poppy, and several other Plants whereof Ashes may be made with small charge and in great abundance: to which may be added Tobacco, which grows plentifully in *Virginia* and several other *American Islands*, the stalks whereof picked and burn'd yield a great quantity of Salt, and might turn to great profit, tho' some damage would accrue to the Soil: For the stalks being left there and putrifying on the ground turn to dung and enrich the Soil by their Salt.

All *Leguminous* Plants have the same Virtues, and are as good for our use; The Ashes of the Cods and Stalks of Beans yield an admirable Salt for making *Crystal*: Peas, Fetches, Millet, Lupin, and Lentills: as also Cabbage-heads, and several other sorts of Plants. Add to these the Milky Plants, all sorts of Tithymals or Sparges, *Catapodium*; the Fig-Tree, Vine-branches and Sow-Burdies, which have Milk like the Tithymals.

Of all the fixed Salts which are extracted from Plants, observe that those are best which are freest from Earth, and all sorts of Heterogeneous Bodies, and which are united in the hardest and whitest lumps, and are most sharp to the taste.

That the best Ashes, and fullest of pure Salt, run soonest in the Furnace. That those are the best Ashes of Vegetables, which are made while they are green, and of the biggest Branches. That those Salts must be diligently kept in a dry place, remote from any moisture that may be hurtful to them. That some of these Ashes make whiter Glafs than others. That the Ashes of Oak which partake of a Vitriolick nature, make Glafs of a darker colour: And Ash and Haw-thorn, their Salts being more *Nitrous*, make the whiter Metal.

Agricola treating of the Salts which serve to make Glafs, gives the first place to *Nitre*, the second to white and transparent Fossil-Salt, the third to the Salt made of the Ashes of *Anthyllis*, or some other *Saline Herb*.

Some have given the first place to the Ashes of *Anthyllis*, and not to *Salt-Petre* or *Nitre*, for want whereof, they have made their Glafs of two parts of Oak-Ashes, and for want of that, of Beech and Firr, one part of Sand, and a little Sea-Water Salt, and a little *Manganese*; but that Glafs is neither white nor very transparent. Now these Ashes are to be made of old Trees, whose Trunk when grown to six Foot high is bor'd hollow, and Fire being put into the Cavity, the Tree is burnt to Ashes: This is done either in the Winter, when Snow has lain long on the Ground, or else in the Summer, when it has not for some time rain'd; because the Rain in other Seasons is apt to make the Ashes foul, by mixing Earth with them. For this reason, it is better to cut the Trees down, and burn them

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within doors; thus far *Agricola*. But time and experience have worn out the use of *Salt-Petre* and *Fossil-Salts*, which have given the priority to *Polverine*, the other being all too soft and gentle, whereas Glass requires Lixivial and fixed Salts, that have a caustical and strong taste, and that have but little Unctuousity, wherewith *Nitre* and *Fossil-Salt* abound, and therefore run most of them into *Sandever*, unto which *Nitre* comes somewhat near in taste and fatness. But *Agricola* and other Authors, seem to mistake *Pliny*, who puts *Nitre* for those *Alkalizate* Salts: For he says. *Lib. 31. Chap. 10.* never much *Nitre* was made of the Ashes of Oak.

Virgil also seems to use the word in the same sense, *Georgic. 1. Semina vidi, &c.* as Mr. *Ogilby* has Tranllated it,

I have seen many would anoint their Grain

With Nitre first, then Lees of Oil would spread.

This kind of good Husbandry he expresseth before, when he says,

*Nor with rich Dung spare hungry Grounds to feed,
And unclean Ashes on poor Champains spread.*

These latter Verses prove clearly, that Salts enrich the Soil, and it is most certain, that Earth wherein there is no Salt, will be Barren. Wherefore the word *Nitre* in the former Verses must signifie either Salt extracted from Ashes, or the Ashes themselves wherein the Salt is contain'd. And to the same purpose are those other two Verses in the same Book.

To burn dry Stubble on the Barren Fields,

In crackling flames oft handsome profits yields.

Now in burning the Stubble, nothing but Salt is produc'd, the nature whereof is to destroy Weeds; which having been a long time and strongly rooted in the Earth, take away the Nourishment from the Grain new sow'd, make the Ground Barren, and

consume the Seed. Besides we may add, that Salt and Ashes destroy the Worms which might otherwise eat the Grain; and that Salt strew'd in Mould in Gardens kills Worms and Weeds. But the coldness of *Nitre*, as my Lord *Bacon* affirms, is an Enemy to all sorts of Grain; but he forgot, without doubt, that there is a way of preparing it, whereby it is so far from being an enemy to Grain, that a Bushel of it mixt with this Preparation, will yield more than four without it. *Nitre* may be extracted from Sea-water, and some Vegetables, but in the Furnaces it would run almost all of it into *Sulphur*.

C H A P. XI.

To make a very fair Crystal of Salt of Lime.

THe Salt of *Lime* wherewith they make Walls in Building, is no more in use in making Glass. It is much stronger than the ordinary Salt, and being well purifi'd, you may put two pound of it to an hundred pound of Salt of *Polverine*, whereof a Fritt must be made and purifi'd well, as we shall shew in the following Chapter; of this Fritt you may make common Glass, and also Crystal, and Crystalline fair and beautiful.

Evantas Imperatus recommends the Salt of Testaceous Fishes, such as Oyster-shells, &c. as very proper for making Glass. There may be made of these Shells a very good Lime proper for Cement, and which yield a very strong Salt; but though this Salt makes the Glass white, yet it is not so transparent as that made of *Kali*, and will most of it run in the Pots into *Sandever*.

C H A P. XII.

The way to make ordinary Fritt of Polverine, Rochetta, and Barillia of Spain.

Fritt is nothing but a Calcination of the Materials mixt together, which make Glafs. Altho' those Materials would melt and be converted into Glafs without this Calcination, yet Use and Reason have dictated this way, since otherwise it would take up a great deal both of time and labour. To avoid which, this way of Calcining the Materials in Furnaces to make Fritt was found out, which being rightly made, and the Doses in the Composition of it justly observ'd, it may be immediately put into the Pot to be clarifi'd before you work it. Fritt made of *Polverine* makes ordinary white Glafs; that which is made of *Rochetta* of the *Levant*, makes a very fair Crystal; and that which is made of *Barillia* of *Spain* makes a Glafs not so white and fair, being commonly somewhat unctuous, which makes the Glafs incline to an Azure or blueish Colour. We will not repeat here the Preparation of the Materials, nor the way of Calcining the Fritt, since we have done it sufficiently in the precedent Chapters; we will only say, that to one hundred pounds of *Barillia*, you may put eighty five or ninety pounds of fine *Tarso*; you must regulate that Dose according to the Goodness and Fatness of the *Barillia*, which Experience will teach you. Then you must take six or eight pound of good Sand, and mix it with the Dose after having well wash'd, dry'd, and sifted it, and of the whole you make a Fritt which will yield a very white and fair Glafs.

This Fritt being Calcin'd in the Furnace, you must take it out hot, and throw upon it three or

four Pails of cold Water, and then put it in a moist and cold place, after which, you must from time to time sprinkle it with a small Lee (which we shall presently shew you how to make) for the space of two or three Months, which will make it as hard as Stone, so that you cannot break it without a Hammer; then it will melt easily, and in short time in the Pots, and makes a very white Glass almost like Crystal, and easier to work. The Lees which communicate to it their Salt, cause this Effect, and augment the Fritt; if your Lees should fall short, or you had none, you might water it with common Water, which, altho' it is not so strong as the Lee, yet it is useful.

To make this small Lee, you must use the Earthy parts or *Feces* that settle in your Earthen Pots when you make strong Lees, whereof we have spoken Chapter V. you must fill those same Vessels with common Water a little heated, and let it stand therein long enough to extract the Salt that remains; afterwards you take out that Water gently with an Iron Ladle without troubling the *Feces*, and filter it to clarify it, and afterwards let it stand some time to settle, and then keep it for the use above-said. These Lees will be still pretty sharp and full of Salt, communicate it to the Fritt in watering it, and by this means none is lost.

In our Modern Times wherein the Workmen rather seek to Abbreviate than Embellish their Work, there are but very few who take the pains to water their Fritt after this manner we have shewn; and that only to save the time they must employ in doing it, for the Water costs nothing. Notwithstanding, as that Fritt is the finest, most fruitful, and most easie to melt, we thought it worth our while to mention it in this Chapter, for the sake of those that are more curious in their Work-Houses.

C A A P. XIII.

The way to make very fine and perfect Crystal.

THis *Crystal* will be white, very bright, clean and beautifull if the Workman take care in managing it. You must take of the *Crystal-Fritt* prepared as in *Chap. 6.* and put it in a Pot in the great Furnace, putting into it little by little, and at some interval of time, as much *Manganese* of *Piedmont* as is sufficient after it has been prepared, as we shall shew *Chap. 18.* The *Fritt* being thoroughly melted, you must take out the Pot, and put it in a great earthen Vessel full of Cold water, or in clean wooden Vessels. This way of putting the *Fritt* into water serves to take from it the *Sand-ever* which is noxious to the *Crystal*, and makes it obscure and cloudy, and very disagreeable to the Sight.

Then put it again into a clean Pot, and being melted, cast it again into Water; which must be repeated, until the *Crystal* be separated from all this sort of Salt. In the last place, let it stand 5 or 6 days in the Pot in the Oven to boil, and stir it as little as possible with the Iron, for it is apt to discolour it, and make it blackish. Being well boil'd and clear, see whether it hath *Manganese* enough, which may be known by inspecting it, (*viz.*) if it be white; but if it be still greenish, you must add more *Manganese* to it, and then let it boil till it be clear, and of a shining Colour.

The Property of *Manganese* added to it in a due quantity is to perfect the *Crystal*, and take from it a foul and dull Green, and give it a bright and shining Whiteness.

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You must take heed to add it little by little, and and by degrees, as we have observed, otherwise it will rather spoil than perfect the *Crystal*, blacking it and taking away its Lustre. All this depends on the Skill and Discretion of the Workman, for there is no Certainty or standing Rule for the quantity to be added. As soon as your *Crystal* is fine and shining, you may use it without delay for what Vessels or other Works you design to put it to; but in the mean while you must have less Fire than for common Glass, and it must be very clear, and without smoak, for the Reasons we have given heretofore.

Moreover the Workman must take care that his Iron Rods be clean and well polished, and that the Necks or Collets of the Glasses where the Irons touch them, be always kept out of the Pots of *Crystal*, because the Iron always discolours the *Crystal*, wherefore particular Care must be therein taken.

None of our modern Workmen, (or at least very few of them) take the pains of this way of separating the *Sandever* from their Materials, by casting them into Water; they content themselves to skim it off with an Iron Ladle when it swims on the top, tho' if it does not all separate, the *Crystal* and Glass will be less clear and fine. This Salt which the *French* call (*Suin de Verre*) *Sandever* is useful for Several Purposes, and in several *Chymical* Operations. It has besides some other Uses and Virtues, that are not known, even to very few of the Learned; I could tell some very surprizing and wonderfull uses of it. But this may serve to whet the Industry of, and excite the Curious to further Enquiries.

C H A P. XIV.

To make Common Glafs become white and Crystalline.

IF you put in a Convenient Pot Fritt of *Polverine*, whereof I have shewn the Preparation in the precedent Chapters, you'll have a Common white Glafs. If you add Salt of *Rochetta* to this Fritt, you will have a very fair *Crystal* Glafs, which is between ordinary Glafs and *Crystal*. To make it very fine, you must add the same dose of *Manganesse* of *Piedmont* prepared as for *Crystal*, in the precedent Chapter: For the *Manganesse* takes away all Greenness from the Glafs and makes it very white. If you would have a very fine Glafs, you must always cast the *Crystalline* Matter into Water: you may also do the same by common Glafs to bring it to Perfection. After that put the Matter in the Pot again, and being melted, put it again into Water: repeating this till it be purified and made fine, as we have noted: and then employ it to the Uses design'd.

To have a Glafs finer than ordinary, this casting of it into the Water must be very exactly observed; for besides its whitening, it is there calcin'd and purified, and has fewer Blisters, and Pustles. But to raise the Matter to the Perfection I speak of, you must mix together 100 Pound of *Crystalline* Glafs, and as much common, and put to it 20 pound of Purified Salt of *Tartar*; that will give a Glafs and *Crystal* more than Ordinary fine, and fit for use; provided you always take care not to mix with it the Collets of the Glafs which has touch'd the Iron Rod, for they always make the Glafs blackish, and are only fit for green Glafs. We will
add,

add, that the addition of twenty pounds of Salt of *Tartar* to 200 pounds of Glafs ought to be when the Fritt is making, that they may the better incorporate together according to the way we have shewn. Here follows the way of purifying Salt of *Tartar*.

C H A P. XV.

The way of Purifying Salt of Tartar.

TAKE *Tartar* of Red Wine, the biggest Lumps, Calcine it in Earthen Pots in a strong Fire till it becomes black, and all the unctuousity be exhale, and till it begins to grow White; then put this *Tartar* into earthen Vessels glazed, which fill with common Water, and boil it over a gentle Fire; so that in the space of two hours the fourth part of the water may be evaporated: Then take them from the Fire; and when the Water is cool and become clear, decant it off gently without troubling the *Faces* or Sediment, and you'll have a strong sharp Lee. Then fill the Vessels again, wherein the *Faces* remain, with common Water, and let them boil as before; then let them cool again, and decant them off as before, and repeat this till the Water become insipid: This being done filter the Lees, and put them into Glafs Bodies to Evaporate in the Ashes at a gentle heat, and there will remain at the Bottom a very white Salt. Take this Salt and dissolve it again in common Water, and let it stand still two days, that the *Faces* may settle, than filter it and evaporate it at a gentle fire as before. Then you will have a Salt whiter than the former; continue this Process of dissolving, filtering, and evaporating it three or four

four times and you'll have a Salt whiter than the Snow it self, purified from all its Tereftriety; which being mixed with *Polverine*, *Rochetta*, or *Soda*, and the requisite Dose of *Tarso* or Sand, being made very fine and well ferced, will yield a very good Fritt, and that a *Cryftalline* and common Glass, finer and better than that before.

C H A P. XVI.

General Remarks for all Colours.

THe first time a new Pot is put into the Furnace, it always leaves some Sully's or Foulness on the Glass, which spoils the Colours: For this reason they always begin to melt white Glass in it first, which afterwards they pour out again into another Vessel, to make common Glass of it, this the Workmen very well know: But the second time there will appear nothing of this foulness.

Particular care must be taken, that when you prepare Materials for tinging Glass, the most whereof are extracted from Minerals, to do it in a separate Furnace: or not to have any Vessels in it, that you use for *Cryftalline* Materials; for the smoak of Metals and Minerals make *Cryftal* pale and uneven. The Vessels or Pots which serve for one Colour must not be made use of for another, and every Colour ought to have its own Pot. Care must also be taken not to Calcine the Materials more than is necessary, for then they burn, and become good for nothing.

As a Proportion ought to be kept and minded in every thing we do; so we will here lay some down, which must not be exceeded, whether for Fritt or Colours. Notwithstanding when the Workman makes

makes any Essay, if his Colour be not deep enough to his mind, he may add as much as he shall think necessary. Which sometimes depends on the Preparation of the Metals, more or less Calcin'd, and often on the Fancy of the Workman.

It is necessary also to be observ'd, that all the Dose of the Colouring ought not to be thrown on the melted Glass at once, but at several times, and in proportion according to the quantity of it, stirring each time the Materials that they may both mix and incorporate, and at the same time to prevent them from rising and running over. We shall acquaint you with several other Particulars on this Subject, in the Chapters wherein we shall treat of particular Colours, where they will be of more advantage to the Reader than to amass them altogether in one Chapter.

We have heretofore acquainted you, that the Furnaces ought always to be very well heated with hard, dry Wood, and not with green or wet Wood, which causes a Smoak that spoils the Work, which requires a vivid strong Fire, and must be taken great care of.

C H A P. XVII.

The way to prepare Zaffer to tinge and colour Glass.

MIrret speaking of *Zaffer*, and of the Latin word *Zaffera*, says it comes from *Germany*. It is taken by some for a preparation of an Earth to tinge Glass blue, by others for a Stone, and by him for a Secret; asserting that there are but few Authors who make mention of it, and no one that tells us what it is. We will here give you the sentiments of some Authors who speak of it, whence the Reader will see, that Authors are undetermined about it.

Cardan

Cardan in his 5th Book *de Subtilitate*, calls it a Stone, his words are these, *There is another Stone which colours Glafs blue, some call it Zaffer.* *Julius Scaliger*, who has compos'd a Treatise of Glafs, does not at all reprehend *Cardan* for calling it a Stone; *Casalpinus* after *Cardan*, l. 2. c. 55. reckons it also among Stones, thus he speaks of it; *There is another Stone colouring Glafs blue, and if you add too much it makes it black, they call it Zaffer; it inclines from an Ash to a Purple Colour: It is heavy and brittle, and melts not of it self, but with Glafs runs like Water.*

Ferant. Imperatius, l. 28. c. 8. says that this Stone is very like the Loadstone and *Manganese*; but the Learned *Agricola* without doubt knew it not, for he makes no mention of it.

Anselmus Boetius of *Boot*, Physician to the Emperor *Rodolphus II.* who has given us a large History of all sorts of Stones and Jewels, has allotted no place to *Zaffer* among those he mentions, altho' it be brought from *Germany*, according to the Sentiment of *Merret*, who says *Zaffer* is a Compound, asserting it is neither Earth nor Stone, not mixing at all with Water, nor breaking, as is easie to remark, by squeezing it between the Fingers. That certainly, if it were either of these two, it would have been discovered by the Diligence of those that have treated of it, being of so great use to those who make Glafs. Which makes that Author say, that *Zaffer* is a Secret, whereof the Composition was found out by a *German*. That if he might give his Conjecture of it, he should think it made of Copper and Sand, and some proportion of *Lapis Calaminaris*; that the blue Colour it gives seems to be owing to the Brass, as that of *Manganese* to Iron. That only Minerals can tinge Glafs, and that no Materials can be found for that purpose, except

except Metalline Ones. Wherefore he concludes, that the matter which composes *Zaffer* can only be either Copper or Brass.

The only Preparation of *Zaffer*, according to *Merret*, is to grind it into a very small Powder and force it through a fine sieve. But *Neri* gives us one which makes the Glafs much finer, which is this. Take *Zaffer*, in the biggest pieces you can get, put it into Earthen Pans, and let it stand one day in the Furnace, Then put it into an Iron Ladle to be heated red-hot in the Furnace, take it thence and sprinkle it with strong Vinegar; being cooled, grind it fine on a Marble-stone, after which wash it with warm Water in Earthen Pans, letting the *Zaffer* settle to the bottom, and decanting off the Water gently; this will separate the foulness and impurity from the *Zaffer*, which will remain at the bottom pure and clean, which you must dry and grind again, and keep it in Vessels well closed for use; this will tinge Glafs much better than at first.

Pometus in his general History of Drugs, makes mention of a Mineral brought from *Surat*, of a bluish Colour, or like a Partridge's Eye, which he calls *Zafer*, *Safre*, or *Sapher*, to which he ascribes the same Virtue of tinging Glafs blue.

C H A P. XVIII.

To prepare Manganese, called by some Magnese, to whiten and tinge Glafs.

M*anganese* is called by that name by Reason of its Resemblance in the Colour and Weight to the Loadstone: It will not only give a blue Colour, but also Green, according to *Virgil*, whereupon thus the Commentator, The Green, says he, is watry, and

and is in all sort of Glass, so that *Manganese* may not improperly be said to be the Soap of Glass. Moreover it will tinge Glass Red, Black, and Purple: and, one may say, it is the most Universal Ingredient in all sorts of Colours; as this Work will shew.

This kind of Load-stone is at present called *Manganese* or *Magnese*, according to *Cesalpinus* and *Albertus*: it is made use of in Glass because it is thought it attracts the Liquour in Glass into it self as the Load-stone does Iron; and without doubt it is this sort of Load-stone that *Pliny* and *Agricola* treat of, who assert that it Attracts the Liquor of the Glass into it self, that it purifies it, and that of Green or Yellow it makes it White, and that afterwards the fire Consumes it.

Lucretius would perswade us that the Name of *Magnes* was given to the Load-stone from *Magnesia*, a certain Country in *Lydia*, near *Macedonia*, where it is found, so it is no wonder that that Species of it we use in Glass retains the Name of *Magnese* and so *Manganese*, since the Country called by that Name produces it. The Ancient Philosophers, call also every thing *Magnesia*, that has a Magnetical Power of Attracting the Occult Virtues of the Heavens and Astral Influences to it. They call also *Magnesia*, Virgin Earth, and Sacred, saying that is the Mother of all things, the only Espoused of Heaven, whence all Fruitfulness is derived. They also mention two sorts of *Magnesias*, the one Simple, the other Compound. They speak little of the simple, as being a light, spongy sort of Earth, to be found almost every where; but much of the other, which is a more Concocted and brittle matter, which Covetous *Pluto* takes care to Lock up among the Treasures of his Kingdom, Concealed in the Belly of *Aries*, under the sign of *Capricorn*, according to some *Astrol. Al-*

chymists, and which some Philosophers have called *Antimonium Saturninum*, by Reason of their Resemblance.

Pliny mentions several sorts of Load-stones, and gives the differences of them, and tells us the Places where they are gotten; but without going farther, that which we call *Manganese*, and which serves to tinge Glass, comes in great abundance from *Germany* and *Italy*; but that of *Piedmont* is the best known, insomuch that the *Venetians* hold it in such esteem, that they make use of no other: For and that found among the Mountains of *Viterba*, and in the State of *Genoa*, contains much Iron, will give a black colour; on the contrary that of *Piedmont* gives a very fine colour, takes away all greenness and makes it very white, observing the due Dose.

The Preparation of *Manganese* is much like that of *Zaffer*, you must put the pieces into an Iron Ladle, and put it into a Reverberatory Fire, and when it begins to whiten sprinkle it with good vinegar, afterwards beat it and wash it while hot, as you do *Zaffer*; after that dry it, and reduce it into powder, and Sift it, and keep it in a vessel cover'd for use.

The best is easie to break, and very shining, the great and less pieces of it full of Rocky Matter as can be.

CH A P. XIX.

To make Ferretto of Spain which serves to Colour Glass.

THe Name *Ferretto* comes from the *Italian* and *Spanish* according to *Cesalpinus*, to whom we refer the Reader, *l. 3. c. 5.* It is called *Ferretto*, because it is found in Iron Mines, and commonly *Ferretto of Spain*, because the most part of that sold here in these parts, and which is the best of any found in Mines, comes from thence. There is some black like Iron, and which communicates its colour to the Matter wherein it is used, which is the reason it ought to be chosen; for good *Ferretto* is known by its being Red, and being beaten, imitates the colour of *Cinabar*, which it always does when it is pretty well calcined.

Pometus in his History of Drugs *l. 2. c. 18.* says that the *Lapis Hamatites*, is what we commonly call *Ferretto of Spain*; that this mineral is of a reddish colour, hard, weighty, and pointed with long and sharp points; that it is brought from Several places, forasmuch as there are no Iron Mines in which 'tis not found; that the name *Hematites* is given it from the Greek *Haima*, which signifies Blood, because this stone is good for stopping blood; and it is called Blood-Stone because it is the Colour of Blood; and *Ferretto*, because it is found in Iron Mines.

Pliny makes mention of Five sorts of *Hematites* or Blood-stones. In *l. 36. c. 20.* he gives a Description of them which he takes from *Sotachus* an Ancient Author, and pretends that they have a Magnetick Virtue in Attracting several sorts of Metals to them.

Anselmus Boetius of *Boodt*, who has largely treated of the Virtues of the *Lapis Hamatites*, no where

calls it by the Name of *Ferretto*, nor makes any mention of it.

C H A P. XX.

To make Ferretto of Spain for Tinging Glass.

ALtho' *Ferretto* be found in Mines, yet it may be artificially made much better, as I shall shew in the following Chapter.

Excellent *Ferretto* used to be made heretofore in *Cyprus*, and at *Memphis*, the Metropolis of *Egypt*, but it is no more used in *France*, whether by reason they make no more of it there, or that we bring it no more from those Places, I cannot tell.

Neri and *Merret*, who have written of the *Art of Glass*, use only Copper or Brass to make *Ferretto*: We will give you their Preparations; but true *Ferretto* cannot be made without Iron or Steel, altho' Iron and Copper are somewhat of a like Nature; since 'tis easie to convert the former into the latter: wherein there is far more Virtue for several Operations than in the Natural Copper, and it is finer, more pure, and redder.

An ordinary way of making *Ferretto* is this; Take Filings of Iron very clean, and Sulphur beat to Powder, put them in a Crucible Layer over Layer, or first one Layer of Sulphur, then one of Filings, and so on, beginning and ending with the Sulphur; which is called Stratification, or *Stratum super Stratum*. After that you must cover the Crucible with another, or with a Tile, and lute it close, and set it into a Furnace with Coals round it for six hours, encreasing the Fire every two hours, that is, the two first hours let the Fire or Coals be half a foot from the Crucible; the two second about a quarter

of a foot, and the two last let it be covered all over with Coals. Then, the Matter being cool'd, you must pound it small, and keep it for Use.

C H A P. XXI.

Another Extraordinary Way of making Ferretto of Spain, which is a great Secret.

THIS way of making *Ferretto* is not common, nor much known; wherefore we will here teach it for Satisfaction of the Curious. It is of a very wonderful use, not only for Tinging Glass, but for several Chymical Operations, wherein we know the use of it, which is very surprizing, if a second and further Preparation be made of it, whereof we shall here make no mention, it being foreign to our Subject; but take that which serves for Tinging Glass as follows.

Take very fine Steel, for in the Perfection of that consists all the Excellency of the Work; make it into thin Plates, or file it: also do the same with Copper or Brass, *viz.* make that also into thin Plates, or take the Filings of it, one part to two of the Steel; put them into a Crucible *stratum super stratum*, lute them, and put it on a gentle Fire for Eight Hours, then take it out, and melt the whole in a Wind-Furnace, then cast it in a Lingot, or in little Plates, and the business is done.

To make use of this in Glass, you must calcine these Plates, then pound them, and searce them, and keep that Powder in a Pot close shut up for use.

C H A P. XXII.

Another Way of making Ferretto of only Copper, for Tinging Glass.

N*Eri* and *Merret* give the Name of *Ferretto* of Spain to the following Preparations, in this and the next Chapter; asserting that it communicates several very fine Colours to Glass. The different ways of Calcining Metals, causes different Effects; which is known to the Experienc'd in this Art.

If the *Ferretto* we have taught in the precedent Chapters, be of vast use in Glass, and very serviceable in Pastes, Enamels, and Glass of Lead, by reason of the great Resemblance it causes to Precious Stones; this and the following are of no less use.

Take thin Plates of Copper or Brass, cut them into pieces, and put them into a Crucible, in the Bottom of which you have laid a Bed of Sulphur pulveriz'd, then a Layer of Copper; then another of Sulphur, and then again of Copper: which you must thus continue *stratum super stratum*, till the Crucible is full. Then cover over the Crucible with another, or with a Tile, and lute it well, and dry it, and put it into a Furnace among hot Coals in a good brisk Fire for the space of two hours. Then take out the Crucible, let it cool, and you will find the Copper or Brass calcin'd, which will break and crumble between your fingers like dry earth, of a blackish Colour. You must pound it to a fine Powder, and searce it and keep it in a Vessel well closed for use.

C H A P. XXIII.

Another Way of making Ferretto of only Copper for Tinging Glafs.

THIS second way of making *Ferretto* is something more troublesome than the former, but its Effects in Glafs are far finer. In this method you must take *Vitriol* instead of *Sulphur*, wherewith you stratifie the thin Plates of Copper in the Crucible just as in the precedent Chapter, then set this Crucible to Calcine in the Mouth of a Glafs-Furnace, which the *Italians* call *Occhio*, and the *French* the *Little Working hole*, where it ought to stand for the space of three days. Then take out the Crucible and add to the Copper new Rows or Layers of *Vitriol*, stratifying it as before; then you put the Crucible in a Reverberatory Fire in the same place as before; which you must continue to do for six times successively one after another, and then you will have a very Excellent *Ferretto*, which you beat to Powder, and it will tinge Glafs of Extraordinary Beautiful Colours.

C H A P. XXIV.

To make Crocus Ferri, commonly called Crocus Martis, to colour Glafs.

WE will shew several ways of preparing *Crocus Martis*, some more Simple, others more Extraordinary and Curious, both with and without Liquors or *Menstruums*, whereof the effects are different both in tinging Glafs, and other uses, to which

it is put. *Crocus Martis*, which is made without *Menstruums*, depends on a very fine Calcination of the Iron, by means of which the Tincture that is Extracted, gives a very fine red to Glafs, and so communicates it self to it, that it not only manifests it self, but makes all other Metalline Colours (which Ordinarily are hidden and dead in Glafs) appear fair and resplendent.

As to the way of *Menstruums*, we may say that all *Acid* and *Corrosive* juices which Operate on Copper, will also do the same on Iron, so that you will always have a red Colour, more or less bright, and which may be mixed with Tinctures of other Metals to cause other different Colours.

We don't in this place understand by our two methods of dry and wet (or with and without *Menstruums*) for the preparation of *Crocus Martis*, those two ways which the Philosophers speak of, in the same Terms, their dry way or method being only a certain Vitrified matter, and their wet or *Menstruous* one, a sort of sweet * Liquor without any *Corrosive*, wherein Metals will dissolve like Ice in warm Water, and which afterwards cannot be reduc'd again into Metals by any way whatsoever.

The first way of making *Crocus Martis* take as follows; Take very fine filings of Iron, or those of Steel are better, mix them in a Crucible with three parts of Powder'd Brimstone, *Stratum super Stratum* (Commonly noted thus *S S S.*) Calcine them four hours at a very strong Fire, till the Sulphur be Consumed: then take the Crucible out of the Fire, and let the matter Cool, then grind it to very small Powder, and searce it through a very fine Sieve, then put that Powder into a Crucible, and lute it well, and put it into the Mouth of a Reverberatory Furnace for

* Such as Van Helmont's *Alkabel*.

the space of Fifteen Days or more ; and of the Reddish Colour it was before it will become a very deep red almost like Purple : keep it in a close Vessel for the use of Glass Colours ; it will work many wonderful Effects.

C H A P. XXV.

Another way of making Crocus Martis for Colouring of Glass.

TH O' this second way of making *Crocus Martis* be very Easy, yet it ought to be Esteemed ; since it tinges Glass of the true red Colour of Blood ; it is prepared thus. Take filings of Iron, or, which is better, of Steel ; mix them well in Earthen Pans with strong Vinegar, only sprinkling them so much that they may be thoroughly wet, spread them in Pans and set them in the Sun till they be dry, or if the Sun be hid by the Clouds set them in the open Air ; then Powder them, and sprinkle them again with Vinegar, and dry them as before, then Powder them again, and repeat this Process Eight times ; at last grind and searce them well, and you will have a very fine Powder of the Colour of beaten brick, which keep in close Vessels for use.

This *Crocus Martis* thus made with Vinegar complies very much with Greens, and the Emerald Colour of Glass of Lead. It is used also in Pastes for the same Colour with Verdigrease, and in Blacks.

CHAP. XXVI.

Another way of making Crocus Martis with Aqua Fortis.

C*Rocus Martis* may be prepared a third way, with *Aqua Fortis*, by which the red Colour of Iron is made yet more manifest in Glass; wherein it is so very resplendent and bright, that it seems almost incredible, if experience did not shew it.

Put fine filings of Iron or Steel into glaz'd Earthen Pans, sprinkle them with *Aqua Fortis*, and set them to dry in the Sun, and then reduce them again into Powder, and repeat this process several times, as you have done with the Vinegar, in the precedent, Chap. and having obtained a good red Colour as before, Powder it and searce it, and keep it for use.

CHAP. XXVII.

Another way of making Crocus Martis with Aqua Regalis.

THis is a fourth way of making *Crocus Martis*, and perhaps the best of all, because in them you cannot find such Diversities of Colours as in this.

Dissolve, filings of Iron or Steel, in a Glass Body well Covered, in *Aqua Regalis*, then in *Aqua Fortis* made *Aqua Regalis* with *sal Armoniac*, as we shall shew in the second Book. Keep them so three days, stirring them every day well, during which you may add fresh filings little by little, wherein you must be very Cautious: for it riseth so much by Fermentati-

on in the *Aqu. Reg.* that it will endanger breaking the Glafs or running over. After three days fet your Cucurbite on a gentle Fire, that all the Water may Evaporate till it leaves the *Crocus* behind dry, which is admirable for Tinging Glafs, which keep for use.

CHAP. XXVIII.

Another way to make Crocus Martis.

THIS way tho' it be eafy makes a *Crocus* of no lefs Virtue and Beauty than the precedent. To make it take fine filings of Iron or Steel without any rust, let them stand in a Reverberatory Furnace with a very strong Fire, the heat being at least to the fourth degree, till it becomes of the Colour of Purple. Then take it out of the Fire, and when it is Cool, put it into a Vessel full of Water, and stir it briskly about, and then presently pour off the Water into another Vessel, which you may reiterate. Thus there will remain in the first Vessel the Iron that is not yet Calcined, which if you please you may put again into a Reverberatory Furnace; In the second Vessel there will be the *Crocus* which fet over a gentle Fire to evaporate the Water. But you must not decant off the Water tho' it appears clear after it has settl'd: for tho' the *Crocus* may seem to be precipitated to the bottom, yet the Water Contains the most subtile parts of it imperceptibly suspended in it. Having well Evaporated the Water you will have a very red Powder, very fine and Extraordinary, which keep for use.

C H A P. XXIX.

The last way of making Crocus Martis.

THis last way will be of some use to those who shall desire to have the Iron or Steel Granulated, or in little drops, the Metal whereof is difficult to Melt. Take a bar of one or the other Metal, of the weight of five or six pounds, which heat as hot as you can in a Smith's Forge, so that it may Sparkle when it comes out of the Fire: At the same time another Person must have ready a long stick of Brimstone and large which is the best for this Operation, and the Metal coming out of the Fire in the condition we have shewn, you must thrust them one against another over a great Earthen Pan full of warm Water, into which the Metal will drop in little drops, or granuli, melting like Wax, when touch'd by the Sulphur; then you must take those little grains, and Stratific them in a Crucible with Powder'd Brimstone, and afterwards sett them in a Reverberatory-Fire, where they will be reduc'd to a red Powder, which grind and scarce and keep for your use.

C H A P. XXX.

The way to Calcine little Plates of Copper, to tinge Glass of a blue Colour.

WE have shewn the way to make *Crocus Martis* for Colouring Glass, and now we will shew that of Copper, which is very near in nature to the other as we have remarked; And which dis-
solves

solves in the same Acids and Corrosives. *Venus* as well as *Mars* (or Copper as well as Iron) gives us different Colours, which proceed from different ways of preparing them, as we shall see in the following Chapters.

Merret pretends that Brass gives us a finer blue than Copper, by reason of the *Lapis Calaminaris* which is mixt with it, and partly causes the Colour.

Of all Metals Copper is only used (as Allay) to give malleability to Gold and Silver in Coin: It melts easily in an indifferent heat, but it is calcin'd into powder with difficulty. There are several ways of Calcining Copper, here follow five of them by help of fire. The first is of Copper alone without any addition; the second by the addition of *Sulphur*; the third by *Vitriol*; the fourth of Brass alone divers ways; the fifth by a preparation of the *Vitriol* of *Venus*. These preparations are the best, and of more value than those prepared by Spirits and Corrosives. All these different ways of Calcinations and Preparations of *Venus*, shall be explained in several Chapters of this Treatise, whither the curious Reader may have recourse.

The little Plates or Leaves, whereof we are now to shew the preparation, are a sort of Copper or Brass exceeding thin, approaching the Colour of Gold, called Festoons. These Plates are made of this Colour by *Lapis Calaminaris*, which does not only Colour the Copper, but augments its weight; this Brass being well calcined tinges Glass of a Blue, and Sea-Green. The way to calcine it is this.

To avoid the expence of buying new, you may make use of those leaves that have been already used and worked, they being good, and cut them with Scissors into little pieces, and put them into a
Crucible

Crucible covered and luted, in the mouth of a Furnace to Calcine, and let them stand there for four days, at a Coal fire, so that the leaves may not melt: For then they would be unfit for this use. The four days being expired, the whole will be calcined, beat them on a Porphury Stone, and Searce them thro' a fine Sieve; and you will have a blackish powder, which you must spread on Tiles, and put it into the same Furnace for four days longer; then take it out and blow off the ashes that may be fallen on it; then reduce it again into Powder, searcing it thro' a fine Sieve as before, and keep it for use.

You may know when it is well Calcined, if the Glass rises and swells when you put it upon it, if it does not you must calcine other leaves, those being not Serviceable by reason they are burnt in the Calcination.

C H A P. XXXI.

Another way of Calcining these leaves of Copper to make a very transparent Red, Yellow, and Chalcedony.

TAKE the same leaves as in the precedent Chap. Cut them into small pieces and Stratifie them with Sulphur pulveriz'd, in a Crucible covered and luted. Then set them on burning coals at the Mouth of the Oven to Calcine for Twenty Four hours; then take it out and grind it small; then put it in an Earthen Vessel in a Reverberatory Furnace, where leaving it 10 hours, take it out and powder it, then keep it for use.

C H A P. XXXII.

To calcine Copper to a Red Powder, which serves in several Processes for colouring Glafs.

ALtho' Copper be of the same nature as Brass, which serves to Colour Glafs blue, yet there is some difference between them, for the latter will tinge it of several Colours, which proceeds from the *Lapis Calaminaris*, and some other mixtures in the preparation.

To make this powder, Take what quantity you please of Copper in thin plates, put it into a great Crucible into the Furnace, till it be calcined, without melting; then being cooled, reduce it into powder which will be very red, and searce it; whereof you may make divers uses as we shall shew hereafter.

C H A P. XXXIII.

To make Copper thrice calcin'd for colouring Glafs.

THE same red Powder in the preceding Chapter serves here. Take of that Powder and put it on Tiles, and calcine it again in the Furnace four days; it will become black, and coagulated into one Mass: Powder it and searce it, calcine it again 5 or 6 days in the same Furnace, and it will become grey without coagulating any more, or running into Lumps, and will be in a condition fit to be dissolv'd. Of this Powder which the *Italians* call *Ramina di Treccotte*, is made Sky-colour'd blue, the colour of *Turcois*, the green of *Emerald*,
and

and several other colours. It must not be calcined above thrice, for it would no longer Colour Glass. You may know if it be calcined well, by casting some of it in a Pot of boiling Glass; if it swell as we have said before, if not, you must set it yet Twenty Four hours longer in the Furnace, or rather begin a new Process.

C H A P. XXXIV.

Another way of making thrice calcin'd Copper with less charge and more ease.

Workmen who seek ways to spare their pains, will find this way of Calcination less Expensive than the others, and almost of equal beauty: Take the Scales which the Brasiers make when they hammer Pans, Kettles, or other works of Brass, as being much cheaper than new Copper. To calcine these Scales there is no need of Stratification as we have shewn before in other Copper, which is troublesome; they need only be well washed from all foulness; and being well dry'd, put them into one or more Crucibles, and set them just into the Mouth of the Reverberatory-Furnace for the space of four days: Being at length cool'd, pound or grind them and searce them. Then set that powder a second time in the same Furnace to reverberate during four days longer; and you will have little Balls of a black Colour, which you must pound and searce again, and then put them the third time into the Reverberatory; and after four other days reduce them to powder as before; thus it will be prepared with less Expence, and as good to colour Glass, which will be easy to see by making tryal on melted Glass: For if it makes it rise when you cast it on, it is right.

C H A P. XXXV.

Another Calcination of Copper call'd Æs ustum.

THe best and finest *Æs ustum* we have in *France* is brought from *Holland*; but several curious persons make it themselves far finer. That which makes the Beauty of the *Dutch* is the Sea-Salt, that they add to the Sulphur, and which they mix together in Powder to stratifie the Copper in a Crucible covered and luted as we have shewn; they take $\frac{2}{3}$ of Sulphur and one third of Sea-water Salt; then they put the crucible on a hot fire of Coals, where they leave it till the Sulphur be wholly consumed. After that they take it out and it is of an Iron-gray, and reddish within: the Tincture it gives Glass is very fine, and it is also serviceable for other Uses.

C H A P. XXXVI.

Another better way of making Æs ustum.

Curious Gentlemen who employ themselves sometimes in Chymistry, and do not grudge their time and charge as the Workmen doe who get thereby their lively-hood; have far finer and more Ingenious preparations of *as ustum*, which render it of greater virtue, and more Power to tinge, We will only give the reader one of them.

Take thin Plates of the Reddest Copper which is the hardest sort, make it red-hot in a Crucible or otherwise, then extinguish it in a Lee of Urine, wherein common Salt has been dissolved; and reiterate this process till the Copper become of the colour

of Gold both within and without. After that you must cement those Plates with two parts of Sulphur, two parts of Salt-Petre, and one part of Vitriol calcin'd *ad rubedinem*, the whole reduc'd to powder, wherewith you must stratifie those Plates in a Crucible, pressing close each Layer or Row; then you must cover it with another Crucible mouth to mouth, the upper having a hole bored at bottom, then lute them well together. The Lute being dry put the Crucible in a * Round Fire during six hours, and hot ashes underneath. The first two hours the fire must be one foot distant from the Crucible the two second hours one half foot nearer; and the two last hours quite close covering the Crucible; You must take special care that the matter does not melt, and that the fire be not too great, for that would spoil all. The Crucible being cold, you must take it out, and emptying the matter pound it well; this is what we call *As ustum*. To make it fit for use you must wash it, to take away the Sulphur, and then dry it and keep it in a close Vessel.

There are other curious Persons who make an *As ustum* yet finer than this, and more penetrating in Colours; but the preparation is more costly and requires more time; for instead of Brimstone and Salt-Petre they make use of a purified Sulphur and fixed with *Sal Armoniac*; and instead of ordinary red *Vitriol* they use *Roman Vitriol* which they prepare with Lee of Urine, and a fusil Salt, which afterwards they put in a reverberatory. But since the others serve well enough for colouring Glafs, and are easier to make, we shall not here give you the preparation of this last which would be too long, and being more serviceable to several other purposes which Experience testifies.

* *Wheel-Fire.*

C H A P. XXXVII.

The way to make Crocus Veneris.

Since we have shewn the way to make *Crocus Martis*, it is but reasonable we should now shew you how to make *Crocus Veneris*. We cannot pass by in silence the *Crocus* which may be made of the *Æs ustum*, we have taught in the Precedent Chap. tho' we are certain the Glafs-Makers will not make use of it, by reason of the length of time requir'd for preparing it: But the curious who are Ignorant of it will be glad to know it, wherefore we here shew it to oblige them. Take as much *æs ustum* of the Precedent Chap. as you please, add to it its weight of good Verdigrease, and as much *Sal Armoniac* fix'd and fusil; pound the whole together well, and dry them over the fire in an Iron Fire-shovel: Then pour into the shovel Lee of Urine, and make the whole boil till the Lee be entirely consum'd; Then put on more of the same Lee; boil it till the Lee be consumed as before, and reiterate it a third time. Then pound or grind the Matter and put it in a Reverberatory to Calcine well, then pound it again into an impalpable Powder, and put it into an Earthen glazed Pot; pour upon the same Lee of Urine, wherein you dissolve it, viz. to each pound of Lee, four ounces of *Sal Armoniack* fix'd and fusil. Then boil the whole over a little fire in ashes for a quarter of an hour, then decant off that Lee into some fit Vessel, for that will contain the Tincture of the *æs ustum*, and of the Green which it has Extracted. Put more Lee upon the Matter, and boil it yet a quarter of an hour over the same Fire, then decant off that Lee to the former;

mer; thus continue to water it with fresh Lee and decant it off to the former as long as it will extract any Tincture from the matter. Then take all these tinctured Lees, and filter them thro' whited brown paper, then Evaporate three quarters over a gentle Fire. And put the remainder into an Alembick, with the Helm (or head) on, and the Receiver, and distil it till it be dry: Then you will find at bottom of the Alembick a *Crocus Veneris*, of a very wonderfull Virtue for colouring Glafs and other Chymical Operations, and some Medicinal Uses.

C H A P. XXXVIII.

Another way more easie to make Crocus Veneris.

AS those who apply themselves to this Art, are not all equally curious in their Work, and good husbandry being in fashion in this Age; we will shew some more easie ways, and more ready to make *Crocus Veneris*, whereof this is one.

Take very thin Plates of Copper, put them into an earthen Pot with common Salt, *S. S. S.* and put this pot on the Furnace, where let it stand till the matter be very red: Then put the Plates with the Salt into cold Water, and wash them well to take away all Blackness. Reiterate the stratification of these plates with common Salt, calcining them at the fire, and washing them as before, as often as you please. After the last time pour warm water on that where the Plates have been extinguished, and then let it stand still some time, then empty it, and you will find at the bottom of the vessel a *Crocus Veneris* red as blood. You must wash it well several times to cleanse it, then dry it well with

with a linen cloth, and keep it for use to colour Glafs.

There are some who content themselves to take *Æsufum*, prepared with Sulphur and common Salt, as we have shewn heretofore, and to heat it red-hot in the Fire nine times, and quench it as often in Linseed Oil; then dry it and powder it.

CHAP. XXXIX.

Another easy way of making Crocus Veneris.

WE now give another easie way of making *Crocus Veneris*. Take of Copper simply calcin'd one part, of *Sulphur vivum* eight parts well powdered; mix them together in a large Crucible, which then set on a Coal-fire in a little Furnace, stirring the Matter continually with an Iron Rod, till the Sulphur be consumed; and reiterate this Process five or six times, then cast it thus refin'd into an Earthen Pan of boiling Water, stir it often with a Stick while the *Calx* descends to the bottom, then the Water being settled and clear, evaporate $\frac{3}{4}$ to extract the Crystals, or rather evaporate the whole, and you'll find at bottom of the Vessel a *Crocus Veneris* very fine and red.

CHAP. XL.

The first Colour of Sea-Green for a Tincture of Glafs.

THE Colour of Sea-Green is given by the *Italians* to *Beryl*, which is a Precious Stone found at the Foot of Mount *Taurus*, by the River *Euphrates*, which has the Green-blue of the Sea. It is found in the *Indies* of a Colour somewhat paler,

which makes it be called by different Names, and when the Colour is deeper, they commonly pafs for other Precious Stones: It is therefore the Water expreffes its Colour. We will treat more largely of it in our *fifth* Book, wherein we fhew the way of imitating Precious Stones.

This Colour, which is one of the fineft Sky-Colours, ought to be made in fine and well purifi'd Crystal, which the *Italians* call *Bollito*, for if you make it in common Glafs it is not fo fair: You muft likewife put no *Manganefe* in this Colour. To make it therefore very fine and beautiful, Take Crystal-Fritt, put it in a Pot in the Furnace, where being well melted and clear, you muft skim off the Salt, which will fwim on the top like Oil, with an iron Ladle: for if you fhould not take it off, the Colour would be foul and oily. The Matter being well purified, you muft add to it, to every 20 pounds or thereabouts, 6 Ounces of the Powder of Copper calcin'd, as we have taught in Chapter XXX. with a fourth part of *Zaffer* prepar'd, alfo in Powder, and well mixed both together; in putting both thefe Powders into the Pot on the Crystalline Metal, you muft do it little by little, for fear the Crystal rifing and swelling fhould run over, whereof care muft be taken, ftirring it well all the while. This being done, let the Metal ftand ftill and fettle for the fpace of three hours, that the Colour may incorporate, then ftir it again: then the Workman may make a proof of the Colour. Twenty four hours after the mixing of the Powders it may be wrought, for by that time it will be well coloured; but the Workman muft firft well mix the whole, for fear the Colour fhould not be precipitated to the Bottom. Which muft always be well obferved in all Veffels wherein there are Colours, and the Dofes of the Tinctures rightly proportioned

ed to the Crystalline Metal in the Pots, according to the quantities we have set done.

C H A P. XLI.

Another Sky-Colour, or Sea-Green.

YOU must use, for this Colour, which is a little close, the same Crystal-Frit as in the precedent, made with *Rochetta* or *Polverine* of the *Levant*; and having fill'd a Pot of it, let it be well purified, and take off the Salt that swims on the top; then put to it 20 Pound of Metal, six Ounces of the Powder of calcin'd Copper little by little, stirring it, well, observing the same Rules we gave for Sea-Green before. Then you will have a very admirable Colour, which you may make lighter or deeper as you please. Two hours after stir it again well, and you will see if the Colour pleases you; in which case let it stand still 24 hours without any stirring, and then it may be wrought as before.

C H A P. XLII.

Another Sea-green colour in Artificial Crystal, which the Italians call Bollito.

THese colours are not to be made without a great deal of Precaution, which this needs as much as any. To succeed well, you must have in the Furnace a Pot filled with 40 pound of good Crystal-Fritt, carefully skimm'd, boil'd, and purifi'd, without any *Manganese*: having arriv'd thus far, you must take 12 Ounces of the Powder of Small leaves of Copper thrice calcin'd, as we have shewn

chap. XXX. And half an ounce of *Zaffer* in Powder, prepared as in chap. XVII. Mix these Powders together, then put them at four times into the Pot, that they may the better mix with the Glafs, stirring them at each time well, as you put them in, for fear it should swell too much, and run over. Two hours after the whole is incorporated, well mixed, and pretty well settled, try if your colour is deep enough then let it rest, tho' the Sea-green or sky colour seems at first Greenish you need not be concerned at that: For the Salt in the Glafs will consume all that Greenness, and change it into Blue.

After your Metal has stood at rest 24 hours, it may be wrought, and you'll have the colour deeper or lighter, according to the quantity of Powder you have used in it. There is no other Rule in that, but the Phancy of the Workman, which is the reason it cannot be ascertained; besides the Matter we use to tinge Glafs, makes it have some more colour, some less, which proceeds from the Preparation of it.

C H A P. XLIII.

A fine Sky-Colour or Sea-Green in Crystal.

THIS fine Colour requires a Crystal Fritt well purified from its Salt, as we have noted before; and which has not been put into Water. Put 60 Pounds in a Pot, and having well prepared it, put in one Pound and half of Scales of Copper in Powder, the Preparation whereof we have shewn in Chapter XXXIV. with four Ounces of *Zaffer* prepared and mixed together; and stir the whole well with the Glafs for the space of two hours. Then see whether you like the Colour, then let it stand
at

at rest 24 hours; then stir the whole again, as before, that it be well mixed with the Glafs and the Colour incorporated with it; then it may be wrought. It will give a very fine Blue, as has been often experimented. The Colour may be heightened as you please; but take care you do not make it too high. If you mix with Fritt of *Rochetta*, as much Crystal Fritt, you'll have as fine a Blue as can be wished.

C H A P. XLIV.

Another Sky-Colour or Sea-Green, made with less charge, to colour Glafs.

THOUGH this Colour be inferiour to the last, yet it has its Beauties sufficient to satisfy both the Sight, and pay the Pains of the Workman. He must take the same Preparation of Scales of Copper, we have mention'd in the precedent Chapter, and the same Dose of *Zaffer*, with as much Crystal made of *Rochetta* of the *Levant*, and *Barrilla* of *Spain*, without any *Manganese* either in the one or other, and which has not been cast into Water, but well purified from its Salt; observing in this place all we have noted to be done in the other Preparations of Crystal and Sea-Green in the preceding Chapters, and you'll have a fine Sky-Colour or Sea-Green, fit for any Use.

C H A P. XLV.

Another Sea-green far finer than the rest.

Neri seems to be the Inventor of this new Sea-green, and to have first Experimented it. It is made with *Caput Mortuum* of * *Vitriol* of *Venus* without any Corrosive, which is a very curious preparation, we will shew it at the End of the 7th Book. This *Caput Mortuum* ought to be exposed to the Air for some days, in a place where the Sun cannot come, where (by a Magnetical Virtue) it will attract the Universal Spirit; which will restore to it again Part of that it has lost by Extraction it has Suffered, and will become of a whitish green Colour. Then pound it with the same dose of *Zaffer* prepared as in Chap. 43. put the whole into a Pot fill'd with Crystal Metal, very fine and well purified from its Salt, observing all we have noted on this Subject; and it will make an extraordinary fine Sea-green.

C H A P. XLVI.

To make a green Emerald-Colour in Glafs.

WE will pass from Blue to Green, and from *Venus* to *Mars*, which enters into the preparation of this. For making this Emerald Colour, take common Glafs well purified from its Salt, without *Manganese*, as we have shewn in Chap. 12. Put it in a Pot in the Furnace, and when it is well

* Neri says of the Spirit of V. V.

melted and purified, add to it (for Example) to 100 Pounds of Glass, 3 ounces of *Crocus Martis* Calcined with Vinegar as in Chap. 25. mix well the Glass at the same time to make it Incorporate with the Crocus, then let it rest an hour, that it may throughly take the Colour. This way nothing will come out Yellowish, and it will lose that Foulness and Blueness which the common Metal always hath, and it will become Green. Then add to the same dose of 100 Pounds of Glass 2 Pound of the Scales of Copper thrice calcin'd as in Chap. 34. And put it in at Six divers times, Mixing it well each time with the Glass, then let it stand 2 hours to imbibe the Tincture. After 2 hours stir it again, and see if it be as you would have it; if the Colour be too Blue you must add to it some *Crocus Martis* prepared as before and you will have a very fine Emerald Colour. Twenty four hours after, mix it as before; and then you may work it as you Please.

C H A P. XLVII.

Another Emerald green more fair than the preceeding.

THe more pure the matter is, the finer the work will be that is made with it: Thus to make a more fair Emerald green than the preceeding, take Crystal Fritt without *Manganese*, which has been twice washed in water to take out all the Salt; and put it in a Pot in the Furnace: Then add to it half of common White Metal also without *Manganese*. These two matters being well melted, mixed, and purified, put to 100 pound of metal 2 pound and a half of powder of Copper Plates thrice calcin'd, prepared as in Chap. 33.

with

with 2 ounces of *Crocus Martis* Calcined and Reverberated with Sulphur as in Chap. 24. After having mixed them well together: You must put in those Powders at six different times, stirring well the matter each time, and Moreover observe all we have said in the Preced. Chap. You may make the Colour Lighter or Deeper, as you please, adding *Crocus Martis* if it be too Blue, and Calcin'd Powder of *Venus* if it be not enough so; you will have from this a surprizing *Burnet Green*,

C H A P. XLVIII.

Another wonderfull Green.

ALtho' this Colour is very admirable, yet we only make use of it in common Glass, made with *Polverine* and without *Manganese*. Being well melted and purified, you must put in equal parts of Powder of Scales of Copper thrice calcin'd, and Scales of Iron which fall from the Smith's Forge, without any other preparation than well washing them, to cleanse them from Ashes and Coals that mingle with them; afterwards well dry them, and Pound them as fine as you can and searce them: These Scales serve in room of *Crocus Martis*. You must observe the doses and way of Proceeding as we have heretofore noted, in Emerald Colours: These Scales of Iron will give an admirable Green; and they will drive out all the dull naturall Green which is in common Glass, and make it become Yellowish, or will give it a yellow Green, very Bright and Fair.

C H A P. XLIX.

Another Oriental Emerald Green finer than the rest.

TO make this fine Emerald colour; put into a Pot 4 pounds of common Fritt of *Polverine*, 5 pound of common white Glass Pulveriz'd, 5 pound of Crystal Fritt well washed; add to this Composition 3 pound of *Minium* or Red-Lead, mix them all together, and in a little time they will be pretty well purified. After that, cast all that metal into water to Purifie it more, taking care that no part of the Lead sink to the bottom of the Pot wherein it is cast, for it will break it, if Speedy care be not taken to take up again what is Precipitated. This Glass thus washed, and after dryed ought to be put in the Pot again, to be melted and Purified during the space of one day; then you must add a little of the *Caput Mortuum* of *Vitriol* of *Venus* without Corrosive, whereof we have spoken Chap. 45. with a little *Crocus Martis*: stirring the metal, and moreover proceeding as we have shewn in the Preceding Chapter. Then you will have an admirable Oriental Emerald Green, which may be wrought as you please. The *Minium* or Red-Lead, we speak of may be had at any Drugsters; yet you may make it with common mineral Lead, which is better in this Operation than that in Pigs, and cheaper. Pound it well, then calcine it at a good Fire, and it will be reduced to a Red Powder.

C H A P. L.

*The way of making Turcois blue, a particular Colour
in this Art.*

WE ought to have put this Colour of *Turcois* after the Blue, and before the Green, but because it is a particular and principal Colour, we thought it would not be amiss to conclude this book with it. For this colour take a pot full of Crystal Fritt tinged of an *Aqua-Marina* Colour or Blue, whereof we have given several preparations; which colour must be fair and full, for all depends on that. It being well melted put into it little by little sea-salt decrepitated, white and reduced to Powder, mixing it well and softly as we have noted in speaking of other Metalline Colours; and the Blue from clear and transparent will become thick, for the Salt penetrating the Glafs takes away its Transparency, and causes a Paleness; hence alone comes the *Turcois* Colour used in Glafs. When the Colour is right to the Workman's Fancy, it must be presently wrought, for the Salt will evaporate, and make the Glafs transparent and disagreeable. If in working this Metal the Colour fades or goes off, you must add a little more of the same decrepitated Salt as before, and the Colour will return.

We will here advertise the Workman, that he must take care that his Salt be well decrepitated, otherwise it will always crackle, and be apt to fly in his Eyes, and endanger his Sight. You must (as I have said) put in the Salt by Intervals, till the Colour Pleases you.

It

It will suffice for this use, that the Fritt tinged *Aqua-Marina* or Blue, be made of one half Crystal Metal, and the other of *Rochetta*, and the Colour will be very fair and good.

The End of the First Book.

T H E

O F T H E
A R T
O F
G L A S S .

B O O K I I.

C H A P. LI.

Wherein is shown the art of making Chalcedony of the Colour of Agats and Oriental Jasper; with the way to prepare all Colours for this purpose. To make Aqua-Fortis and Regalis, necessary in this business. The way of preparing and calcining Tartar, and uniting it with the Red Colour of its own kind called by the Italians Rosichiero, which produceth Glass of many Colours with undulations in them very pleasant to behold, and gives it an Opacity like Oriental Stones.

BEfore I proceed to the Explication of these preparations, it will be necessary to shew those of some *Minerals* used for such Compositions. And although one may buy several of them Publickly, ready made, yet our design being to

to make this work as perfect as we can, it will be necessary that we shew the Chymical way of preparing them after the best manner, by which the curious in this Art may do it themselves for less charge than they can buy them. There is no doubt, but that the Metalline matters made use of to tinge Glafs, may give it several colours more lively and brighter than any it receives in the ordinary Furnaces, when these matters are artfully prepared, and their Metalline Colours are choicely pick'd out and Collected, and well purified from Heterogeneous matters which hinder the communication of their Tincture to the Glafs. The colour of Chalcedony, or rather the matter whereof it is made, is nothing but an Amassement of Several Colours which may be made in Glafs, and which many are not acquainted with. We will shew the whole process and the way of well succeeding in it. It is most certain that all the Colours we can extract will never give that Beauty and Splendor to Glafs which is desired, if they be not well prepared. You must therefore for this purpose well calcine and dissolve the metals with *Aqua Fortis*. You must open the *Copper*, *Sulphur*, *Vitriol* and *Sal Armoniac* and other minerals with a great deal of patience, and prepare them at a gentle Fire, the violence of the fire being very noxious in this affair as well as in others, which very often renders Operations defective, which otherwise would succeed well, among those who are impatient or ignorant. You must observe Regularity in all those Cases we shall treat of, and exact proportions of the Doses, and put them in, in fit and due time, otherwise the Process will miscarry; especially in the Red Colour whereof we treat in the 8th Book, and in the *Tartar* that it may be perfectly Calcin'd. You must yet further observe that the Metal be

well Boiled, well Purified, and made fit for Working; then proceed in it as diligent Workmen ought to do. Thus you may perfectly imitate Agat, oriental Chalcedony, with the Fairest and most Beautifull Colours, and wavings, so lively and full, that it will seem as if nature her self could not arrive to the like perfection, or art imitate it. Yet experience shews us that in several things, and in particular in this Art of Colouring Glass, that Art cannot only imitate nature, but also far surpass her. The Eye and Phancy shall be judge, in the three ways which we will shew, where every thing shall appear so distinctly, that the curious shall easily understand it, and all that will apply themselves to it may succeed therein, if they do not deviate from these precepts. If they are well put in practice, you'll find more than we can tell you.

C H A P. LII.

The way to prepare Aqua-Fortis, which dissolves Silver and Quicksilver.

THERE are several sorts of *Aqua-Fortis's*, prepared after different manners, appropriated to the different Uses they are design'd for; but all of them always with Salt-Petre or Nitre, which is the principal ingredient in *Aqua-Fortis*. That we shall here Treat of being not an Ordinary one, may pass for one of those that have a peculiar Composition. For this Water, take 1 pound of Nitre or Salt-Petre refined, three Pound of Roch-Allom calcined on the Fire-Shovel; and four Ounces of *CrySTALLINE Arsenick*, the whole reduced into Powder,

to

to which add seven Ounces of * fine Sand ; and having well mixed the whole Composition, put it into a Glass Cucurbit, always leaving $\frac{1}{3}$ part of it Empty, $\frac{2}{3}$ being filled, lute the Cucurbit well with a strong lute, whereof we will give you the preparation at the end of this Chapter. But before you put the Cucurbite or Body on, you must lay Sand four Inches deep, and thick Iron-Bars to bear the weight, then fit a head, and lute the joints well, with a lute made of fine Flour and Lime powdered, and mixt with whites of Eggs : then put on the Joints roulers of fine Linen, then lute it again and then put on Linen roulers again, three or four times, each time letting it dry before you put on the next rouser. And then this will bear the Violence of the Fire, and the penetrating force of the Spirits of the *Aqua-Fortis*.

After that, you must put this Body of the *Alembick* in a deep Earthen-Pan, made of the same Earth as *Crucibles*, filled with Sand, so that it be buried in the Sand to within two Inches of the joints ; then set it in a Wind Furnace fit, and capable to maintain an equal Fire. We here give you the figure of it, this Furnace may serve for several uses, as we will hereafter Explain.

Your *Alembic* being thus fitted, you must put to the head a Glass Receiver very capacious, the better to resist the force of the Spirits, otherwise all may break. Lute it well to the Mouth of the *Alembic*, as you did the joints before, and with the same precaution of letting it dry each time in the Air, taking care not to kindle the Fire in the Furnace, till the lute of all the joints be dry, for that is very necessary.

The whole being thus in right order, kindle a small coal Fire for the space of three hours, during

* Neri says Lime.

which time the windy humour that is in the Materials, and which would break them will be drawn of into the Receiver. So continue a moderate Fire for six hours, then encrease it little by little, putting on at last billets of dry Oaken-Wood to the coals, for six hours more, till the *Alembic* or head begin to be tinged yellow, and the Spirits begin to rise. Observe to continue this Regimen or degree of Fire, till the head and receiver begin to grow red; then augment it till the *Alembic* become of a deep red; continue this degree of the Fire as long as that Colour lasts, till all the Spirits are drawn of, and the Head and Receiver begin by degrees to grow clear, and reassume their common Colour in cooling; which sometimes will be two days first. Notwithstanding you must continue the Fire some time afterward; then let the Furnace cool of its self; taking care, that whilst the *Alembic* and Receiver are still red, and the Fire in force, that you admit no cool Air into the place, and that nothing cold touch them, which would break them. When all is cold, cover the head and receiver with wet Linen cloaths, that the Spirits (which are about the Head and Receiver) may the better sink to the bottom of the Receiver, and let it stand so twelve hours. Then bath the joints and the luting with warm Water, that you may the better loosen the bandage, and so take off the head from the Receiver, otherwise it would be difficult to do it; then you may break the body which will be good for nothing, and take out the *Faces* which reduce again into Powder: add to each Pound of that Powder, four Ounces of refin'd Nitre, and put the whole into a Cucurbit (or Body) whereon pour all the *Aqua-Fortis* before distill'd; then put on the Head and Receiver, and lute it and dry it well as you did before; having put it on the same Sand Furnace, during the first four hours make a gentle Fire, which
after-

afterwards may be encreased little by little, till the Head and Receiver begin to grow clear and all the Spirit is drawn over. After which let all cool, covering the Head and Receiver with wet Cloaths; then let it stand twelve hours as before. Then unlute the joints again with warm Water, and put the *Aqua-Fortis* into Glass Vessels well stoppt, that the Spirits may not exhale, and keep it so for uses hereafter to be mentioned. This is the *Aqua-Fortis* which is commonly called Water of separation, and the best that can be made. There are some that instead of Roch-allom take the best Roman Vitriol, or the like. You may know whether the Vitriol be proper for this use or not by rubbing it on a piece of well polished Iron; if it be it will leave a Copper Colour on it; Then this Vitriol, the purification whereof we will give in the next Chapter, will make an *Aqua-Fortis* far more penetrating than the former.

Now we come to shew how to make the lute which we promised, which tho' common is very usefull in this Case. You must take one Part of Lome (a fat Earth) which is found in Rivers, 3 Parts of Sand, of common Wood Ashes well sifted, and of the Shearings of woollen Cloath each one half; mix the whole well together, and putting water to them make a soft past, to which add one third part of common Salt Powder'd, and work them all well together, then use them in luting your vessels.

Here follows the description of a usefull Furnace, which may serve instead of several others, the Number whereof would be troublesome, it being proper for several Operations. To render this Furnace more Intelligible to those who are not acquainted with it, we have here given a Cut of it, whereon we have marked *A. B. C.* the places made use of, with their Names, that they may by the same Letters here set down again be the

better understood. *A.* is the Ash-hole, into which all the Ashes, on the Iron Grates which go cross it, fall down, and which are taken out with a little Iron shovel, or a sort of Iron Peel.

B. is the space or whole room of the Ash-hole.

C. Is the Fire-Grate which ought to be of square Iron Bars lying with the Edges upwards that the Ashes may not lie thereon, which they would do if the flats were upwards.

D. is the place where the Fire is made of Coal or Wood.

E. is the Door of it.

F. is several holes wherein are put Iron Bars which go cross from one side to the other, to keep up the vessels wherein the matters to be worked are contained, stopping up the other holes that are not used with Lute.

G. is the Work hole, or little Laboratory of the Furnace.

H. is a semicircular opening with the like hole in the Cover to put the neck of the Retort through, when you distil in a Reverberatory, or otherwise.

I. is the inner part of the Work-hole of the Furnace.

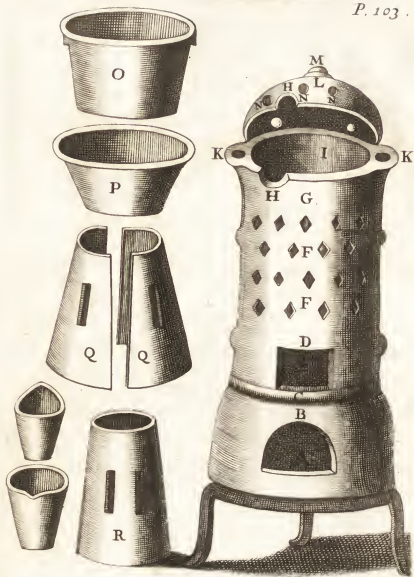
K. is two Registers.

L. is the Cover of the Furnace for 8 Registers.

M. is a round hole which serves for a Register to Reverberate, and to pass the neck of the *Mattrasses* through which are in *Balneo*, whether in digestion or otherwise.

N. is the Registers which are to be opened or shut to augment or diminish the heat of the Fire of the Reverberatory.

This Furnace, very usefull in a little Laboratory, may serve for most part of our works. First of all for a wind Furnace for several operations if the vessel containing the matter be so accommodated



dated in the work-hole, that the fire may touch it immediately. It may be also serviceable for Fusion of several Metalline matters which we Employ for Tinctures, to calcine them, vitrifie them, make Enamels, &c. If it be open at the bottom where the Ash-hole is, and placed upon an Iron Trevet; and besides that, covering the top with two Cases the better to keep in the heat.

2. For a Reverberatory Furnace, if you cover the work-hole with its cover, or door, and shut the Registers, the vessel containing the Materials being exposed to the naked flame.

3. For a *Balneum Maria*, if you put into the hole a Copper Vessel of the same Diameter, in shape of a Copper, the bottom whereof must be strong and flat, and fill it with hot water, wherein you may put the Vessel that contains your matter: Which if it be a *Matrass* or Bolt-head, you may let the Neck out at the hole at the middle of the Cover, which covers the *Balneum* (or vessel full of water.)

4. For a *Balneum Vaporosum*, by putting in the same hole, a vessel full of water that shall rise in vapours: And in that vessel, another which shall contain the materials two Inches above the water, shutting this vessel with a fit cover least the vapours Exhale.

5. For a *Balneum Aerium*, or dry bath, by putting in the same hole a vessel filled with hot Air shut close, and therein also another vessel with the Materials.

6. For a Sand or Ash Furnace, and with filings of Iron, if the vessel put in the hole, and which is exposed to the naked Fire be filled with Sand, Ashes, or Filings of Steel, and that you put in the one or the other, the vessel that contains the matter you are to work on.

7. For a Lamp Furnace, if in place of the Bars below you put a Porringer full of Ashes, to contain the Vessel wherein your matter is; provided you put also a Glass Beli on that Vessel to cover it that must stand on the Brim or Ledges of the Porringer, well fitted to it, to preserve the heat that arises: and then put under that Porringer the Lamp on a little Trevet.

In short, this Furnace may serve for almost all Chymical Operations whatsoever, which would be too long here to mention.

C H A P. LIII.

The way of purifying Vitriol to make Aqua-Fortis stronger and more penetrative.

WE have promised in the preceding Chapter, to shew the way of purifying Vitriol, which consists in taking away its Yellowness, which alone hinders the good effects it is capable of producing.

Take *Roman* Vitriol, the best you can get; dissolve it in common warm Water, then let it stand three days; then filter it, and sling away the yellow *Faces*; then evaporate in Glass Bodies two thirds of the Water, and put the Remainder into Earthen glaz'd Pans, and set it in a cool place for the Crystals of it to shoot, which in 12 hours time they will do, about the Brims of the Pans in little transparent pieces, like natural Crystal of an Emerald-Colour; and at bottom there will remain a sulphureous Sediment, which must be carefully separated, and cast away.

Then you must take all those little green Crystals, and dissolve them again in warm Water, as before, and then filter and evaporate them in the same Glass Bodies:

Bodies: And set them again to crySTALLize, as before, in a cool place, taking care to separate all the yellow *Faces* you find. Reiterate this Process of dissolving, and filtering, evaporating, and crySTALLizing the third time; then you will have a well purified and refined *Vitriol*.

We will here add for the sake of the curious, that those who make use of *Vitriol* instead of *Roach-Allum*, to make *Aqua-Fortis*, the Preparation whereof we have shewn in the precedent Chap. ought to take a special care in the Distillation, that as soon as the Red Fumes are passed, all the Spirits of Nitre are raised, and that then the Fire must be extinguished; for that which follows after, is only Spirit of *Vitriol*, which hinders the Operation of the Spirit of Nitre in the Solution of Metals.

You may also draw a parting Water in 12 hours time, (as some Refiners do) during which time, but little Spirit of *Vitriol* can arise with their fires.

C H A P. LIV.

The way to make Aqua Regalis for the solution of Gold and other Metals, except Silver.

A *Qua Regalis*, is nothing but a common *Aqua-Fortis*, wherein you dissolve $\frac{1}{4}$ of its weight of *Sal-Armoniac*. But to have a good and strong *Aqua-Regalis* you must take one pound of *Aqua-Fortis* prepared as in Chap. 52. put it in a Glass Matrass, and add to it only 2 Ounces of *Sal Armoniac*, then put the Matrass into a warm Bath or Pan, of warm Water, and stir it often, that the *Sal armoniac* may be well dissolved in the *Aqua-Fortis*, which will

will be tinged of a yellow Colour. Then you must add as much *Sal-Armoniac* to it as the *Aqua-Fortis* can dissolve, then let it settle a little; and the *Sal-Armoniac* will leave at the bottom all its Terrestreity. After that decant it gently off into another Vessel, so that you don't trouble the settling at bottom, or rather filter it through whited-brown Paper. This Water will dissolve Gold and other Metals, far better than the common *Aqua Regalis*, except Silver, which it toucheth not at all, for reasons which Chymists are acquainted with.

C H A P. LV.

Another way of making Aqua-Regalis far stronger than the former.

Our Design being not only to shew Operations and Processes proper for Glass, but also for the sake of Gentlemen chymically inclin'd, whose Curiosities are not contented with what's common, or with ordinary Preparations; those which we here give of *Aqua-Regalis* are among the number of those, whose Virtues are far above the common Preparations, they more intimately penetrating and dissolving Gold and other Metals than others, rendring them more volatile, and consequently more proper to be drawn over in Distillations.

The first is that which some Philosophers call the Water of the two Champions, which is made with two parts of purified Sulphur, two parts of purified *Sal-Armoniac*, and one part of calcin'd *Flints*, all reduced to powder, and mixed well together. Then take an earthen Retort, which must have a little hole

on the back (or Curvature) on the upper side, through which you may put in the Ingredients. For the more safety sake, you may lute the Body of the Retort over well, and let it dry; then put it in the Furnace we have describ'd *chap.* LII. and fit to it a great Glass Recipient (by reason of the violence of the Spirits) wherein you may put a little common Water to attract them; lute the Joints of them as you do for *Aqua-Fortis*, and let them be well dry'd before you kindle the fire, for Reasons we have elsewhere assigned.

The Lute being dry, and all in right Order, you must begin by a gentle fire, that the Retort may grow warm by degrees, and afterwards gradually encrease it till it grow red-hot. Then put in at the Hole of the Retort four Ounces at a time of the Ingredients you have prepared, and stop it again presently. Doing thus you will see in a little time great quantities of cloudy Vapours arise, and pass into the Receiver, and fill it, which will dissolve little by little, mixing themselves with the common Water, and the Receiver will grow clear. As soon as you perceive this, you must put four Ounces more of your Ingredients into the Retort, and give time for the Vapours (arising again) to dissolve as before; then reiterate this Process till all your Ingredients are distill'd off. Then unlute your Receiver, and pour the Liquor into an Alembick, and draw off the Phlegm in *Balneo Mariae*, and rectifie it in an Ash-Fire: Then your Water will be made, and fit to dissolve any Metal but Silver.

C H A P. LVI.

Another way of making Aq. Reg. more easie, and with less precaution.

THIS second way of making *Aq. Reg.* will be more easie than the former, and the Water of as much force. Take 1 pound of good Salt-Petre, powder it, and mix it with 3 Pound of Potters Clay, or Flints calcined to Powder; put the whole into a Glass Retort well luted, and fit to it a great Receiver, lute the Joints well, then put it in a reverberatory Furnace, and distil it according to Art in a gradual Fire. When all the red Spirits are passed over, as we have explained in speaking of *Aq. fortis* in the 52 Chapter. Then draw off the Phlegm in *Balneo Marie* (which the Chymists and we hereafter will note by the two Letters *B. M.*) then rectifie it in an Ash-Furnace, and keep it for use.

Then take a Pound of Sal Armoniac, well powder'd, and mix it with four Pound of Wood-Ashes, (out of which you have before extracted all the Salt with warm Water) then put the whole into a Retort, fit a Receiver to it, and distil it in a Sand-Furnace, and the Spirit of the Sal Armoniac will pass over into the Receiver.

Then unlute your Receiver, and take off that Phlegm of the Spirit in *B. M.* and rectifie it in Ashes. This done, take equal parts of each of these Spirits; then mix them together and distil them in an Ash-Furnace. Then you'll have a strong Menstruum for dissolving Gold.

I can't here omit, that the Spirit of Sea-water Salt distill'd as Salt-petre, has the same effects as the Water of the 2 *Champions* whereof we have given the
Prepa-

Preparation in the preced. Chap. and as that we have just now treated of; and in the mean while is not so sharp nor corrosive. You must, to make it successfully, take 3 parts of Spirits of Sea-water Salt, and add to it one part of Salt-petre, then distil it together in an Ash-Furnace, the better to unite them. Then you'll have an *Aqua Regalis*, which will dissolve Gold sooner than the Spirit of Sal-Armoniac, and which will make it rise and pass over in the Receiver; thus you may this easie way make it more fit for the use you design it for.

But notwithstanding this, you must not imagine that this Solution of Gold is a radical and total one, because it will pass over in an Alembic, and that so it is reduc'd into a Species of *Aurum potabile*: For there is nothing but the one Sovereign Menstruum of the Philosophers, which has that virtue, as being homogeneous to it, and formed of it. That is the only Liquor in which it can putrifie and be totally resolved, and regenerated again after the manner of the Phœnix, to become a Spiritual and Glorious Body, capable of performing all those wonderful Effects ascrib'd to it.

C H A P. LVII.

The way to Calcine Tartar.

WE have already given one Preparation of *Tartar* in *Chap. 15.* both for the Calcination of it, and to extract the Salt; and we have largely shewn in *Chap. 5.* of what importance it is to dry it thoroughly: For that reason we will not repeat it here, but refer the Reader thither.

To make this Calcination, which is easie, Take *Tartar* in great lumps, the thickest and most shining you can get, blow away all the Powder, then put it in new Earthen Pots upon live Coals, or in a little Furnace, where you must leave it till it smoaks no more, and all its humidity be exhale'd, and it be reduc'd into Lumps of a black purplish colour; then it is calcin'd and well prepared.

Tartar may also be calcin'd by wrapping it in pieces of brown Paper; then lay a Bed of live Coals, and lay a bundle of it upon them, then another Layer or Bed of Coals, and on them another parcel of *Tartar*; continue thus to do S. S. S. till all your parcels of *Tartar* are laid on, observing that the upper Layer be always of Coals; and leave the whole in that State till the *Tartar* be well calcined and leaves off smoaking; then take it off and blow away the Ashes.

C H A P. LVIII.

A way to make a fair Chalcedony in Glass.

Altho *Chalcedony* is not so dear as it has been heretofore, since it is found in *Europe*; yet People have not left off counterfeiting it by help of Art, to make several Works of it no less beautiful than the true, and much cheaper.

We will shew three different ways to prepare this *Chalcedony*, which will make three different Species of it, all of them very fair, but whose Beauty may be also augmented by the number of Ingredients we compose them of, and which cause those Diversities of Colours, which that Stone ought to have.

Among the rest of the Ingredients we employ in this Subject, there are some that give no colour to Glass, as *Tartar*, *Soot*, *Sal-Armoniac* and *Mercury*.

Those

Those that are of an unctuous Nature, as Lead, Soot, Tartar, the Azure-stone often hinder the Union of the Ingredients, by reason of the Separation which may happen by the cooling the Metal; which does not happen to those who know how to observe the degree of heat, wherein the principal knowledge of this Art consists.

To make the first sort of *Chalcedony*: Put two Pound of *Aqua fortis* (whereof we have given the Preparation in *Chap. 52.*) into a Glass Body with a long Neck, four Ounces of fine Silver in small and thin Plates, or granulated, put the Body in an Ash Furnace over a soft Fire, or in warm Water, and the Silver will be presently dissolv'd. At the same time take another Body and dissolve in it 6 Ounces of Quick-silver in a Pound and half of the same *Aqua fortis*. After that pour both the Solutions together into a greater Body, which put in the same Bath, or warm Water, or Ash-Furnace: then add to it six Ounces of *Sal-Armoniac*, which dissolve over a gentle Fire; then put to it one Ounce of *Zaffer*, and half an Ounce of *Manganese* prepared, little by little, with as much *Ferretto* of *Spain* also little by little, for fear the Matter coming to swell too much should break the Vessel. Add to all these Ingredients one Ounce of *Crocus Martis* calcined with Sulphur; as much Scales of Copper thrice calcined, which ought to boil like *Manganese*; as much blue Lake that the Painters use; and the same quantity of Red Lead, the whole reduc'd into Powder. In putting in these Powders you must gently stir the Glass Body, that they may the better incorporate with the *Aqua fortis*, nevertheless take care there be not too much heat; then you must well stop the Matras (or Glass Body) stirring it well every Day for ten Days, that the Powders may well incorporate, and that they may always appear as separated from the Water. After that
put

put the great Glass Body in a Sand-Furnace in a temperate heat, or rather empty it into a Glass Cucurbit, after having luted it at the bottom, and put it over the same Fire, so that the *Aqua fortis* may evaporate in 24 Hours, and at bottom of the Vessel you will have a yellow Powder, which keep safely in Glasses for use. When you are to make *Chalcedony*, take white Crystal in Glass, well purified, and that has been often melted; for Crystal new made is not fit for that Operation, because the Colours will not stick to it, but are consumed by the Frit. Put about twenty Pound of this sort of Crystalline Glass into a Pot; and being well melted, put in about three Ounces of your Yellow Powder at three different times, mix the Glass well with it each time, that the Powder may incorporate with it, the Glass being thus well mixed, let it stand an Hour, then mix it once more and let it stand during 24 Hours: Then mix it again for the last time, and make an Essay of it, it will give a yellowish Azure colour. Having made your Essay, and found your Matter right, you may take your Pot out of the Furnace, and when it is cold you'll have colours which shall represent Wavings of the Sea, and other fine things. But to have a very fair *Chalcedony*, you must make a second Operation to join to the first, by taking eight Ounces of Tartar calcined, as we have shewn *Chap. 41*. Two Ounces of Soot of the Chimney well purified, half an Ounce of *Crocus Martis* calcined with Sulphur: Mix the whole well together, then put it into the melted Metal at five or six different times; otherwise the Impetuous Swelling of the Materials would break the Pot, and the whole would be lost; which may be avoided by putting it in little by little, stirring it each time well, that the Matters may incorporate: Make the Pot also boil, then let it stand twenty four Hours. After which you may work it into what you please,

please, which put in the Furnace to whiten, and see if the Glafs please you; if it be green without, and blue, white, red, yellow and of other Colours like Jasper and Oriental Agat. If looking on it obliquely it be red like Fire, and held to the Sun it shew the Colours of the Rain-bow by reflection of the Rays; if so, then it is fit to make all sorts of Vessels which may be polished at the Wheel. If it be pale and clear, you must add to it more calcined Tartar and Soot as before, stirring it well to make it incorporate; then let the Glafs stand and purifie several Hours, and afterwards work it as you please.

Chalcedony is much used for the Effigies of Kings and Princes, for Heads, Cups, and many other Vessels; principally for making Seals, because it may be graved easily, and the Wax will not stick to it.

C H A P. LIX.

A second Species of Chalcedony.

THE second sort of *Chalcedony* ought to be finer than the former: The Preparations are as follow.

Put into a Glafs Body a Pound of *Aqua fortis*, and three Ounces of coppel'd Silver granulated, the better to dissolve.

In another Glafs Body put also a Pound of *Aqua fortis*, with five Ounces of Mercury well purified and passed through the Glove, and close it well.

Take likewise another Glafs Vessel, and put into it also a Pound of *Aqua fortis*, with two Ounces of *Sal-Armoniac* to dissolve in it.

After it is dissolv'd add to it *Crocus Martis* prepared, as in *Chap. 27.* *Feretto of Spain*, of *Chap. 22.* Copper calcined as in *Chap. 32.* Leaves of Copper calcin'd by means of Sulphur, as in *Chap. 31.* of each half an Ounce; the whole reduced into Powder; taking care to put them in one after another, and little by little, for fear the Vessel should break.

Then put in another Earthen Body, one Pound of *Aqua fortis*, with two Ounces of *Sal-Armoniac*; and the whole being dissolv'd, add successively as before of good crude Antimony, of blue Enamel which the Painters use; of red Lead, and of Vitriol well purified of each one half Ounce; the whole well powder'd, and put in little by little, as we have said, for fear of breaking the Vessel, then close it well.

Take also another Glass Body, wherein put one Pound of *Aqua fortis*, and two Ounces of *Sal-Armoniac*; being dissolv'd, add to it two Ounces of prepared *Zaffer*, as we have shewn in *Chap. 17.* a quarter of an Ounce of *Manganese of Piedmont* also prepared, as in *Chap. 18.* half an Ounce of thrice calcined Copper, as in *Chap. 33.* with an Ounce of *Cinabar*; the whole being well pounded, put it by little and little into the Vessel; taking care (as we have said) that the Powders don't by too much swelling break the Vessel; then close it well.

You must have a sixth Vessel of the same bigness with the rest, wherein likewise put a Pound of *Aqua fortis*, and two Ounces of *Sal-Armoniac*; as soon as it is dissolved, cast in two Ounces of Ceruse little by little, for that will cause a great fermentation. Then add the like weight of Painters red Lake, and as much of Iron Scales from the Anvil, putting it in little by little, as we have heretofore admonish'd, and for the same Reasons; and lastly proceed very slowly

slowly in all these Operations; then stop your Vessel well.

All your six Vessels being on a gentle fire of Ashes, or in a warm Bath, to hasten the Solution of your Materials, you must stir them at least six times a Day, during the twelve in which you leave them in that heat, that the *Aqua fortis* may the better penetrate the Powders, and they communicate their Tinctures the better to the Glafs. The twelve Days being past, take a great Glafs Crucible that will hold the whole, and lute it well for fear of breaking; let the lute dry, then pour in gently your Materials in the six Matras's one after the other, after having well stirred each of them beforehand; then put your Cucurbite on a gentle Ash Fire, and fit to it a Head and Receiver, and lute well the Joints; then distil gently all the *Aqua fortis* for the space of Twenty four Hours, that is in the Body, making a very gentle Fire towards the end, otherwise the Powders may be spoiled by too much heat, and the Spirits which ought to remain in the Powder would pass into the Receiver. Then they will remain at the bottom of the Vessel of a yellowish red colour, which keep in a Glafs well stopp'd, for tinging Glafs, or Crystal, which is yet better, as I have shewn in the preceding Chapter.

C H A P. LX.

The third and last way of Chalcedony.

THIS third way surpasses the other two in Beauty; it is something tedious, but the Learned know that what is most perfect, requires most time.

To make this Preparation, you must use the *Aqua fortis* of Chap. 52. putting one Pound in a Glass Matras, with four Ounces of Leaf-Silver to dissolve, and stop the Matras.

Take another Matras, wherein put a Pound of the same *Aqua fortis*, with five Ounces of Mercury purified with Salt and Vinegar after this manner. Take common Salt, sprinkle it with Vinegar in a Wooden-dish, where add to it a little common fair Water to make it dissolve, put in your Mercury, and stir it well with a Wooden-Pestle to draw out the Blackness; repeat washing them often with fresh Salt and Vinegar, till there be no more Blackness; then dry them with warm Linen or Cotton, and pass it thro' the Glove, then it will be purified, and fit to put in your *Aqua fortis*. When it is dissolved, stop the Matras and keep it.

Take another Glass Body, wherein put a Pound of *Aqua fortis* with three Ounces of fine Silver calcined. Amalgamate the Silver with the Mercury, as the Goldsmiths usually do, and put it into a Crucible, with its weight of common Salt purified, as we have heretofore shewn: Then put the Crucible on hot Coals, that the Mercury may evaporate, and that only the Silver remain at bottom, which will be purified and calcined. Then add to that calcined Silver,

ver, an equal weight of common Salt purified as before, mix them well together, and put them over the Fire in a Crucible to calcine them afresh; then wash them well with warm Water to take out the Salt; then put this Silver into a Glass Vial fill'd with common Water, which boil till one fourth part be consumed, then let it cool and settle to the bottom, then decant off the Water, and put more upon it: Reiterate this Process with fresh Water three times, and at the fourth dry the Silver, and put it into your *Aqua fortis*, and stir it well, and stop the Matras.

(We have promised to give the way of purifying common Salt, which is this. Take what quantity you will of Sea-Salt, dissolve it in a convenient quantity of common Water, boiling it for the space of two Hours, then let the Water rest, that the earthy part of the Salt may settle to the bottom: Then filter the Water, and evaporate it in an Earthen Vessel, or rather in a Glass Cucurbit, till the Salt remain dry at the bottom. Dissolve this Salt again, making the Water boil, then let it stand for the Dregs to settle, after which filter it and evaporate it as before; which you must continue to do, till it leave no more Fæces or Dregs, and it will be well purified and prepared.

To continue our Preparation of the Materials, you must put into a Glass Matras a Pound of *Aqua fortis*, with three Ounces of purified *Sal-Armoniac*; that is to say, filter'd and whitened till it leave no Fæces or Dregs, as we have shewn in common Salt: Then dissolve in that Water a quarter of an Ounce of Silver, and stop the Vessel well.

Take another Glass Matras, and put into it also a Pound of *Aqua fortis*, with two Ounces of *Sal-Armoniac*; being dissolv'd, put into that Water, of *Cinnabar*, of *Crocus Martis* calcined with Sulphur as

above; of *Ultramarine*, and of *Ferretto of Spain*; prepared as in *Chap. 22.* of each half an Ounce, the whole well pounded into Powder; you must do this little by little as we have heretofore hinted for fear of breaking the Vessel, by the fermentation which they make with the *Aqua fortis*; then stop the Matras.

Put into another Matras a Pound of *Aqua fortis*, and dissolve in it two Ounces of *Sal-Armoniac* as before; add to it of *Crocus Martis* calcined, as in *Chap. 25,* with calcined Tin, known among the Glass-Men, of *Zaffer* described in *Chap. 17.* and of *Cinnabar*, of each half an Ounce, the whole well-powder'd, and cast little by little into your Matras; for the Reasons before assigned, which require that great precaution; then stop the Matras.

Take another Glass Body, wherein put one Pound of *Aqua fortis*, and dissolve in it two Ounces of *Sal-Armoniac*; then add one Ounce of small Leaves of a Copper calcined, as in *Chap. 31,* half an Ounce of Scales of Copper thrice calcined, as describ'd in *Chap. 34,* half an Ounce of *Manganese of Piedmonte* prepared, as in *Chap. 18,* and half an Ounce of Scales of Iron which fall from the Smiths Anvil, the whole well pounded, which cast little by little into your Matras for fear of breaking it, then stop it well.

Put into another Glass Body one Pound of *Aqua fortis*, and two Ounces of *Sal-Armoniac*: The dissolution being made, put to it little by little half an Ounce of red Lead, one Ounce of Scales of Copper of *Chap. 34,* half an Ounce of crude Antimony, and as much *Caput Mortuum* of Vitriol purified, the whole well pulveriz'd; then stop the Matras.

Take

Take another Glass Matras, put into it one Pound of *Aqua fortis* with two Ounces of *Sal-Armoniac*; add to that Water of Orpiment, of white Arsnick, of Painters Lake, half an Ounce of each; the whole being well powder'd, and put into a Matras with the same precaution as before, stop it well.

We have not repeated at each Operation, that you must put your Matras on an Ash Furnace over a gentle heat, or in a warm Bath to hasten the Solution of the Materials; because we have told you it must be always done in *Chap. 58*, in speaking of the Preparation of those things which serve to tinge the first Species of Chalcedony; which may suffice for the instruction of those who employ themselves in this Art. We will add, that all the nine Matrasses mentioned in this Chapter, must remain fifteen Days in the same heat, stirring them often every Day, that the Water may the better operate on the Materials subtilizing them, and well opening their Tinctures. Then put all these Materials, with the *Aqua fortis*, into a great Glass Body, little by little, that they may unite well together. Close the Body and set it in the same heat, stirring it well for six Days. After that, take a great Glass Cucurbit well luted half way up the Body of it, put it on an Ash Furnace, put into it all the Materials out of your Body, fit to it a Head and Receiver, lute well all the Joints, then distil it during the space of twenty four Hours, over a very gentle Fire, for fear the Colours should be spoil'd, that the Water pass gently over, and the Spirits remain in the Powder, which of green will become yellow.

Thus putting that Powder in the requisite Dose (as we have taught in the first Species of *Chalcedony*) into purified Glass Metal, made of broken pieces of Crystal, and not of Fritt; and adding to it in its due time, calcined Tartar, Soot of Chimney, *Crocus*

Martis made with Vinegar, observing all we have on this Subject remarked, these Materials will give an opacity to Glafs, which may be worked twenty four Hours afterwards, managing it well with proper Tools, and often heating it; and you'll have things made of an extraordinary Beauty, greater then can be imagin'd.

The End of the Second Book.

O F

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G L A S S S.

B O O K III.

C H A P. LXI.

The Way of making Glass of the colour of Gold Yellow, of Granat, Amethist, Saphir, Velvet Black, Milk White, Marble, Peach Flower, and deep Red: Also to make Fritt with Natural Crystal, to colour Glass of a Pearl Colour, Viper, Ruby, Topaz, Opal, Sun-flower and others, with several other particulars in this Art.

THERE are several Ways of giving Glass the Colour of Gold, of Amethist, of Saphir and others; which are not unknown to the Curious in this Art; and as there is generally some one way more particular and finer than the rest, several may be ignorant of that; for that reason this Third Book is destin'd to that end, *viz.* to shew

shew the best, and also to make Fritt of Natural (or Rock) Crystal, the way and Process whereof we will lay down so distinctly, that it shall be impossible for any one to miss his aim in doing it, that observes these Rules: To that end we caution those who employ themselves in making them, that they must be very punctual in the Dose, Time, and Circumstances, and Materials: For if you err in any one, the whole will be spoil'd and come to nothing, for you will have quite different Colours from what you proposed to your self. We will endeavour to make our Descriptions in the following Chapters, so clear and plain, that we hope they will prove to the Reader's Satisfaction.

C H A P. LXII.

To make a Gold-Yellow in Glass.

Gold-colour being one of the most noble and finest we can make, by reason of its imitating the most perfect Metal in Nature, as we have said in *Chap. 8.* must be made with the purest Materials, and great precaution.

Take two parts of Crystal Fritt, made with *Tarso*, and not with Sand, which is not so good; and one part of Fritt composed of two thirds of *Tarso*, and one third of fine Salt of *Polverine*, prepared as in *Chap. 7.* pound and mix them well, and to each hundred Pound of this Composition, add one Pound of Tartar purified, pounded and searced fine; and one Pound of *Manganese of Piedmont*, prepared as in *Chap. 18.* mixing well these Powders with the two Fritts, because you must not cast them on the melted Glass as in other Colours: Then put the whole little by little into a Pot, and put them into a Furnace, wherein

wherein let them stand at an ordinary Fire four Days, for fear the Glass rising, should run over. When that Matter is well purified, you may use it for making Vessels, and what other Works you please, which will be of a fair colour. If you would have the Colour yet clearer, you must add more Powder, and you will have a very fine Golden-colour. If you would have it yet finer, take fine Crystal Fritt made of *Polverine of Rochetta*, and the Golden-colour will be yet more fair.

CHAP. LXIII.

Granat-Colour in Glass.

THE beauty of this Colour is to express the Yellowish-red of Fire, when it is exposed to the Sun: We will treat more largely of it in the fifth Book, in shewing the way to counterfeit this Stone, as also several others.

To give Granat-colour to Glass: Take of Crystal Frit, of Fritt of *Rochetta*, each an equal quantity, mix them well, and to an hundred Pound of these Materials, add one Pound of *Manganese of Piedmont*, prepared as in *Chap. 18*, one Ounce of *Zaffer*, prepared as in *Chap. 17*, mix them well with the Fritts, then put them little by little into an Earthen Pot made red-hot in the Furnace, because the Glass is apt to rise and run over. After four Days the Glass being well tinged and purified, you may work it; you may encrease or diminish the Colour as much as you please, that depends on the Discretion of the Workman who puts in the Powders, which ought to be orderly put in, that the Matter be not spoiled.

C H A P. LXIV.

To make an Amethist-Colour in Glafs.

A *Methist* being of a Violet Colour, proceeding from Red and Blue, must be well imitated to look beautiful. For this Colour, take Crystal Fritt well made, with *Tarso* and not Sand, this Colour requiring no other; to which add to each Pound one Ounce of the following Powder, which mix well together before they be put into the Pot. After that you must set the Pot to the Fire in the Furnace little by little, otherwise the violence of the Powder would cause it to break. When this Glafs has been well purified for the space of four Days, and it has the colour of *Amethist*, you may work it. This Colour may be augmented or diminished by means of the Fritt, or Powder, according to the Discretion of the Workman.

This is the Powder which produces the *Amethist* Colour in Glafs. Take one Pound of *Manganese* of *Piedmont*, prepared as in *Chap. 18*, and an Ounce and half of *Zaffer*, prepared as in *Chap. 17*; mix them well together, and put the Dose we have shewn to each Pound of Fritt, to have a true *Amethist*-Colour.

Porta in his sixth Book, *Chap. 5*. only allows one Drachm of *Manganese* to each Pound of Metal, to make the Glafs of an *Amethist* Colour; but that Dose is too weak, and you must follow that we have shewn.

C H A P. LXV.

To make Glass of a Saphir-Colour.

TO imitate the Colour of *Saphir* in Glass, which is of a clear and transparent Blue; you must put to each hundred Pound of Fritt of *Rochetta*, one Pound of *Zaffer* prepared, with an Ounce of *Manganese* of *Piedmont*, also prepared as we have shewn. Well mix these Powders with the Fritt, then put the whole into a Pot in a Furnace, letting the Glass be well melted and purified: For the longer it remains on the Fire it becomes so much the finer, if you take care to take it out from time to time. Then mix it very well, and make an Essay of the Colour, and if it be not full enough, augment or diminish it as much as you think fit; then the Glass may be wrought, and you will have a *Saphir* of the Colour of the Double Violet of *Constantinople*, which the small Dose of *Manganese* produces.

C H A P. LXVI.

Another way of giving Glass a finer Saphir-Colour.

GLASS will have a far fairer *Saphir-Colour*, if in room of Fritt of *Rochetta*, you take good Crystal Fritt, and add to it the same Dose of Powder, as in the preceding Chapter. Of this Glass thus tinged you may make what Works you please. You must not put the Powder of *Manganese* and *Zaffer* on the melted Glass, but mix it with the Fritt as we have noted: For the Colour the melted Glass takes, is not so fine as when the Materials are first mixed.

C H A P.

C H A P. LXVII.

To give Glass a Velvet Black.

ALTHO' this Black Colour look mournful, yet it is not without its Beauty : To make it, take pieces of Glass of several Colours, to which add a little less than half the quantity of *Manganese* as *Zaffer*, and put the whole into a Pot in the Furnace. This Glass being well purify'd may be wrought, and it will give a Black like Velvet, fit for many things.

C H A P. LXVIII.

Another Way of giving Glass a much fairer Velvet Black.

ANOTHER Way of giving a Black Velvet Colour to Glass, much fairer than the former, is to take twenty Pound of Crystal Fritt in Powder, with four Pound of Calx of Lead and Tin, of each an equal quantity ; mix the whole well together, and put them into a Pot heated in the Furnace ; and when this Glass is well melted and purified, you must cast in three Ounces of Steel calcined and powder'd, and three Ounces of Scales of Iron from the Smiths Forge, powder'd and mixed with the Steel ; mix the whole well as you cast them in, that the Glass may not rise, and the better to incorporate them. Then let all rest twelve Hours, during which time, stir them sometimes ; then you may work it : And you will have a Velvet Black Colour very fair, wherewith you may work as you please.

C H A P.

C H A P. LXIX.

Another Velvet Black fairer than the precedent.

THIS last Way of making a Black, surpasses in Beauty the preceding. Take one hundred Pound of *Rochetta* Fritt, two Pound of Tartar, six Ounces of *Manganese* prepared, reduce all to Powder, mix them together, put them into a Pot, which you must put into the Furnace leisurely, that the Matter don't rise too much. Then let it melt and purifie during the space of four Days or thereabouts; mix the Materials well, cast them into Water the better to purifie, and then melt them again; and you'll have a Black of an extraordinary Beauty, which may be wrought as you please.

C H A P. LXX.

To make a Milk White Colour in Glafs.

THE Milk White to be done well, requires no less exactness than the Blue. To succeed in it, take twelve Pound of good Crystal Fritt, two Pound of Calx of Lead and Tin, one of each, and half an Ounce of *Manganese* of *Piedmont* prepared, as we have shewn: The whole pulverized and mixed together, and put them into a Pot heated in the Furnace, where let them stand twelve Hours, then mix the whole well, and make an Essay of it. If the Colour don't please you, add to it some Calx of the two Metals before mentioned, which incorporate with the Glafs, well mixing it. Eight Hours after the Glafs will be fit to work, and white as Milk.

C H A P.

C H A P. LXXI.

Another Fairer and Whiter Colour.

THIS second way of giving Milk White to Glafs, is much better than the precedent, and the Working more exquisite. We only make use of the Calx of Tin, without mixing any Lead; and we put sixty Pound of that Calx, to four hundred Pound of pure Crystal Fritt, with two Pounds and an half of *Manganese of Piedmont* prepared; the whole being well pulverized and mixed, must be put in a Pot heated in the Furnace, there to purifie during eight Days: Then cast the Matter into the Water the better to purifie it, then put it to melt again in the same Pot, after having dry'd it. If it be transparent, you must add to it fifteen Pound of the same Calx of Tin as before, mixing it well with the melted Metal, to make it the better incorporate; twenty four Hours afterward, it will be finer and whiter than Snow, and ready to work.

C H A P. LXXII.

The Way to give Glafs the Colour of Lapis Lazuli.

LAPIS LAZULI, which is a fine Blue, and full of Veins of Gold, will not be easie to imitate, without a great deal of Care and Industry in its Preparation.

To make this fine Colour, we must make use of the same Matter of the fine White in the preceding Chapter, and when it is in fusion in the Pot, you must add to it little by little the Blue Enamel in Powder, that the Painters make use of, mixing well the whole together each time, and that as often as there is occasion to make this Colour. Then try if it please you, and when it is to your Mind, let it stand two full Hours, then stir it well and make a second Essay of it. If the Colour be perfect, let it stand ten Hours and then mix it again. If it keeps in the same State without changing colour, you may employ it in making what Vessels you please, which will be of the true colour of *Lapis Lazuli*. If in working this Glass it chances to rise, you may cast in a little Leaf-Gold, which will make the Glass approach yet nearer to *Lapis Lazuli*, and which will in a moment stop the rising of the Metal, as Sugar will do in boiling Oyl.

C H A P. LXXIII.

The Way to make a Marble-Colour in Glass.

WHITE Marble being very simple, it is easie to imitate, the way of doing it only requires Crystal Fritt, which must be worked as soon as it is melted, before it be purified, for so it will give a very fair Marble Colour.

C H A P. LXXIV.

The Way of making a Peach-Colour in Glass.

TO make this Colour, which is a very agreeable one, take Glass prepared, and tinged of a Milk White, whereof we have spoken in the precedent Chapters; and when it is in good fusion, put in some *Manganese of Piedmont*, prepared as in *Chap. 18*, and that little by little, stirring the Matter well at each time, till the Colour become as fine and perfect as you desire it; but you must work the Glass in time, otherwise the Colour will be lost; and you will have a very fair Peach Colour.

C H A P. LXXV.

The Way of tinging Glass of a deep Red.

OPAQUE Colours have a Body, but the Transparent ones none; wherefore this deep Red must be mixed with Matters that give it one, as we will shew.

You must take twenty Pound of Crystal Fritt, one Pound of pieces of White Glass, and two Pounds of calcined Tin; mix the whole well together, and put it in a Pot in a Furnace that it may purifie. That being well melted, cast in an Ounce of calcin'd Steel well pounded; and an Ounce of Scales of Iron from the Anvil, well pulveriz'd and mixed together, stirring well the Glass with an Iron Stirrer, when you are putting in the Powder, to hinder it from rising too much. You must take care not to put in too

much

much of the Powder, for that would make the Glafs black, whereas it ought to be clear, shining, and of an obscure yellow Colour. Then take about six Drachms of calcined Copper, prepared as in *Chap. 32*, cast it upon the melted Glafs, often mixing it, to three or four times, and the Glafs will be as red as Blood. If the Workman like the Colour, he must presently work it, for fear it should become black, and the Colour be lost, wherein you must take great care. If notwithstanding this the Colour comes to be lost, you must add more Scales of Iron in Powder, and it will return. This Work seems somewhat wearisom, but you must not think of that, but prepare and finish the business carefully, otherwise you will not succeed.

C H A P. LXXVI.

The Way of Calcining Natural (or Rock) Crystal, to make an Extraordinary Fritt.

ALTHO' we may imitate Natural Crystal by help of Art, and make as fine with the Materials we have shewn how to prepare; yet the way we are going now to describe, of making a Fritt of Natural Crystal, will make one so extraordinary, that it will surpass in beauty all we have yet shewn the Preparations of.

Make Natural Crystal red hot in a Crucible covered close, then extinguish it in Water, and reiterate the same eight times. Then dry it well, and grind it on a Porphyry Stone to an impalpable Powder. Often purifie this Powder of Crystal, after the same way we have shewn to purifie *Polverine of Rochetta*, in *Chap. 7*, observing all we have said on that Sub-

ject. Then mix that Cryſtalline Matter, with about one third part of Salt extracted from *Pelverine* of *Rocketta*, prepared as in *Chap. 7*, make a Fritt of it, then put it into a Pot well heated in the Furnace, and when it is in good fuſion add to it a proportionable Doſe of prepared *Manganeſe* of *Chap. 17*. After that often caſt it into the Water to puriſie, as we have noted in ordinary Cryſtal, and puriſie it very well at the Fire before you work it, as we have elſewhere hinted. Then you will have a Cryſtal more beautiful and ſhining, than you have otherwiſe ever ſeen.

C H A P. LXXVII.

To make Pearl Colour in Cryſtal.

TRUE Pearl Colour is ſo fine and ſhining, that it might ſeem difficult to give it to Cryſtal; yet it is ſo eaſie that Tartar alone does it.

Thoſe who have a mind to perform this Proceſs, muſt calcine their Tartar till it become White, as we have ſhewn at the end of *Chap. 5*, then having well purified the Fritt of the Natural Cryſtal, whereof we have ſpoke in the preceding Chapter, and being in a good fuſion in the Furnace, you muſt caſt into it this white Tartar at ſeveral times, mixing the whole well each time, which muſt be continued to be done till the Glaſs becomes of a Pearl Colour; for there is no other Rule in this Caſe than Experience to guide your ſelf by.

When the Colour is come to perfection, and the Workman likes it, he muſt preſently work it, becauſe it will be ſoon loſt, as Experience teſtifies; and you may make of it Works of an extraordinary Beauty.

C H A P. LXXVIII.

The Way to tinge Natural Crystal of a Viper colour.

THE Green Viper Colour is not disagreeable, but it is very dangerous to make, by reason of the Materials whereof it is composed, if you are not very careful in making it. Take two Ounces of Rock Crystal of a good Water, two Ounces of crude Antimony, and as much Orpiment, with one Ounce of *Sal-Armoniack*; reduce these three last into Powder: Stratific with these Powders the Pieces of Crystal, in a good Crucible; cover it with another that is bored through the bottom, lute them well together, and when the Lute is dry, put them in the middle of the Coals in a Furnace, let them be gently lighted that the Crucible may grow hot by degrees. It will smoak very much when it first grows hot, wherefore this Operation must be made in a large Chimney, that the Smoak may fly away, and you must go out of the Laboratory, because it is very dangerous and may prove Mortal. Let the Fire kindle of it self, and the Crucible grow cold; then take out the Pieces of Crystal which lie on the top of the Crucible, which will have the Colour of Rubies, and be marked with fine Spots; and those which are at the bottom will for the most part have the Colour of Vipers. Separate the other pieces from them, which will be of other Colours, and polish the whole at the Wheel like other Stones, then with Foils you may set them in Gold. These Stones will be of a very agreeable colour. You might tinge a great number together, but that would be more chargeable.

C H A P. LXXIX.

To make in Natural Crystal the Colour of Rubies, Topaz, Opal, Gyrafol and others.

IT seems something strange that Crystals mixed with Matters that tinge it, should in the same Vessel receive so many different Colours. But if you consider that the Spirits of these Matters, have Virtues different from those of their Bodies, you will not so much wonder at such Diversities. The Pieces which lie highest, are the most penetrated by these tinging Spirits which always ascend, and so give them more vivacity and colour; and so to the others in proportion to your Orders.

For this Operation, take two Ounces of Orpiment of a yellow Colour approaching Gold or Saffron, and as much White Arsenick; one Ounce of crude Antimony, and the same weight of *Sal-Armoniac*; the whole reduced to Powder and mixed together. With this Powder stratifie pieces of Natural Crystal in a great Crucible, putting the least pieces to the bottom, and the greatest at the top which ought to be fine and without Spots. The Crucible being fill'd with the Powder and Crystal, cover it with another bored at the bottom, lute them well and let the lute dry. This last Crucible must (as we have said) be bored at bottom, that the smoak of the Materials ascending through the Hole, may better tinge the Crystals in passing, which it would not do so well if it passed out of the sides. When the Lute is dry, put it in the Furnace, and cover it with Coals up to the middle of the Crucible on the top, then put some live Coals to them, that they may kindle by themselves
little

little by little, they ought to be great Coals, and made of Oak. You must take care of the Smoak, it being very dangerous, as we said before ; and order it so that they kindle well, that the Business may succeed, and that the Fire may go out of it self, taking care that no Air can get in at the Mouths of the Crucibles, for that would make the Crystals break, and then they are good for nothing.

The Crucibles being cold unlute them, and take the Crystals out, the greatest parts of which will be tinged with the colours we have mentioned : Polish the best colour'd at the Wheel, which will also brighten their Colours, and make them look like Oriental Stones, and they'll be fair and hard as they are.

All the Success of this Secret consists in the Orpiment, which must be of the colour of Gold ; and if you don't succeed the first time, you must try a second ; and observing well what we have said, you may be assured to succeed.

The End of the Third B O O K.

O F T H E
A R T
O F
G L A S S .

B O O K I V .

C H A P. LXXX.

The Way of making Glafs of Lead, commonly called Vitrum Saturni: To calcine Lead, and extract from it the Colours of Emerald, Topaz, Sea-green or Azure, Granate, Sapphire, Gold, and other Colours.

GLASS of Lead, known to few Artists in this way, because they make no use of it by reason of its brittleness, is beyond doubt, the fairest and noblest Glafs of any other. In this Glafs you may imitate all the Colours of Oriental precious Stones; and if this Glafs were as tough as Crystal, it would far surpass it in beauty. It is true, if you don't

don't work it with great care, no Pots nor Crucibles will hold it, for it will crack them and run out. I will here give all the Methods of preparing it, and that so distinctly, that the unexperienced may succeed in it. The Business principally consists in knowing well how to calcine the Lead, and recalcine it again, which is commonly known, notwithstanding in the next Chapter we will shew how to do it for the sake of those that do not know it. The better the Lead is calcined, the less apt it is to turn into Lead again, and break the Pots in this Operation. We will also shew, that you must always drop the Glass into Water when it is melted, for the least Lead remaining in it, breaks out the bottoms of the Vessels, and so you lose your Matter, which may be avoided by carefully minding what we have said, and which we shall note again in the following Chapters.

It is our Opinion, and that not without reason, that that subtilty whereby the Lead so easily in this case pierces the Pots when it is not wholly calcin'd, comes from a certain unctuous yellow Matter like Oyl, that is seen to swim on the top sometimes in a violent fusion. For we have often observed, That if that unctuous Matter be not taken off as soon as it appears on the top, it will pierce the Pot, and so all run out among the Coals.

This unctuous Matter has strange and infinite Virtues known to the *Adepti*, both in curing Diseases, and other Operations. He who knows how to make it Transparent, and give it the Jacynth Colour in *Ezekiel*, which is that *Electrum* spoken of in the first Chapter, may boast he has a Material, from which may be extracted a *lac Virginis*, in great esteem among the Philosophers. But let this suffice, we are not here to instruct the ignorant in those *Arcana*, but remit them to the Writings of the *Adepti*.

Kircher assures us, that if Mercury congealed with the Vapour of Lead, be heated in a Brass-Spoon over live Coals, it will exhibit a strange variety of Colours, that you cannot imagine the like. And *Zibav.* speaking of Lead in his seventh Book, C. 20. *de Transmut. Metall.* That the Melters and Tryers of Metals daily turn Lead into Glafs, and that this Glafs is Black, Red, Yellow, Green, or otherwise coloured, according as the Lead is differently calcined.

CHAP. LXXXI.

To Calcine Lead.

L EAD is easie to be calcined, because it is so to melt; for this purpose you may make use of the Furnace described in *Chap.* 52, or in a Kiln: You must put in a good quantity of Lead at a time; for in two or three Days may be calcined several Hundred Weight. The Fire ought to be hot enough to melt Glafs, and not hotter; for if it be hotter it will not calcine the Lead. As soon as the Lead is melted, and it yields on top a yellowish Matter; begin to draw forward the calcined part with an Iron fit for the purpose, always spreading it in the internal Extremity of the Furnaces or Kilns bottom. This Lead being well calcined for the first time, ought to be put again into the Furnace moderately hot to reverberate. You must spread it with the Iron, and stir it continually for several Hours, and at this second calcination it will become Yellow; then searce it through a fine Sieve, and that which does not go through, must be put with other Lead to calcine afresh; always taking care, that the Furnace have just a moderate heat, and be not too hot.

There

There are several other ways of calcining Lead which we will not mention here, because this we have shewn is the best and most easie, and will dispatch a great quantity in a short time. All the Potters know how to calcine it, because they make use of it in their Glasing.

C H A P. LXXXII.

The Way to make Glafs of Lead.

WE have told you the Beauty of this Glafs, in *Chap. 77*, which may be tinged of several Colours, as Black, White, Green, and Red, which are natural to it, the degrees of the Fire only making it take those different Colours.

This Glafs being well made, besides the Beauty it has, which it communicates to Glafs, and to Tinctures of precious Stones wherein it is employ'd, it has other great Virtues in Metallick Operations, which are not known to all the World, whereof we could largely treat, if it were not besides our Subject.

To make *Vitrum Saturni*: Take fifteen Pound of calcined Lead, as we have shewn in the preceding Chapter, and twelve Pound of Crystal or *Rochetta* Fritt, according to what colour you would have; mix them well together, and put them in a Pot in the Furnace, where ten Hours after it will be in good fusion; then cast the whole into Water, and take out speedily the remaining Lead at bottom of the Vessel, for fear it should break; then take it out of the Water and dry it, and put it into the same Pot to melt again: Take care not to put in the Grains of Lead (if there be any) which were in the Water, and which will be loosened from the Matter. After
your

your Matter has been again in fusion six Hours, you may work it.

You may also make a Glafs of Lead, by taking three parts of Lead, one of fine Sand, and change them into Glafs in the Furnace: As also of three parts of calcined Litharge, and one part of calcin'd Flint, melted and vitrified in the Furnace together.

C H A P. LXXXIII.

The Way how to Work Glafs of Lead.

IT is not enough to shew how to make Glafs of Lead, if we don't shew how to work it too. If any one would make Vessels of it for use of any Figure; he must take a Glafs Workman's Iron they use to take the Metal out of the Pots with, and take what quantity of Glafs of Lead with it he pleases, when it is in fusion, and let it a little cool, then work it after the manner we have shewn *Chap. 3.* You must clean well the Marble you make use of, and while the Glafs is cooling, you must wet the Marble with cold Water; for otherwise the Glafs would scale it, and part of the Marble would stick to it. If the Marble be hard, you have so much the less to fear, for it will not break so easily, nor stick to the Glafs.

C H A P. LXXXIV.

To make Glass of Lead of a fair Emerald Colour.

THE easiness of tinging Glass of Lead of any colour, is the reason, you may be sure, of giving it an excellent Emerald-Green, especially because Green is also Natural to it.

Take twenty Pound of Crystal Fritt powder'd and scarced, and sixteen Pound of Calx of Lead also sifted; mix them well together, then put them little by little into a Pot heated in a Furnace, and eight or ten Hours afterwards it will be melted; then cast the melted Matter into Water, and carefully take the remaining Lead from it; then put the Matter after it is dried into the same Pot again, and seven or eight Hours after it will be again melted. Reiterate this process of casting the melted Matter into the Water, and separating the Lead that sticks to the Pot, as before; then this Glass will be cleansed and purified from all the foulness and unctuousity the Calx and Powder would leave in it and be very resplendent. You must put it again in the Pot, where it will melt and purifie in a little time. When it is melted, put to it six Ounces of Scales of Copper thrice calcin'd in Powder, as in *Chap. 34*, with twenty four Grains of *Crocus Martis*, made with Vinegar, as in *Chap. 25*, also in Powder, and mix them together.

This Powder must be cast in at six times, always mixing well the Glass, and taking at each time the interval of saying the *Creed*: Let it rest one Hour, and then stir it again, and see if the Colour pleases you: If it be as you would have it, let it stand eight Hours, that the whole may well incorporate. Then stir

stir it well, and let it rest a little, that the *Faces* may precipitate to the bottom of the Pot; then it may be wrought, and the colour can scarce be distinguished from true Emerald.

C H A P. LXXXV.

Another Way of making Glass of Lead of a fairer Emerald than the former.

FOR this colour, which will be far fairer than the precedent, you must change one Ingredient of the other Chapter, and instead of Scales of Copper thrice calcined, put the same Dose of *Caput Mortuum*, of *Vitriolum Veneris*, prepared as at the end of the seventh Book; then proceed exactly as in the former Chapter, and you'll have a very exquisite Green.

C H A P. LXXXVI.

To make a Glass of Lead, of the Colour of Topaz.

TOPAZ is a lighter colour than Emerald, and casts Rays the colour of Gold, wherefore the colour can't be well imitated except this way.

Take fifteen Pound of Crystal Fritt in Powder, and ten Pound of Calx of Lead also in Powder, mix them well, and searce them very fine, then put them in a Pot heated at the Furnace, where leave it eight Hours, that it may be melted. Then cast the Matter into Water, and take out of the Pot all the Lead (if there be any) that remains. Put the Matter again into the Pot to be melted, and cast it by intervals

vals into the Water. Add to that Matter half its weight of Glafs tinged of a Golden colour, as in *Chap. 62.* incorporate and purifie well the whole together, and you'll have a Glafs of the true colour of Oriental *Topaz*, fit to be wrought.

C H A P. LXXXVII.

To make a Sky, or Sea-Green, in Glafs of Lead.

WE have shewn several Ways in the first Book to tinge Glafs of a Sky-colour, or Sea-Green, which would be needless to repeat here.

That we now shew which is made in Glafs of Lead, has no less Beauty. Take sixteen Pound of Crystal Fritt, ten Pound of Calx of Lead, mix them together, and put them gently into a Pot heated in the Furnace, where they will be in good fusion in twelve Hours time. Then cast that Matter into Water, as I have shewn before, and take the remaining Lead out of the Pot, and put your Matter in again to melt. Eight Hours after cast it again into Water, taking the remaining Lead out of the Pot, then it will be well purified. Put it in again to melt in the same Pot, and when it is in good fusion, cast in at four different times, four Ounces of small Copper Leaves, prepared as in *Chap. 30.* with a quarter of an Ounce of *Zaffer*, prepared as in *Chap. 17.* After having mixed these Powders well together, and the Matter at each casting of it in: Two Hours after stir the Matter well in the Pot with an Iron Rod, and make an Essay to see if the Colour be full enough, then let it stand ten Hours to purifie, and to give the Colour time to incorporate with the Glafs: Then it may be wrought to the Uses you design it, stirring
it

it well, and letting it rest a little to settle, before you Work it.

C H A P. LXXXVIII.

To make a Granat Colour in Glass of Lead.

THE Vivacity of this Colour appears no less in Glass of Lead than in Crystal, if it be made carefully. To make it, take twenty Pound of Crystal Frit, with sixteen Pound of Calx of Lead; and after having added three Ounces of *Manganese of Piedmont* to it, and half an Ounce of *Zaffer*, both prepared as we have shewn; put the whole into a Pot heated in the Furnace: Twelve Hours after, cast that melted Matter into the Water, and take out the Lead that remains behind in the Pot. Then put the Matter again in the same Pot, where it will be purified ten Hours after. You must mix it well with the Iron, and let the *Faces* precipitate; then see if the Colour pleases you; then work it to what Uses you please, and you'll have a Glass of Lead of a fine Granat-colour.

C H A P. LXXXIX.

To make a Sapphire-Colour in Glass of Lead.

THE Beauty of *Sapphire* is no less imitable in Glass of Lead, than the Colours of other Precious Stones; and its clear Blue Transparent Colour will have as much Splendour. To make it, mix together fifteen Pound of Crystal Frit in Powder, and
twelve

twelve Pound of Calx of Lead, then searce it, pounding again what does not pass through the Sieve. Add to that two Ounces of prepared *Zaffer*, twenty four Grains of *Manganese* of *Piedmont* also well prepared, mix the whole well together, put it in a Pot heated in the Furnace, and let it stand to melt during the space of twelve Hours. Then cast the vitrified Matter into Water, and carefully take away the Lead that remains in the Pot; then put the Matter again into the same Pot, and let it stand to be re-purified Twelve Hours. Then see if the Colour pleases you, and you may Work it. You'll have a Colour like the true Oriental *Sapphire*.

C H A P. XC.

The Way to make a Golden-colour in Glass of Lead.

THIS Colour is as fine in Glass of Lead, as in Crystal: It takes that Colour both from the Lead, and the Ingredients mixed with it.

Take sixteen Pound of good Crystal Fritt in Powder, to which add the same weight of Calx of Lead also in Powder, and well searced; then add six Ounces of Copper Scales thrice calcin'd, as in *Chap. 34*, and forty eight Grains of *Crocus Martis*, made with Vinegar, as in *Chap. 25*, the whole mixed well together, put it in a Pot heated in the Furnace: Twelve Hours after cast the Glass in Water, and take the remaining Lead out of the Pot, and then put the Matter again into the same Pot, to be well purified during Twelve other Hours.

After that, stir it well, and see if the Colour pleases you; if it chance to be greenish, add to it some *Crocus Martis*, and the Greenness will vanish; then you will have a Golden-colour very fine, which may be Wrought.

These are all the Colours we can give to Glass of Lead alone. We shall augment the Number in a Part of Lead, whereof we shall shew the Preparation in the following Book, because it is useful for imitating Precious Stones, as we shall shew in the same Book; which is the Reason we have not done it in this.

The End of the Fourth B O O K.

O F T H E
A R T
O F
G L A S S S.

B O O K V.

C H A P. XCI.

Shewing the Way to prepare Natural Crystal, and to make a very fine Salt of Tartar, and several sorts of Pastes, for Emerald, Topaz, Chrysolite, Jacinth, Granat, Sapphire, Beryl or Egmarine, Carbuncles, Rubies, and several other Colours, of so great Beauty that they surpass the Natural Stones themselves in every thing but Hardness.

WITHOUT doubt it will seem surprizing to several, that Art should be capable of imitating the Natural Colour of Precious Stones in so great Perfection, as that the Beauty of the Artificial should surpass that of the Natural Oriental

ental ones, in every thing excepting their hardness, which they have been many ages in acquiring: and I doubt not but several Ingenious Men are this day searching after means to give them that too. The Curious will find in this Book all that is necessary to attain this Art, nay, and to do something more than I mention. For since Art can easily imitate Nature, it is not to be doubted but that Ingenious Men may some time or other arrive to give the same perfection to Crystals that precious Stones have acquired in the Bowels of the Earth.

The Natural, or Rock Crystal, which we make use of, as the Basis of our Artificial Gems, is the only Stone that does not proceed from any Metal, being the first substratum of others, only made of a congealed Water, with a subtil Earth, as other precious Stones. Its Virtue proceeds from *Mercury*, and the Spirit of *Raphael*, having also a great Sympathy with *Saturn* and *Jupiter*, whence it is proper for healing several Diseases. All the diversities of Gems proceed only from a sulphur or an unctuous Substance, which insinuates its self in their Composition, which fixes them more or less and also tinges them. This Sulphur is an Exhalation of Metalline and Mineral Spirits, forced up by the Central Fire, which virtually contains divers Colours, and which are determin'd and brought into act by proper Subjects.

Thus Granat and other precious Stones agree with Crystal, as Mercury does with Saturn, their harmony in the Heavens assures us of these reasons and proportions here on Earth.

Precious Stones derive their Origin from the Stars and the Primum Mobile, as do the Metals both perfect and imperfect, of the colour of Sulphur, and the qualities whereof they partake, and wherein they agree with the Stars. Great and wonderful

Opera-

Operations might be performed with these Precious Stones, if they were separated from the Impurity of their *terra damnata*, and reduc'd by the universal *Menstruum* into their first principles. It is only by this *Menstruum*, or mundane Spirit, that Metals and Minerals can also be so dissolv'd, that being full of their Attractive Virtues.

We can boldly assert that this universal Spirit contains in it self all the secrets of Alchymy; and that without it, it is impossible to have the Tincture, Water, and Salt of Precious Stones, or to make use of the admirable Virtues God has imparted to them. Yet I don't dispute but that there is a certain Acid Water Extracted from a Simple, wherein a dissolution of Gems may be made, and an admirable *Magisterium*, and a Precious Treasure-for the Health, being prepar'd *secundum Artem*. That Water will also extract the Tincture of Gold, the Virtue of which is not less for preservation of Life, and curing several Malignant Fevers.

As to Artificial Gems, which are the Subject of this Book; all the Art consists in rightly imitating the Tinctures of those that are fine, which must be extracted from Subjects that resist the Fire. The Tinctures we give them are fixed in the Crystals though volatile, without altering their Colour. As for example *Verdigrease* being put on the Fire, becomes of another Colour, but being in fusion with the Crystal it fixes and changes not its Colour; for natural Colours always return to their principle, and the great quantity of fixed, always retains some of the volatile. You must therefore for this end take permanent Colours which change not, being mixed one with another. For example Blue and Yellow make Green, you must therefore take a Blue that cannot be altered by the Yellow you mix with it; and a Yellow that cannot be altered by the Blue: and so of others.

Isaac Hollandus, who has writ much on the Art of making Gems, shews us a very fine way, by which he has performed things almost incredible. We will give you some of his Preparations, among those we design to treat of, and add several curious Matters to what he has said of them, both for Pastes, Tinctures, and the Fabrick of Gems, to Encourage the Lovers of this Art to set their Hands to work at it. It is true the way is troublesome and tedious, but any one that will diligently apply himself to it, will find himself sufficiently rewarded for his pains, both by the Pleasure of seeing so fine Productions, and the Profit he may get by a thing of so small charge.

CHAP. XCII.

The Way of preparing Natural Crystal.

WE have already given a very fine Preparation of Natural Crystal in the second Book, *Chap. 76*, yet we will give you here the principal one, which is its Calcination, and which we will explain at large.

To perform this Calcination well, Take Natural Crystal the fairest you can get, since that is the Basis for Artificial Gems, it is no matter whether it be in great or small pieces. Fill with these Pieces of Crystal a large Crucible, cover it with a Cover made of the same Earth, which must be somewhat broader than the Mouth of the Crucible, for fear Ashes or Coals tumble in, which you must take particular care of. Then set your Crucible in burning Coals in a little Furnace, and when your Crystal is well heated, cast it into a Vessel of cold Water, the more Water there is, so much the better will the Calcination be performed, because the cold of it is so much
the

the greater. Then take it out of the Water, and dry it in an Earthen Ladle, then put it into the same Crucible to be heated again, taking care to cover it well: Then cast it again into fresh cold Water, and repeat heating it and quenching it thus twelve times, changing each time the Water. You may know if your Crystal be well calcined, for it will easily break and crumble: If there appear in it any black Veins, you must take care to take them all clean out, by breaking them, and do this till only the White remains behind; then it is well prepared.

After you have well dried your Crystals thus calcined, grind them to an impalpable Powder on a Marble or Porphyry Stone, by putting a little on at a time, and scarce it well through a fine Silken Sieve.

And since we use this Powder of Crystal for all Artificial Gems whereof we are going to treat, your best way will be to keep a good quantity by you, which you may always have recourse to in Working.

If you design to succeed in this Art very well you must not use ordinary Fritt of Crystal, how good and fair soever it be, nor *Chalcedony*, nor *Tarso*, nor any other Stones; for the Glass made of them is far less fair and resplendent than that made of Natural Crystal, which has the most lustre, and approaches nearest precious Stones, as we have already remarked in the preceding Chapter.

CHAP. XCIII.

The Way of making a very fine and pure Salt of Tartar.

NERI makes use of no Salt of *Tartar*, in all his Preparations of Artificial Gems; notwithstanding this Salt being prepared after a certain manner, we shall here relate, for the sake of the Curious. It serves in a great measure to work the Crystal, being a true Vehicle, for the better introducing the Colours that are to be given, and which is of use for the Tinctures several ways.

Those, who in their Operations of Artificial Gems, have made no use of Salt of *Tartar*, have without doubt been ignorant of this fine Preparation of it; for if you use ordinary Salt of *Tartar*, there is a Sulphur and Foulness in it, which renders Crystal obscure, and consequently would be hurtful in these Operations.

To make this Salt, you must first calcine your *Tartar*, till it become Grey, and not to perfect Whiteness; and then dissolve it in warm Water to extract the Salt, filter that Water, and then evaporate it over the Fire; then you'll have remaining at the bottom of the Vessel, a White Salt. To take away all Foulness from this Salt, dissolve it again in warm Water, then evaporate it again over a gentle Fire; take it off the Fire, and cast it into cold Water, and you'll find it will leave on the surface of the Water a thick Froth, which you must skim off with a Skimmer that has little Holes no bigger than a small Pins Head: Put the Vessel again on the Fire, and evaporate the Water as before, then take it off the Fire, and cast upon it fresh cold Water, and skim it well as before.

before. Reiterate this Proceſs till you find no more Froth; then Evaporate the whole over a gentle Fire till it be dry, and you will have a Salt of *Tartar* well purified, which is not ſo fuſil as the other, becauſe it is free from all that Unctuoſity which cauſes the Fuſion. Keep this Salt of *Tartar* in a Veſſel well ſtopped, and uſe of it in Cryſtal with your Colours when you ſet them to melt.

Altho' this Salt of *Tartar* be very fine and pure, yet it is not that of the Philoſophers, which has far more Virtue, and opens more powerfully the Metals and Minerals where it is employ'd, tho' it be of the ſame Nature as this, and extracted from the ſame Principle.

The Philoſophers have moreover another Salt of *Tartar* extracted from Metalline Matters; and this laſt is far more Excellent than any others.

We will treat thereof at large in the Treatiſe we have promiſed, where we will explain the Virtues both of the one and the other, as well in Medicine as in the Buſineſs of Metals, and ſhew ſeveral very Curious Effects performed by their means.

C H A P. XCIV.

To make a Paſt for Oriental Emerald.

WE have already ſhewn the way of tinging Cryſtal and Glafs of Lead, of a very fair Emerald-colour, but not to make a Stone that ſhall imitate a true Natural Gem, which may be uſed in Rings, or otherwiſe, which now we come to do.

There

There are divers sorts of Emeralds, but at present, they are all distinguished into either oriental or Occidental, the Orientals are more hard, and the others less. We will shew several ways of Imitating the Emerald more or less full, which will be all Beautyful. This is the first.

Take two Ounces of natural Crystal prepared, as we have shewn in *Chap. 92.* and 4 Ounces of common Minium or Read-Lead, powder'd and Searced, add 48 Grains of Verdigrease well pound-ed and of a good Colour, with 8 Grains of *Crocus Martis* prepared with Vinegar as we have shewn *Chap. 25.* Mix the whole well together, and put it into a good Crucible that will resist the fire, in it you must leave an Inch empty. Then cover the the Crucible with an Earthen Cover, lute it well, and dry it, then put it in the hottest place of a Potters Furnace where they make their Earthen Vessels, and let it stand as long as their Pots. Being cold break the Crucible and you'll find within a matter of the Colour of a very fine Emerald. If you afterwards set it in Gold, it will surpass in Beauty the true Oriental Emerald.

If it happens that your Matter is not enough refined and purified, you must put it in again a second time in the same Furnace, where it will be purified as much as needs be; which you may know by lifting up the Cover, if the Matter appears shining.

If it is not so, lute the Cover on again, and put the whole in the Furnace. You may take notice once for all, that you must not break the Crucible, before the Matter be thoroughly baked and purified, for if you do, and so are obliged to put the Matter into another Crucible, the Past will be painted and full of Blisters.

If you cannot easily come to a Potter's Furnace, you may make one your self with little Charge, wherein you may put twenty Crucibles at once, each of different Colours, so one Baking may serve for a great deal of Matter.

You must make use of dry and hard Wood to heat the Furnace, as we have said before in baking Glafs, and continue the Fire twenty four Hours, in which time your Matters ought to be baked and purified enough, but for more Surety you may continue the Fire six Hours longer, and they will be certainly baked enough.

Your Matter being thus rightly baked, you may polish it at the Wheel, as we have said; and set it with a Foil in Gold, as is done with true Gems, and you'll have a brighter Emerald than the Oriental.

C H A P. XCV.

Another deeper Emerald-Colour.

THAT which makes Emerald deeper than the precedent, proceeds from the smaller quantity of Crystal employ'd in it, with more of the other Materials, which make it more fair, but also more brittle. You must Bake it at least six Hours longer than the precedent, to take away that Imperfection which Lead usually gives. The Dose of this Past, is one Ounce of Natural Crystal prepared, as we have shewn, six Ounces and an half of Red-Lead, seventy five Grains of Verdigrease, ten Grains of *Crocus Martis* made with Vinegar, the whole pulverized and well mixed together; then follow the Method we have shewn, in the preceding Chapter, which would

would be too tedious to repeat here, and on every occasion, so we will avoid it; only observing to let your Matter stand longer in the Fire, as we have said, and you'll have an admirable Oriental Emerald-colour, which being set in Gold with a Foil of the same Metal underneath, will be inexpressibly fair.

C H A P. XCVI.

Another Way to make a fairer Paste for Emeralds.

THIS Paste will be as brittle as the precedent, for the Reasons we have said; for you must take seven Ounces of *Minium*, to two Ounces of Natural Crystal prepared: To which add full eighteen Grains of Verdigrease, ten Grains of *Crocus Martis*, the whole pulverized and well mixed. Then proceed as we have shewn in *Chap. 94*, and you'll have an Emerald fit for all small Works, but not so hard as the former, by reason of the great quantity of Lead in it. Wherefore you ought to keep it longer in the Fire, that the pale Colour of the Lead may vanish.

C H A P. XCVII.

Another fairer Paste for Emeralds.

THE Colour of this Paste will surpass the others in Beauty, if the Workman takes care. Take two Ounces of Natural Crystal prepared, six Ounces of *Minium* in Powder, and eight Grains of Verdigrease also in Powder, mix the whole well together, then put them into a large Crucible covered and well luted.

luted, in the same Furnace as before. Moreover do all as in *Chap. 94*, and you'll have an extraordinary fair Emerald-colour.

C H A P. XCVIII.

Another very fair Emerald-Colour.

THIS Stone will be far harder and finer than the precedent, because it contains less Lead. To make it, take four Ounces of Natural Crystal, prepared as in *Chap. 92*, the fourth part of an Ounce of Red-Lead, and the same quantity of Verdigrease, the whole pulverized and sifted fine, which put together in a Crucible well closed and luted, in the same Furnace as before, proceeding as in *Chap. 94*, leaving the Crucible in the Fire thirty six Hours. After which, if you will you may cast your melted Matter into a Marble Mould heated, putting it near the Fire to cool gently, and you'll have a very fine Emerald.

C H A P. XCIX.

To make a PASTE for an Oriental Topaz.

THE *Topaz* of the Ancients, is the same which the Moderns call a *Chrysolite*, whereof we shall treat in *Chap. 101*, and their *Chrysolite*, that which Modern Jewellers call a *Topaz*, which is a Stone of a Golden-colour. Such are the Oriental *Topaz's* which are the most hard of all Stones next the Diamond. Their Colour is like Water tinged with Saffron or Rhubarb, but shining and pure. There are some found

found in *Europe*, but as soft as Crystal, and approach somewhat on Black with a Golden-colour; if there is any one found of the Colour of pure Gold, it is extraordinary, and not distinguishable from the Oriental ones, but in hardness.

To imitate the Oriental ones, take two Ounces of Natural Crystal of *Chap. 92*, seven Ounces of Red-Lead in fine Powder and searced; mix the whole well together, put them into a good Crucible, wherein you leave an empty space of about an Inch deep, for fear the Matter should run over in Baking, or stick to the Cover of the Crucible in rising, and spoil the Work. Then proceed as in *Chap. 94*, observing the same Circumstances of Time and Fire, and you'll have an admirable *Topaz-colour*.

C H A P. C.

Another fine Topaz-Colour.

TAKE two Ounces of Natural Crystal prepared, as we have shewn; two Ounces of Native *Cinnabar*, two Ounces of *Æs ustum*, the whole powdered, four times as much calcined Tin also pulverized, put the whole in a Crucible well covered and luted, into a Furnace as before, wherein let them stand twenty four or thirty Hours at a Fire not too violent, and which shall always retain the same degree of heat, for this Powder will easily melt. Then you'll have a fine *Topaz-colour'd* Paste.

A very fine *Topaz-colour* may be made by putting to four Ounces of the same Natural Crystal half a Dram of *Crocus Martis*, and a very little *Minium*, observing the same Circumstances for Baking it as before.

C H A P. CI.

To make a Paste for an Oriental Chrysolite.

WE have told you that the Modern Jewellers call that a *Chrysolite* which the Ancients called a *Topaz*, or *Chrysolopas*, which is a Precious Stone, Green and Diaphanous, some whercof cast a Lustre of Gold: This Stone is so hard, that it will easily endure the File, and sometimes there are pieces of them found big enough to make Statues of; witness that related by *Juba* King of *Mauritania*, which was made in Honour of the Queen *Arsinoc*, Wife of *Ptolomeus Philadelphus*, of the height of four Cubits.

To imitate this Stone, take two Ounces of Natural Crystal prepar'd, eight Ounces of *Minium* in small Powder, add to it 12 Grains of *Crocus Martis* made with Vinegar, as in *Chap. 25.* mixing the whole well together. Then put the whole into a Crucible in the same Furnace as before, leaving it there a little longer than the others, that it may have time to purifie from the Lead. Then you'll have a Paste for the Oriental *Chrysolite*, which will appear very admirable set with a Foil in Gold.

C H A P. CII.

To make a Paste for Sky-colour, to imitate the Beryl, called also Aqua-Marina.

WE have already treated of this Colour in *Chap. 40*, wherein we have taken notice how this Name of *Beryl* came to be given it by the *Italians*, because

cause it has the Blewish-green of the Sea, and also whence this Stone is gotten.

To imitate this Stone, take two Ounces of Natural Crystal prepared, five Ounces of *Minium*, twenty one Grains of *Zaffer*, prepared as in *Chap.* 17, the whole reduced to a fine Powder, put it in a Crucible covered and luted, proceed as in *Chap.* 94, and you'll have a delicate Sky-colour.

This Colour may be also imitated by taking half a Dram of *As ustum* to eight Ounces of Natural Crystal prepared, and putting the whole in a Crucible to bake in the Furnace as before.

C H A P. CIII.

To make a Paste for Sapphire-Colour.

THE *Sapphire* is very much esteemed for its Beauty, which is a very clear Sky-colour, and pleasant to behold. There are some that are whitish like Diamonds, others very Blue, and some Violet-colour; the Stone is soft, but easy to harden.

To make this Paste, take two Ounces of Natural Crystal prepared, four Ounces and an half of *Minium*, twenty six Grains of the Blue Smalts the Painters use; the whole being well pulverized, put them in a Crucible, and cover and lute them well, then put them in the Furnace to Bake as long time as before prescribed; and you'll have a fine Violet-colour approaching blue.

C H A P. CIV.

Another Oriental Sapphire.

THE Past for this *Sapphire* will be nearer the Oriental Colour than the former. Take two Ounces of Natural Crystal prepared, six Ounces of *Minium*; to which add two Scruples of *Zaffer*, prepared as in *Chap.* 17, and six Grains of *Manganese* also prepared as by *Chap.* 18, the whole reduced to fine Powder; mix them well together, and put them in a Crucible, and cover and lute it well; then put them in the Furnace to bake the same space of time as before shewn, and you'll have an Oriental *Sapphire* of a very fine Violet-colour.

C H A P. CV.

Another deeper Oriental Sapphire.

THIS Past for *Sapphire*, will be of a deeper Colour than the former, you must put to two Ounces of Natural Crystal, prepared as in *Chap.* 92, five Ounces of *Minium*, forty two Grains of prepared *Zaffer*, and eight Grains of *Manganese* of *Piedmont* also prepared; the whole reduced to an impalpable Powder, and mixed well together.

Moreover, proceed as in *Chap.* 94, observing well all Circumstances, and you'll have a *Sapphire* deeper than the preceding, somewhat tending to a Violet-colour, which you may Work, and Polish, and Set.

C H A P. CVI.

To make a Pafte for an Oriental Granat.

THE *Granat* is very like the Carbuncle, for both being expofed to the Sun, they exhibit the Colour of live burning Coals, being between Red and Yellow, which is the true Colour of Fire.

There are feveral forts of *Granats*, both Oriental and Occidental, fome deeper, others lefs fo; but the Jewellers know how to make them appear, by fetting them on Silver Foils.

We will not trouble the Reader with all that might be faid concerning them, feveral Authors having largely treated thereof, we fhall content our felves with fhewing here the way how to imitate them by our Art.

Take two Ounces of Natural Cryftal prepared, and fix Ounces of *Minium*, with fixteen Grains of *Manganefe of Piedmont*, and two Grains of *Zaffer*, prepared as we have fhewn in the firft Book, the whole pulverized, and well mixed together, and put in a Crucible into the Furnace, with it's Cover well luted, there to Bake, with the fame Precaution we heretofore have given; and you'll have a very fine *Granat*, as refplendent as the Oriental.

C H A P. CVII.

A deeper Oriental Granat.

THIS Colour will be not only deeper, but also far fairer than the precedent. To make it, take two Ounces of Natural Crystal prepared, five Ounces and an half of *Minium*; to which add fifteen Grains of *Manganese* of *Piedmont* prepared, having pulverized it, mix the whole well together: Moreover proceed as in *Chap. 94.* for Baking this Paste, only take notice you must here leave more empty space in the Crucible, because this Matter rises more than the others, wherein care must be taken. Then you'll have a deeper Oriental *Granat* than the former, which you may polish, &c.

C H A P. CVIII.

Another fairer Granat.

THE Paste for *Granat* will be yet much fairer than the Precedents, if you take to two Ounces of Natural Crystal calcined and prepared as in *Chap. 92.* 6 Ounces of Vermillion or *Minium*, in fine Powder, thirty five Grains of *Manganese* of *Piedmont* prepared, and four Grains of prepared *Zaffer*, as in Book I. which being well pulveriz'd mix together in a Crucible, leaving a greater empty space than in the others, by reason the Matter rises more; then lute the Cover well, let it dry, and put it in the Furnace to Bake, as we have shewn *Chap. 94.* observing the same Circumstances we have noted on that

Subject, and you'll have a very fine *Granat* fairer than the rest.

C H A P. CIX.

Observations for Pastes and their Colours.

WE might have inserted this Discourse in *Chap.* 91, as being the first of this Book; but we thought it better to place it here, where we will shew divers ways of making Pastes, no less fair than curious, and where it will be necessary to give some little Instruction to those who undertake to make them, as also concerning the degrees of the Colours that may be therein imitated.

The making of these Pastes is the essential point of the Business; because on it depends the beauty of our artificial Gems: But the baking also is not of less Consequence, forasmuch as without that you cannot Succeed. It is not Enough to well Regulate the Fire during the time we have Noted in *Chap.* 92. whilst the matter is to stand in the Furnace, but you must also take care that the Crucibles don't break before the matter is well baked and purified: For if the Crucible breaks and you are forced to pour out the matter into another Crucible, the whole Work will be spoiled and the matter full of Pustles and Blisters. You had much better let the Crucible Cool, if it be not quite broken; then Lute it well, and put it in the Furnace again to make an end of baking. You must also take Notice not to break the Crucible to take out the matter before it be perfectly baked.

The curious may avoid these inconveniences, if in room of ordinary Crucibles they make them of the same Earth that the Pots for making Glafs are made of, which will resist the Fire longer than we have occasion here for baking, and bear a more violent Fire than we have occasion for.

Those of Germany also will do very well for this business because they endure the Fire better than the ordinary ones. But I will yet abridge all these precautions, by shewing an easy way to prepare the common Crucibles, which I have seen tryed, and resist the Fire a long time. Take an ordinary Crucible or rather one of *Germany*: Heat it a little in the Fire, then dip it into Olive Oyl, and let it soak a little of it in. Then take Glafs reduced to an impalpable Powder, and strow it all over the Crucible, both without and within, as thick as you can, then put it into a Furnace in a small heat, and then increase the Fire to a melting Heat; then the Glafs will Melt and Vitriſie so well with the Crucible, that it will endure the Fire far longer than is required for our Business.

We will also further remark that the Colours we here shew for Pastes are proportional to the Doses we give them; but those who would have them deeper or lighter, must regulate themselves accordingly: If they make small Stones for Rings, the Colour must be deeper by reason of their smallness: If they make greater, the Colour must be lighter, but deeper for Pendants than any other. The whole depends much on the Fancy of the Workman, who is to proportion the Doses of the Colouring to the Work he designs.

In speaking of these Colours in this Chapter, our design is only to shew more easie ways to those who exercise themselves herein, for otherwise we have sufficiently discours'd of them in the precedent

Chapter, as we shall continue to do in the following.

We shall say nothing further here of calcined Copper, or Verdigrease, or *Zaffer*, or *Manganese*, having sufficiently done it before; but only advertise the Curious, that there may be extracted from Gold a very fine Red, and one a little more obscure from Iron; an excellent Green from Copper; a Golden Colour from Lead; Blue from Silver, but a much fairer from Granats of *Bohemia*; which are low priz'd by reason of their smallness, but give a very fine Colour.

The same may be done with Rubies, Sapphire, and other precious Stones, as Chymists well know. If I should treat of all those Colours in this Tract, it would make it half as big again as I design it, and would be too prolix for our present Purpose; what we have shewn already, is sufficient to make very fine Works.

C H A P. CX.

To make Sulphur Saturni, to be used in Pastes for all Artificial Gems.

ISAAC HOLLANDUS has so well shewn us the way to imitate the Colour of all Precious Stones, that I cannot pass by in silence this following Method of his extracted from his Works. As it is not common, nor his Book seen by every one, and that there may be some that cannot understand him, we thought the Reader might be glad to have it, since it is the most curious way that can be made use of for this Work.

The way to make his Sulphur for it is this. Take *Cerufs*, or White-Lead, ground very small, put it into a great Glafs Body, and pour thereon as much distill'd Vinegar as will rise a Palm above it; and as the Vinegar will rise and swell very much at first pouring on, you must take care to pour it on gently, till all the fury and noise be gone. Then set this Body on a hot Furnace in Sand, there to evaporate the eighth part of it away. Then let it cool and decant off the remainder of the Vinegar, which will be well coloured and full of Salt, which keep in another Glafs Vessel. Then pour fresh distill'd Vinegar on the remainder of the *Cerufs*; set it again on the Furnace to evaporate as before, and decant off that Vinegar as the former. Reiterate this Process of putting fresh Vinegar on your Matter, and evaporating it, and decanting it off till it have no further Colour nor Sweetness, which commonly happens about the sixth time. Take all your coloured Vinegars, and carefully filter them off, then take one or more Glafs Cucurbits, and evaporate all the Vinegars over a gentle Fire, and you'll find remaining at bottom a Salt of *Saturn* of Lead, very White.

Then take a Glafs Matras, lute it well down to the middle of the Body, and put your Salt of Lead in it, and put it on a Sand Furnace over a gentle Fire, for the Space of twenty four Hours, covering it with Sand up to the Neck. Then take out your Salt, which ought to be as red as *Cinnabar*, and grind it fine on a Marble; if it be Yellow, you must put it on the Fire again for twenty four Hours longer, and take care it don't melt, for then all is spoil'd.

When your Salt of Lead is perfect, as we have shewn, you must put it again into a Glafs Cucurbit, and pour distill'd Vinegar on it as before, and decant it off when it is enough coloured, and put fresh

Vinegar on the remaining Salt, and continue this process till all the Salt be dissolved, and the *Faces* or Dregs all separated. After that, put all these coloured Vinegars into Glafs Vessels, and let them stand six Days to settle, then filter them carefully and separate all the *Faces*. Then put all these filter'd Vinegars into a great Glafs Body to evaporate as before, and you'll find at the bottom a very white Salt of Lead, sweet as Sugar.

This Salt being well dried, dissolve it afresh in common Water, and let it stand six Days, that all the *Faces* may precipitate to the bottom. Then filter that Water, and evaporate it in a Glafs Cucurbite over a gentle Fire, as we have said, and you'll have at bottom a Salt more white than Snow, and as sweet as Sugar. Reiterate this Method of dissolving in fair Water filtering, and evaporating till three times; then take your *Saccharum Saturni*, and put it in a Glafs Body in a Sand Furnace over a temperate heat, where leave it for several Days without augmenting the Fire; then it will become redder than *Cinnabar*, and give a Calx finer than Wheaten Flour.

It is this Calx thus purified from all its Terrestreity, which is called Sulphur of *Saturn*. Now in making Pastes for Emerald, Sapphire, Granat, Topaz, Chrysolite, Blue and other Colours; you must employ it instead of *Minium*, in the same Doses we have shewn in the precedent Chapter of this fifth Book. Observing all we have noted in the Subject of Baking, and proceeding as in *Chap. 94*. Then you'll have Stones of different Colours, far fairer than the Natural ones, and which can scarcely be distinguished from them.

The Pastes made with this Sulphur, will not have that Grease and Yellowness which others have, and will not be so apt to spot by the Breath: Upon this account the Curious will have no cause to repent of the
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the trouble of making this Sulphur, tho' the Work be very laborious. They also know that all fine Works require very pure Matters, and that they cannot have that purity without the great time and care of those who undertake them.

I may also here say, that this Work well carried on, is more precious than it seems to be, except to those who are acquainted with it. For the sweetness this Lead has acquired, by the Preparation we have shewn, is a true sign of its Purity, that it is fit to make a Medicine very homogeneous to Nature. I don't say that this Preparation alone, we have here shewn, is sufficient for so elevated a Mystery as that whereof we speak; but I cannot also conceal that it is the chief part of the Work, especially if you observe some little Circumstances which *Isaac Hollandus* has omitted to mention, whether he was ignorant of them, or thought them not necessary to his Preparation, I can't tell. The Learned will easily penetrate into this Mystery, and others that have a true desire to know it, will find Subject to exercise their Wits on, in embracing so serious a Study to penetrate into the depths of it.

C H A P. CXI.

The Way to make very hard Pastes with Sulphur of Saturn, and to give them all the Colours of Precious Stones.

THIS Paste is a Consequent of the precedent Operation, because we employ therein the same Sulphur of *Saturn*, we just now mentioned; and that which chiefly causes its Beauty, is that all the Ingredients we use in it are perfectly purified.

To do this, take ten Pound of Natural Cryſtal prepared, with ſix Pound of Salt extracted from *Polverine* of *Rochetta*, purified, pounded, and well ſearced, as we have ſhewn in *Chap. 7*, whereunto add two Pound of Sulphur of *Saturn* chymically prepared, as in the preceding Chapter; then mix theſe three Powders well together, and put them into an Earthen glazed Pan, and caſt on them a little common fair Water to reduce theſe Powders into a Lump ſomething hard. Afterwards divide them into ſeveral Parcels of about three Ounces each, making a hole in the middle the better to dry them at the Sun; being well dry'd, put them into an Earthen Pot well luted, then calcine them in a Potters Furnace, then pound and grind them well on a Marble, and ſearce them through a fine Sieve. This being done, put this Powder into a Glaſs Furnace, there to melt and purifie for three Days; then caſt the Matter into the Water, as we have elſewhere ſhewn; and after you have dried it, put it again into the Pot in the ſame Oven, there to melt and repurifie for fifteen Days, that it may be without ſpot, and that it becomes of the colour of Precious Stones.

This Cryſtalline Matter may be tinged of ſeveral Colours, *viz.* Emerald by means of Copper thrice calcined; Topaz by means of prepared *Zaffer*; and ſo of others whereof we ſhall not treat here, having largely done it elſewhere. To ſucceed, you muſt put into the Furnace as many Pots as you deſign to make diſſerent Colours, add to each as much Chryſtalline Matter as you pleaſe, and regulate according to the weight of the tinging Materials which you add to them, and proportionate them to thoſe we have deſcribed in the precedent Chapters of this Book. This Paſte will have finer Colours than the true Natural Stones, and approach near to their hardneſs;

hardness; particularly that of the Emerald, which the Curious will find by Experience.

C H A P. CXII.

The Way to make Saturnus (called) Glorificatus.

THIS is a Preparation we hold in no less esteem for Pearls for Gems, than that of *Isaac Hollandus*, and whereof we have spoken in *Chap. 110*, they have some likeness, yet this last is more easie to make, and more short, and has no less Virtue.

Take a good Litharge, or rather good *Cerufs* of *Venice*, what quantity you please. That which you choose, grind into a subtil Powder, in a great Glafs Cucurbite, whereunto pour good distill'd Vinegar, as much as shall swim on the top of the Matter a Hand high. Then put this Vessel on a soft Ash-Fire, and when the Vinegar is well colour'd and impregnated with Salt of *Saturn*, decant it off into another Vessel; then continue to put new Vinegar on your Matter, which stir well with a Stick, to facilitate the Solution of the Salt; and do it so often, that your Vinegar shall have extract'd all the Tincture from the Salt, and that colour it no more.

Then take all your coloured Vinegar, rectifie it four times on *Tartar* calcined to Whiteness, then filter it carefully, and put it in a Glafs Cucurbite, on a Sand or Ash-Fire, where gently evaporate it till it be just skin'd over. Then put the Vessel into a cold place, having taken care to cover it, for fear of any foulness tumbling into it; and in a little time you'll find your Matter in little Stones, Pure, ChrySTALLINE, and Fusible, which you must take out of your Vessel with a Skimmer full of Holes. Then put your Vessel on the same Fire to
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evaporate the remaining Vinegar till it be juſt ſkin'd over, and then ſet it in a cold place to Cryſtallize as before. When you have taken out all the Cryſtals, dry them well, and reduce them into a ſubtile Powder, and keep them in a Veſſel well ſtopped, taking care to make at leaſt ten Pounds. Thus you have *Saturnus Glorificatus*.

C H A P. CXIII.

Another Way of making Paſte for Precious Stones, with Saturnus Glorificatus.

THERE are ſome who uſe tranſparent Flints calcined, to add to *Saturnus Glorificatus*, and make Paſte for Artificial Gems; but as we eſteem Natural Chryſtal prepared much more proper for that Work, we ſhould employ it before calcined Flints.

Take therefore of Natural Chryſtal prepared ten Pounds, of *Saturnus Glorificatus* ten Pounds, the whole reduced to fine Powder, which mix well together; then put it in a Pot in a Glaſs-houſe Furnace, there to be melted and purified three Days: Then caſt it into a great Wooden Veſſel full of cold Water, then dry it, and put it in the Furnace in the ſame Pot, the better to purifie. When this Chryſtalline Matter is well melted, and clear, take out the Pot; and when it is cool, pound it to an impalpable Powder on a Marble, then keep it in a Glaſs Veſſel well ſtopped, for fear of Duſt falling in; and that Matter will ſerve for a Baſis or Stuff to make all ſorts of Artificial Gems of.

We need not here repeat the Way of making them of this Paſt, becauſe we have ſhewn it before in ſeveral others; but for ſake of the Curious who are never weary of Learning, we will do it; beſides that there
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are some who may take pleasure in reading it, as we do in writing it; particularly we will treat of some Species of Stones we have, as yet, not at all mentioned.

C H A P. CXIV.

To make a very fair Carbuncle.

THE Carbuncle is a very Precious Stone, whereof several Authors have written, but I don't know one that says he has seen it. They attribute to this Stone the Property of giving Light in the Dark, like a burning Coal, or a kindled Lamp. *Ludovicus Verromannus* reports that the King of *Pegu*, carried one about him of such a bigness, and so much Splendor, that those who saw that Prince when it was Dark, saw him shining as if encircled with the Sun; but this Author, as well as the rest, says he never saw one.

Pliny pretends there are several sorts of Carbuncles, some Male ones more hard and brighter, and other Females more languid. But this Author is so confused, and so little assured of it, that we cannot take his Testimony as Authentick. Yet among all those Species which he describes, those seem to approach nearest Carbuncles, which he calls *Lithizontes* and *Sandastri*. The first discovers strongly its splendour at the Fire or Sun; being in the Shade it appears of a Purplish Colour; being exposed in the open and clear Day, it sparkles as it were at the Sunbeams, and hides as it were bright Stars within it. The second is curious by reason of Golden Sparkles appearing and glittering within like Stars, which are always seen across it within side, but never near the Surface, imitating the *Hyades* by their number and

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Disposition and Order. This Author ſays laſtly, that the *Chaldeans* held this laſt Stone in great Veneration, and uſed it in all their *Ceremonies*. As for me I am apt to think that the Carbuncle, is that Stone the Ancients have related to give Light by Night like a flaming Fire, and by Day like a twinkling Star, which is now no more to be found as we have hinted in the firſt Chapter, and that their Carbuncle is the Stone only known to the *Adepti*, the Matter whereof is ſo pure and Spiritual, that Evil Spirits dare not look on it, much leſs come near it.

Whether the Carbuncle be a precious Stone found in the Bowels of the Earth or not, we can imitate the Properties theſe Authors give it by help of our Art. And we will ſhew you two Ways of doing it in this Chapter.

For the firſt take ten Ounces of Matter prepared with *Saturnus Glorificatus*, and Natural Cryſtal, reduced to impalpable Powder, as we have ſhewn in the preceding Chapter, whereunto add half an Ounce of *Crocus Martis*, in fine Powder prepared as in *Chap. 27*. After having well mixed theſe Powders together, put them into a good Crucible, which cover and lute well, then put it into a Glafs-houſe Fire for three Days, by putting it nearer and nearer the ſtrength of the Fire by degrees. Then take out your Crucible, and put the Matter into a Marble Mortar, then pound and grind it very ſmall, with its weight of *Sal Gemme*, and put it into another Crucible, which cover and lute as before. Being dry, put it into the ſame Glafs-houſe Furnace, approaching it to the Fire little by little, and letting it ſtand twenty Hours in good Fuſion. Then take it out, and put it again into the Furnace to bake again, as you do Glafs, where leave it twelve Hours, that it may cool gently.

Your Crucible being cold, take it out of the Furnace to bake again, then break it, and you'll find in it the Matter tinged of a very fine Carbuncle Colour, which you may cut of what Form and Greatness you please, and then cut and polish them at the Wheel, and they will be perfect.

There is a certain Slight, which I shall not mention here, which several Artists may know, whereby these Carbuncles may be made to undergo all Trials. It is a Point which will deserve the Study of all those who are ignorant of it; to discover it to every one, would be a Profanation of the Secrets of Art, and would make the Ignorant as knowing in one Moment, as those who have employed all their Lives in Searches after the profoundest Knowledge.

C H A P. CXV.

Another Carbuncle more noble and fairer, called, Carbunculus nocte illuminans.

THERE is a second way of making a Carbuncle, called, *Carbunculus nocte illuminans*, which is far more resplendent and fairer than the former. Those who have written that it shone in the Night, and made the Possessors of it always very lucky, only spoke by way of allusion to the Philosophers Stone, to which alone that vertue can be attributed; that is, the Stone and Carbuncle which is not to be found, that is, except in the Hands of the *Adepti*, who alone can make and possess it. We may here boldly say, That the *Carbunculus nocte illuminans*, is not a Stone any where formed by Nature, but made by Art; for Nature cannot purifie the Matters she furnishes us with, and this Stone cannot be made of them, except when they

they are purified in the utmost perfection, which Art alone can do. Thus this Master-piece of Work, this Carbuncle, this Phoenix, or this Stone so famous among the Philosophers, is far more precious than any Nature can form, since by means of it, you may in two Hours time make simple Crystals as valuable as any Stones Nature spends so many Ages in bringing to perfection.

If there are any Carbuncles in the World, or Precious Stones that have their Beauty, we are perswaded that they must be the products of Art rather than Nature, and that they are only made by that pure and incomparable Matter of the Philosophers, exalted in colour and virtue to the highest degree: We are perswaded by all the Authors we have read, that there is no such Natural Stone; so that there is only the precious Elixir of the *Adepti*, whereof a Stone of the Qualities given to the Carbuncle can be formed, which far surpasses in Beauty, Rubies, Garnets, Jacynths, &c.

But now we come to the way of imitating this second Carbuncle, or rather the Beauty which Authors attribute to it, not with the *Elixir* of the *Adepti*, whereof we know nothing but the virtues, but with the ordinary Matters known to all the Students in this Art.

Take ten Ounces of Matter prepared with Natural Crystal, and *Saturnus Glorificatus*, and reduced to an impalpable Powder; add to it an Ounce of Gold calcined, as we shall shew hereafter; then mix the whole well together, and put it in a good Crucible, which must not be above half full, cover it and lute it well, let it dry, then put it into a Glass-house Furnace for three Days, by bringing it little by little nearer to the strongest Fire, as we have said before. After three Days take out your Crucible, and put the Matter into a Marble Mortar, which pound to an

an impalpable Powder, to which add its weight of *Sal Gem* also in fine Powder, which mix well together, and searce through a fine Sieve, the better to incorporate.

Put this Powder into a new Crucible, which also fill but half way, which cover, lute, and dry as before: Then put it in the same Glass-house Furnace, bringing it nearer little by little, where let it stand ten Hours. After which take your Crucible out of the Furnace, and put it into that where they set their Glasses to anneal, whence take it out ten or twelve Hours after, and having broken it, you'll find the Matter tinged of a Carbuncle-colour, the most lively and resplendent that can be made by this Art, whereof you may make what Stones or Works you please. We have promised the Calcination of Gold, which may be performed several ways, but as fine Works cannot be made without the most pure Matters, we will pretermit the more common ones, to shew you the following, which is very fine and proper for this Art. Dissolve an Ounce of Gold in three Ounces of *Aqua Regalis*; then add to it four Ounces of common Mercury purified, and pass'd through Wash-Leather, which will precipitate your Gold to the bottom of the Matras joyning it self to it. Then your *Aqua Regalis* will grow clear, which when it is, and seems to have no more Gold in it, decant it off, then wash your Matter with warm Water to dulcifie it, and take off all the Saltness. Add to this Matter, being dry'd, its weight of Flour of Brimstone, then pound the whole well together, put them in a Crucible, to which fit another on the top, which must be bored on the bottom, with a hole big enough to put a Quill through, which lute well together, and dry them. Then put them in a round Fire, which you must give them by degrees for four Hours, the Crucible being the last Hour wholly covered over with

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Coals, which let kindle and cool again. Then open the Crucible, and you'll find your Gold calcined which amalgamate with four Ounces of fresh Mercury; to which add five Ounces more of Flour of Brimstone, pounding them well together as before then put the whole in your Crucibles, which lut and give them the same round Fire as before, which reiterate a third time, the better to calcine and open your Gold; then put it into a glazed Earthen Pan pretty deep, and pour on it good Spirit of Wine that may swim two Inches above, then put Fire to it, and when it is burnt, you'll have a very fine Gold, in an impalpable Calx, well opened, which edulcorate with warm Water distill'd, and dry it gently.

There is yet another way to calcine Gold more perfectly, by means of which you may make a good *Ceruss*, and afterwards a perfect Vitriol or Salt, whereof the Principles may be separated, and you may perform Wonders with them in Medicine and Metallick Chymistry; but that Calcination would be too long to describe here, besides it is foreign to our Business, the Gold of that being too much opened.

C H A P. CXVI.

To make Oriental Rubies.

THE true Ruby, which is a precious Stone, diamphanous and very radiant, ought to have the colour of Blood, and Scarlet, and clear *Lacca*, and shew about the edges of its Fire, a little Azure-colour. This Stone is found in the Isle of *Ceilen*, and in the River of *Pegu*, in a Rocky Matter of a Rosie colour, which is the Matrix wherein it is generate
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and nourished; and if that Rocky Matter be transparent, it yields the Balas Ruby, whereof we will treat in the following Chapter.

Sometimes there are found such fine and large Rubies, that some have mistook them for Carbuncles. If any Ruby ever merited that Name, it was that of Queen *Elizabeth* of *Austria*, Dowager of *Charles IX*, which after her Death she left to the Emperor *Rodolphus II*, her Brother. It had been purchased long before for sixty thousand Ducats, which was then a very considerable Sum.

Queen *Mary de Medicis* had also one of an inestimable Value, and Bigness, but I cannot learn what the Purchase was, or what became of it.

To imitate this fine Colour, take four Ounces of our Matter prepared with Natural Crystal, and *Saturnus Glorificatus*, two Ounces of *Crocus Martis* prepared as in *Chap. 25*, one Ounce of Verdigrease, two Ounces of Mercury calcin'd *ad rubedinem*, and two Ounces of *Sal-Gem*, the whole reduced to fine Powder, well mixed together, put into a Crucible covered and luted and set in a Glass-house Furnace for three Days, then take it out and put it in the Furnace where Glasses are set to Anneal, there to cool by degrees for twelve Hours. Then break your Crucible, and you'll find your Matter tinged of a fine Ruby-colour, which you may divide, cut, and polish, as we have said before.

We could shew a way of imitating Rubies with only *Orpiment*, which are very fine, but so brittle, that we thought it better to say nothing of it, rather than give occasion for an Expence that would turn to no Profit.

C H A P. CXVII.

To make Balafs Ruby.

THIS Precious Stone is of the Nature of a Ruby, since it is found in the same Matter as that. Its very bright colour resembles a Vermillion Rose and Crimfon, being mixt of a Natural Red and of a Sky-colour: We will now shew the way to imitate it.

Take six Ounces of *Saturnus Glorificatus*, mixed with Natural Crystal, as in *Chap. 113*, half an Ounce of *Crocus Martis*, half an Ounce of Mercury calcin'd *ad Rubedinem*, and two Drams of *Sal Gem*, the whole reduc'd to an impalpable Powder, and mixed well together. Then put it in a Crucible covered close and luted, and so into a Glafs-house Furnace for three Days, proceeding moreover as in the preceding Chapter, and you'll have a very fine Matter, the colour of *Balafs Ruby*.

C H A P. CXVIII.

To make Oriental Sapphire.

WE will not repeat here the Nature or Colour of the *Sapphire*, having done it before: But we will add, that from the true *Sapphire*, may be extracted the three Principles, which are of infinite vertue in Medicine, whether united, or separate. To imitate this Precious Stone, with our Matter prepared with *Saturnus Glorificatus*, and Natural Crystal, take

take ten Ounces, add two Drams of the Calx of Gold, mix these Powders well together, put them in a Crucible covered with another, let them dry, then put them in a Glafs-house Furnace for three Days. Moreover do all we have ordered in *Chap. 116*, and that Mass will be of a very fair Oriental *Sapphire*-colour, which cut and polish at the Wheel.

C H A P. CXIX.

The Way to make an Oriental Emerald.

THE Chapters wherein we have shewn how to imitate this Precious Stone, contain also its Nature and Colours; and all we design to say here, our Intent being not to enlarge on all the Properties of Precious Stones, but only to shew the Means of imitating them, as we shall go on to do.

To make this Oriental Emerald, take ten Ounces of our Matter prepared, of *Saturnus Glorificatus*, and Natural Crystal, half an Ounce of prepared Verdigrease, half a Dram of *Foretto* of *Spain* also prepared, as in *Chap. 20*, the whole reduced into fine Powder, and well mixed together, and put it into a Crucible covered with another, lute it and dry it; then set it in a Glafs-house Furnace for three Days, and after in the Annealing Furnace twelve Hours. After which break the Crucible, and you'll find the Matter tinged of a very fine Oriental Colour, which cut and polish as before.

C H A P. CXX.

The Way to make Turcois.

WE have shewn the way to give a *Turcois-colour* to Glafs, in *Chap. 50*, but we have not yet spoken of its Colour or Nature, which obliges us to do it in this Chapter. The Name of *Turcois*, which this Precious Stone bears, comes from the place where it is found, *viz.* in *Turky*, altho' this Stone also comes from *Persia* and the *East-Indies*, where it is found in abundance, the Colour whereof approaches nearer to Blue than Green, which also distinguishes them from those that come out of the *West*, which are more Green and Whitish. They call the first by the Name of the Stone of the Old Rock, and the other by that of the New. The *Turcois* is the finest and noblest of all *Opaque* Precious Stones: Its colour is composed of Green, White and Blue, and imitates that of Verdigrease. They attribute great Properties to this Stone, such as bringing good or evil Luck to People, and to denote things to come to them, either by their breaking or changing Colour, which we omit discoursing of, to shew the manner of imitating them.

Take ten Ounces of our Matter prepared, of Natural Crystal, and *Saturnus Glorificatus*; half an Ounce of purified Verdigrease, and one Ounce of prepared *Zaffer*, the whole in fine Powder; which mix well together in a Crucible covered with another, well luted and dried, which afterwards put into a Glafs-house Furnace, where leave it for three Hours, then twelve Hours in the Annealing Furnace, that it may cool gently. Then take out your Crucible and break

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it, and take out the Matter, and cut and polish it, and you'll have *Turcois* colour'd Stones, like those of the Old Rock.

C H A P. CXXI.

To make Oriental Topaz.

IT will be needless here to repeat the Quality of the *Topaz*, since we have done it already in this Book: So we shall content our selves to shew the manner of imitating it, with our Paste composed of Natural Crystal, and *Saturnus Glorificatus*, whereof take ten Ounces, of very good *Orpiment* one Ounce reduced to fine Powder. After having mixed them well together, put them into a Crucible covered with another, which lute and dry well, then put it into a Glass-house Furnace for three Hours, and then let it cool gently, in the Annealing Furnace. Having taken your Matter out of the Crucible, you may cut and polish it as you please, and you'll have a very fine Oriental *Topaz*.

C H A P. CXXII.

The Way to make Chrysolite.

WE have also describ'd the Nature and Properties of the *Chrysolite* in this Book, as well as of the *Topaz* and other Gems, wherefore we will only shew the way here to imitate its Colour.

Take ten Ounces of our Powder of Natural Crystal, and *Saturnus Glorificatus*, to which add one Ounce of *Crocus Martis* prepared, the whole reduced to fine Powder, well mixed, and put into a Crucible covered and luted, as we have said: Observing moreover what we have remarked for the Baking, and you'll have a fine *Chrysolite*-colour, which will be of the Native Green.

C H A P. CXXIII.

Another Way of making all sorts of Precious Stones much harder, to turn Jargons of Avernia into Diamonds, to make Diamonds of Alanfon, and harden them, to make white and fine Sapphires as hard as true Diamonds, &c.

HERE we give another way of making Precious Stones, different from those we have given before, which will be much harder, and consequently approach nearer the Nature of fine ones, because we employ no *Saturn* therein, which always makes Stones softer and heavier, what Preparation soever you use of it.

We shall only make use of Natural Crystal, and some Materials added to it, to give it the Colours of all sorts of Precious Stones. We also use in the Composition of the Materials of these Gems, fine and pure Salt of *Tartar* prepared, as in *Chap. 93*, which ought to open our Crystal, and make it the better imbibe the Colour of the Tinctures which we give it, which will make the Stones appear more fine and shining.

To prepare our Crystal, you must first calcine it, as we have shewn in *Chap. 92*; that is, by heating it
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red hot in a Crucible, and quenching it often in cold Water, changing the Water each time. But instead of grinding it to an impalpable Powder upon a Marble, as we have shewn in the same Chapter, you must pound it in a Brass Mortar with a Pestle of the same, and not use Iron no more than Marble, then scarce the Crystal through a fine Sieve; and this is the Basis of all our following Gems: We should have desired to have put down all our Preparations in one Chapter, since there are only the Doses and the Colours to be changed, the more to abridge this Work; but the fear such a Mixture should breed confusion, obliges us to continue our Work as we have begun it, which is to make a Chapter of each sort of Stone, and of the difference of their Colours.

After that, we will give the true manner of turning Jargons of *Avernia* into Diamonds, to make Diamonds of *Alanson*, to harden them, and make them exceeding Sparkling; to give hardness to white and fine *Sapphires*; so that it will be difficult to distinguish them from true Diamonds. Finally we may chance to add something further, for the sake of the Curious.

C H A P. CXXIV.

The Way to make a fair Emerald.

WE will abridge as much as possible all the Processes of these Chapters, that we may not trouble the Reader with dull Repetitions. The change of Materials for this Work making great differences in it, we could not explain in one Chapter, all the different Ways of making one and the same Stone,

Stone, because ſuch a Mixture would occaſion confuſion.

To make a fine Emerald of our Cryſtal: Take two Ounces of it, and add to it forty eight Grains of *Crocus Martis*, and two Ounces and forty eight Grains of pure Salt of *Tartar*, prepared as in *Chap. 93*, the whole reduced into fine Powder in a Braſs Mortar, which put into a Crucible covered with another, and luted well together; then put it into the Glaſs-houſe Fire, there to bake twenty four Hours, and then in the Annealing Furnace for twelve Hours, that the Matter may cool little by little, which then take out of the Crucible, cut and poliſh, and you'll have a perfect Emerald.

C H A P. CXXV.

The Way to make a Violet-Sapphire.

WE ſhall ſhew ſeveral ways of making *Sapphires* of our Cryſtal of different Colours. To make this, take one Ounce of our Powder of Cryſtal, one Dram of Salt of *Vitriol*, and nine Drams of fine Salt of *Tartar*, the whole in fine Powder. Then proceed further as we have ſhewn in the preceding Chapter; and you'll have a *Sapphire* of a very fine Violet-colour.

C H A P. CXXVI.

Another Violet-Sapphire of a deeper Colour.

THIS *Sapphire* will be very fine, but of a very deep Colour, and if any Perſon deſire it to be lighter, he may eaſily make it ſo, by diminiſhing one fourth

fourth part of the tinging Ingredients which we add to Crystal.

Take to make this, two Ounces of our Powder of Crystal, two Ounces, five Drams, and twenty four Grains of Verdigrease, thirty two Grains of Azure, and two Drams of Sublimate, the whole in very fine Powder. As to the baking of it observe what we have said in *Chap. 124.*

C H A P. CXXVII.

Another very fine Blue-Sapphire.

THE Blue Colour of *Sapphire*, is no less agreeable than the Violet, and it is the Male of its Kind. To make it, take one Ounce of our Crystal in Powder, add to it a Dram of Salt of *Vitriol*, three Grains of Verdigrease, one Grain of *Azure*, and one Ounce, one Dram, four Grains of our fine Salt of *Tartar*; the whole in fine Powder; put it into a Crucible covered and luted, to be baked and purified, as we have heretofore shewn, and you'll have a very fine *Blue-Sapphire*, &c.

C H A P. CXXVIII.

Another fine Sapphire.

THE Colours of these *Sapphires* being different, by the Dose and mixture of the Ingredients, we will shew each in a Chapter by it self.

Take two Ounces of our Powder of Crystal, two Ounces of our fine Salt of *Tartar*, five Drams, twenty four Grains of Verdigrease, and thirty two Grains of

of *Azure*, the whole reduced to impalpable Powder; which you must set to bake and purifie in a covered Crucible in a Glafs-house Furnace, as we have said before, and you'll have a very fine *Sapphire*.

* C H A P. CXXIX.

Another Admirable Blue.

TO arrive to this fine Colour, take one Ounce of our Powder of Crystal, one Dram, fifty six Grains of our fine Salt of *Tartar*, the whole reduced to a fine Powder, put it into a Crucible covered and luted, which bake and purifie twenty four Hours in a Glafs-house Furnace, then set it to cool gently twelve Hours in the Annealing Furnace. Then you'll have an admirable Blue, which you may cut and polish, &c.

C H A P. CXXX.

The Way to make Beryl, or Egmarine.

THIS *Beryl*-colour will be very fine Sky-colour, if you take one Ounce of our Powder of Crystal, one Ounce of our fine Salt of *Tartar*, and six Ounces of Salt of *Vitriol*, the whole reduced to fine Powder in a Brass Mortar, and searced through a fine Sieve; farther proceeding as in *Chap. 124*.

C H A P. CXXXI.

Another deeper Egmarine.

THIS deeper Colour we give *Beryl*, is no less fine than the first. Take nine Drams, forty eight Grains of our Powder of Crystal, three Drams, twenty four Grains of Verdigrease, and one Ounce, five Drams, twenty four Grains of our fine Salt of *Tartar*, the whole reduced into fine Powder in a Brass Mortar, and then baked, as we have shewn in the preceding Chapter.

C H A P. CXXXII.

To make a fair Jacynth.

IT is scarce possible to make *Jacynth*, without Lead in its composition, wherefore you must put upon an Ounce of our Powder of Crystal, two Ounces and an half of *Minium*, with twenty four Grains of Verdigrease, two Drams of *Sublimatc*, and five or six Leaves of Silver; the whole reduc'd to fine Powder in a Brass Mortar, and searced through a fine Sieve, mix them well together, and put them in a Crucible covered with another, and well luted, then bake and purifie it in a Glass-house Furnace for twelve Hours. Then take it off the Fire, then pound it again in a Brass Mortar to a fine Powder, lifting it through a fine Sieve. Then put it in a new Crucible, which cover and lute well, which set again in the Glass-house Furnace for twenty four Hours, and twelve more

more in the Annealing Furnace. The Crucible being cold, take out the Matter which will be of a fine *Jacynth*-colour, which cut and polish.

C H A P. CXXXIII.

Another fairer Jacynth-Colour.

IF this *Jacynth* be fairer, it is also more brittle than the other, because it has more Lead in it. To make it, take an Ounce of our Crystal in Powder, three Ounces of *Minium*, and forty five to forty six Grains of Verdigrease. Mix well these Matters together, after having pounded them well in a Brais Mortar, and searced them through a fine Sieve. Then put them into a Crucible covered and luted in a Glass-house Furnace, where let it stand twelve Hours. Then take out the Matter, which pound and sift well; then put that Powder into another Crucible covered and luted, which put into the same Glass-house Furnace for twenty four Hours, and the Matter will be well baked. Then take out the Crucible, to put it in the Annealing Furnace; and twelve Hours afterwards take your Matter out of the Crucible, which will be of a fine *Jacynth*-colour, and may be Wrought.

C H A P. CXXXIV.

Another Oriental Jacynth-Colour.

THIS Colour will be of a very fine reddish Yellow, such as is the true Oriental *Jacynth*: To make it, take one Ounce of our Crystal in Powder;
three

three Ounces of *Minium*, one Ounce of *Arsnick* prepared as for the *Topaz*, and one Ounce of *Vitriol* calcined *ad rubedinem*. The whole reduced to a fine Powder in a Brass Mortar, proceeding moreover as in the preceding Chapter.

C H A P. CXXXV.

The Way of making a true and very fine Peridor-Colour.

THE *Peridor*, whercof we have as yet made no mention, is a sort of a clear *Topaz*, of a Gold-colour Light, but which is notwithstanding beautiful. To imitate it well, take two Ounces of our Natural Crystal in Powder, six Ounces of *Minium*, an Ounce of our fine Salt of *Tartar*, and eight Grains of Verdigrease; the whole reduced to impalpable Powder, pounded in a Mortar, and searced through a fine Sieve. You must observe the same Circumstances for baking this Stone, as for the *Jacynth*, by reason of the *Minium* that enters into the one and the other, and you'll have a very fine *Peridor*.

C H A P. CXXXVI.

Another Colour of Peridor.

THIS *Peridor* ought to be harder and more fixed than the precedent, because there is no *Minium* in it, but it will not be so Vivacious. Take one Ounce of our Natural Crystal in Powder, a Dram of Salt of *Vitriol*, two Drams of *Vitriol* calcined *ad rubedinem*,

rubedinem, four Grains of Verdigrease, and of our fine Salt of *Tartar*, as much as equals the whole in weight, *i. e.* one Ounce, three Drams, and four Grains. All these Matters being reduc'd into fine Powder in a Brass Mortar, mix them well together, then put them into a Crucible covered with another, and well luted, twelve Hours after take your Crucible and break it to take out the Matter, which cut and polish at the Wheel, then let it be Wrought by a good Workman.

We will not speak here of other sorts of Gems, which may be imitated by this same way, adding the Doses of their Tinctures.

C H A P. CXXXVII.

Of Jargons of Avernia, and the Way to make those Red which are of a Gridelin-Colour.

WE have promised to treat of the Jargons of *Auvergne*, which are little Stones commonly found in that Country, and several other places of *France*: They are red and shining like *Jacynth*; which has gain'd them the Name of false *Jacynths*, because they much imitate that Precious Stone.

There are found, notwithstanding, many of these small Stones, which are not of a red Colour, but of a kind of Gridelin. You may give these last a Red Tincture, with as much ease as you can take it away from the former to convert them into Diamonds, as we will shew in the following Chapter.

To give a Red Colour to Jargons that are of a Gridelin, you must take equal parts of purified *Sal-Armoniac*, and of *Tartar* calcined to Whiteness, as we have otherwise shewn; Mix these Matters well in
fine

fine Powder, then stratifie your Jargons in a Crucible S. S. S. beginning and ending with the Powders. Then put the Crucible in a good Coal-Fire, but not hot enough for the Stones to melt, but only to grow red hot, that they may be the better penetrated by the Tincture the Materials will give it, then let it cool, and by this Method they'll take as fine and shining a Red Tincture, as the true and finest Natural Jargons of this colour have.

C H A P. CXXXVIII.

The Way of Extracting a Tincture of Jargons d'Auvergne, and to make very fair and hard Diamonds thereof.

THOSE Stones may be made white and hard like the true Diamonds, by taking away their Tincture, which is no contemptible Secret. There have been made Rose-Diamonds of them so fine and curious, that the best Goldsmiths have been mistaken in them, and thought them true Diamonds.

You must boil your Jargons in a *Balneum* of Mutton-Suet, wherein they will lose all their Red Colour and become White.

Then take equal parts of *Emery* of Spain, Rock-Crystal, Pumice-Stone, and Sulphurous *Trepoly*, the whole reduced into fine Powder, and searced through a fine Sieve, make a Paste of it with *Aqua Vita*, wherewith cement your Jargons in a great Crucible S. S. S. then cover it with another, and lute them well, then set it in a Furnace over a gentle Fire for half an Hour, then augment your Fire till it be hot enough for Fusion, wherein leave the whole for fourteen Hours, then let the Fire go out, and the Crucible

ble cool of its ſelf; wherein, after you have broke it, you'll find your Stones of a very fine Diamond Colour, hard, ſhining, and ſparkling like the true ones, which you may poliſh and work up as the Goldſmiths.

This Sulphurous *Trepoly*, which enters into the Composition of this Paſte, being not commonly known, we will ſhew the way of making it, that we may leave nothing imperfect, which might be any Obſtruction to the Proceedings of the Curious. Take equal parts of *Trepoly*, of crude Antimony and common Sulphur, and grind them to a fine Powder on a Porphyry Stone, and make them into a Paſte with Vinegar, which being dry will eaſily crumble. This is the Sulphurous *Trepoly* which we make uſe of.

Some Perſons in making the ſame Proceſs of taking away the colour from Jargons, and giving them the hardneſs and whiteness of Diamonds, have made uſe of Barly-meal, wherewith they make a Paſte with diſtill'd Vinegar impregnated with Lead, wherewith they ſtratifie their Stones, or Jargons, in a Crucible, covered with another, and well luted, which they afterwards put in a gradual, round, or Wheel Fire, for ſix Hours. But this way they could not give them the true Diamond-colour. Wherefore I adviſe thoſe who would try this Experiment, to follow our firſt Proceſs, which has ſeveral times ſucceeded.

There are moreover ſome who ſtratifie their Stones with pounded Coal, which they put in a Crucible covered and luted, which they ſet on the Fire ſix Hours, ſo that the Crucible be always red hot. I don't approve of this way, becauſe the Coals may dry the Humour of the Stone, and calcine it.

C H A P. CXXXIX.

The Way to make Diamonds.

THE Quality and Colour of the Diamond being so well known, we shall not enlarge upon them in this Chapter, but only shew the way to counterfeit them, make them endure the Fire, and harden them.

Take of good Natural Crystal, calcined and reduced to subtile Powder, what Quantity you please ; fill a Pot with it, and set it in a Glass-house Furnace twelve Hours to be melted and purified : Then drop the melted Matter into cold Water, then dry it, and reduce it again to Powder ; add to that Powder its weight of our fine Salt of *Tartar*, of *Chap. 93.* Mix these two Powders well, and make little Pills of them with common Water. Then wipe these Pills, and put them into an Earthen Pot on a strong Fire, there to grow red hot for twelve Hours space without melting. Then put them into a Pot in a Glass-house Furnace, where leave them two Days, to be well melted and purified, then put the Matter twelve Hours in the Annealing Furnace to cool little by little. Then break the Crucible, and you'll have a fine Material for Diamonds, which cut and polish at the Wheel.

C H A P. CXL.

Another Way of making the Diamond of Alanfon.

HERE follows a way of making Diamonds of *Alanfon*, which is not quite so fine as the precedent, but has, notwithstanding, several Advantages which attend it; besides it is more easie, since there only needs an ordinary Fire to succeed in it.

Take an Earthen glazed Pot, set it on a little Furnace, put in it Filings of Steel, with some Vine Ashes at discretion, wherein place by one another Crystals cut and polished; then pour common Water gently on it, which warm and boil during the space of twelve Hours, taking care to add boiling Water fresh into the Vessel, as the Water in it consumes by boiling, and take care it boil continually. Then see if your Crystals have acquired the colour and hardness you expected: If not, continue the Fire some Hours longer, and they will be like the true Diamonds of *Alanfon*; taking care to repolish them again at the Wheel, to give them colour and brightness.

C H A P. CXLI.

The Way to give the true Colour and Hardness of a Diamond, to Crystals and Diamonds of Alanfon.

THERE is nothing in Nature which Art cannot imitate, and oftentimes those things which seem most difficult, prove to be most easie when managed with Judgment; or when he that undertakes

to

to do them has experimented any thing of the like Nature before, and knows the Nature, and Properties, and Powers of his Subject.

Although the Imperfect Metals be immature, or unripe, they contain, notwithstanding, a great deal of fixed and volatile Gold, which may be easily separated, or attracted out by means of Art. Imperfect Metals may be very much meliorated by Fire, by a proportionable and agreeable coction. There are also Crystals and Precious Stones, which have no Natural hardness, which may be given them by Art, having all the Natural Dispositions thereunto required, since they have the same Principle as the most fine, and that they only want a little Sulphur, which hinder'd their thorough coction.

Thus this Defect may be obviated in Precious Stones, as well as Metals, by giving them a due coction, and so changing them for the better. We will begin to give the most simple way of attaining it, before we shew those that are more exalted.

You may give the colour and hardness of Diamonds to Crystals and Diamonds of *Alanson*, by taking good *Dutch Trepoly* and making a Paste of it with Water out of the Smiths Forge, wherein you must wrap up the quantity you design of Crystals, or Diamonds of *Alanson* cut and polished; then set it in a Crucible covered and luted on a gradual Fire, where let it stand till the Crucible become red hot. A little time after take it out, and take out the Stones, then polish them again at the Wheel to give them their colour.

To set them in Works, take *Indian Paper*, with Leaves of Tin, like those you put behind Looking-glasses, then let them be set by some good Goldsmith, and they can scarce be distinguished from fine ones, except by very nice Discerners.

C H A P. CXLII.

Another Way to harden Crystals and Diamonds of Alanfon.

CRYSTALS also acquire hardness in the Paste we are now going to describe, because their Humidity exhales, and they become more fixt.

Take Barly-Meal well sifted, with *Petroleum*, or Rock-Oyl; then cut that Paste in the middle, and put all your Stones in order, so that they may not touch one another. Then cover your Stones with the other half of the Paste, then put it in a Crucible covered with another, and luted well together, and let it dry. Then set this Crucible in a gradual Wheel-Fire from five to six Hours, a small Fire the two first Hours, which encrease from two to two Hours, till the end of the six; then let the whole cool of it self. Then break your Crucibles, and you'll find your Stones very fine, shining, and sparkling like fine Diamonds, which repolish at the Wheel, and set by a skilful Workman.

C H A P. CXLIII.

A Way to harden Crystals and Diamonds of Alanfon; and to make them sparkle as much as Natural Oriental Diamonds.

ALTHOUGH this be an important Secret, and all People may commit Cheats by it, yet I will here give it, for the sake of the Curious, who only seek for their own Satisfaction.

Take

Take one Pound of Load-stone, a Pound of Quick-Lime, and half a Pound of common Sulphur, the whole reduced to powder, and well mixed. With this powder cement your Crystals and Diamonds of *Alans* well cut, in a Crucible covered and luted well: Being dry, set it in a Glass-house Furnace three Days, in a place where the Matters may be continually red hot without Fusion, if you have not a Furnace ready at hand for that purpose; and take care not to take out the Crucible all at once, but let it cool gently, otherwise the Stones might break. Having broke the Crucible, you'll find your Stones very fine, and shining, and which will resemble Diamonds of the Old Rock, which repolish at the Wheel to give it colour, then work it; and they can scarce be distinguished from fine ones.

C H A P. CXLIV.

The Way to turn White Sapphire into true Diamond.

THE White *Sapphire* being fine and fixed, is only imperfect, by reason of its wanting colour and hardness, which may be remedied by means of Art, and be made to surpass Nature, because she only would have made it a perfect *Sapphire*, but Art can turn it into a true Diamond.

Only Fire can cause this Effect, in changing its Natural colour, and giving it that of a Diamond. Thus take very fine Sand, wash it in several Waters to clean it, till the Water become clear, and then dry it. Of this Sand fill a Crucible half full, then put in your *Sapphire*, and fill it up with the same Sand. Then cover your Crucible with a cover of the same Earth, or with another Crucible; lute the whole

with a good lute, as we have heretofore shewn, lay it on an Inch thick, and let it dry in the shade. Being dry, set it in a Glass-house Furnace, approaching it nearer the Fire by degrees, and leaving it twelve Hours in the same degree of heat. Then withdraw it little by little for the space of six Hours, and let it cool gently. The Crucible being cold, break it, and you'll find your *Sapphire* within, which will have all the Qualities of a fine Diamond; that is, its shining and hardness. Repolish it at the Wheel, and work it.

C H A P. CXLV.

Another Way of turning the White Sapphire into a true Diamond.

HERE follows another noble Method of converting the *Sapphire* into a Diamond, which will be easier to those who have not the opportunity of a Glass-house Furnace, for it may be done with a Wind Furnace, in twelve Hours time.

The Materials we are going to shew, which are used in this Operation, will at first seem very expensive; but if you consider it diminishes not, but you find it all again, you'll easily see, that the only Expence is in the Fire.

You must therefore begin, by well wrapping your *White Sapphire*, in a thin Iron Plate, that it may be easily managed. Then take fine Gold, purified by *Antimony*, to the highest, put it in a Crucible in a Wind-Furnace, melt it, and when it has a good fine Gloss, put the *Sapphire*, covered with the Iron-Plate, into the Bath, so that it may float on the Gold on every

every ſide; then give it a ſtrong Fire for twelve Hours, ſo that the Gold may be all the while in Fuſion. Take out your *Sapphire* with a little pair of Tongues, ſhaking out the Gold that may chance to ſtick in the Leaf-Iron; then let it cool by the Fire gently, for fear it ſhould break. Being cold, take away the Plate or Leaf of Iron, and you'll have your *Sapphire* of an admirable Beauty, it having acquired by that coction all the Qualities and Perfections of the Natural Diamond. Polish it at the Wheel, and Work it.

C H A P. CXLVI.

Another way to turn the White Sapphire into a true Diamond.

THIS Way will be found, by ſeveral, to be more eaſie and better, becauſe it does not oblige to ſuch an Expence in Gold, ſo that People cannot purchaſe it. This is the Reaſon we ſhew it here, tho' others have ſpoke of it, and among the reſt *Joh. Bapt. de Porta*, who has writ of this Art.

Take Filings of Iron or Steel, put them in a Crucible, then put in your *White Sapphire*, ſo that it may be wholly covered with the Filings: Set the Crucible in the Furnace, and give it a good Fire, that the Filings may be red hot without melting. After it has been ſome time in this Fire, take it out with a little pair of Iron-Tongues, to ſee if it be of the colour of Diamond; if not, put it into the Filings again, and reiterate this till it be perfect.

You may do the ſame thing with that filing of Steel, and an equal part of *White Enamel* in Powder. Having well mixed them together, put them in

in

in a Crucible, and put your *Sapphire* in the middle of them; after having first pasted them, with your Powder of Enamel wetted with Spittle, and well dried it at the Fire. When your Matter is red, and it has remained some time in that condition, take out the *Sapphire* with your Tongs, to see if it have taken the colour of the Diamond: If it has not, put it in again as before, and continue to do this till it be perfect. Then polish it and work it.

This is all we design'd to say concerning the Make and Perfections of Gems, tho' there are other ways of doing them, and several other curious things might be said on this Subject; but that would require a large Volume, which perhaps we may do in the next Edition, if we find the Curious take any Satisfaction in this.

The End of the Fifth Book.

O F T H E
A R T
O F
G L A S S .

B O O K VI.

C H A P. CXLVII.

Wherein proper Rules and Matter for all sorts of Enamel are prescribed, with Directions for qualifying the Fire, in order to succeed well. How to make Goldsmiths Enamel of several Colours for Gold. A neat Preparation of the Magnese. A Spirit of Saturn, a fixt Sulphur, and a mild Vitriol of Venus, of most sovereign Vertue and Use.

THIS most agreeable way of enriching Gold by Enamel, which proceeds from the beautiful Variety of Colours which may be apply'd, being an Art no less painful than necessary for Ornament. We proceed to lay down such Methods in this Book, as shall equally answer the Benefits

nefits of the Publick, and fatisfaction of the more Curious.

For should we omit this our Intention, the Work would be deficient, and this *Art of Glass* deprived of one of its most excellent and principal Beauties; therefore we propose in the first place, to give direction for the Choice of *Matter* to be used, and thence shew the Preparations for all sorts, and how to make and suit the Colours most convenient on Enamel.

The Method not only used by the Goldsmiths, but by such as form Pourtraitures with it of all sorts, as *Man, Beasts, Fowl*, and other Curiosities, very naturally, by a just disposure of the Colours, is most admirable; to effect which no more is required than a lighted Taper, and a hollow Pipe of Metal for that purpose, to blow the Blaze to the *Matter*, and make it malleable and soft, and thence the severall Figures are drawn or impressed thereon.

And this may be so far improv'd and heightned, as to admit of Performances rather to be thought the Essay of a Divine than Human Artift. Witness that notable *Piece of Chariot* drawn by *two Oxen*, of which *Cardan* takes notice in the *fifty second* Chapter of his *tenth Book*, which was so completely done in *Little*, that the whole might be covered with the Wing of a Fly. The *Ship* rigg'd and *Man* arm'd which *Hemel* says he saw. Those little Statues of *Men*, with severall other Curiosities of Figure *Vormicus* also affures of. Not to omit the Church of *St. Mark* at *Venice*, where the *Mosaick-Work* is plentifully interlaced with History of all Sorts, distinguishable by the Variety of Colours, and Gildings, and all consisting of severall different Subjects. In short, what *Account Agricola* has left us of these Matters, in his *twelfth Book*, gives us no less cause to admire this Art than he had, when he saw such notable
 Pieces

Pieces of which he makes mention, and which he assures us was deservedly very great.

The use of *Enamel* is very ancient, however that of working on Metal is more modern; and for the great Perfection to which it is arrived, we are obliged to this present Age, as we shall further shew in the *Seventh Book*, where we will also endeavour to discover further, and make greater Improvements therein.

C H A P. CXLVIII.

To prepare the Matter for Enamel.

NOW we proceed to shew the Ingredients by which the *principal Matter for Enamel* is prepared, before the Colours can be applied, of which we shall give Directions in the following Chapters.

Take *Lead* in Piggs thirty pound, *Plate-Tin* of *Cornwall*, thirty three pounds; mix and calcine them as directed for *Lead* in *Chap. LXXXI.* precisely observing the Directions there laid down. This done, searce the *Calx*, and put it all into a glazed Earthen Pot, fill'd with Water, put it over a fire, and let it boil a little; then take it off, and pour the Water gently into another Vessel, which will carry along with it the more *subtile Calx*. Repeat this until no more of the *Calx* can be subtiliz'd; which you may discover by the Pureness of the Water in pouring it out of one Vessel into the other. After this calcine the *Remains* of what is in the first Pot, as before, and thus continue to calcine and subtilizetill you can get no more of the *subtile Calx*. Lastly, put the Waters out of all your Receivers into larger, and set it on a slow Fire to evaporate. The Fire must be very gentle for this Reason, that the *Calx* do

not founder or fall to the bottom, but continue more fine and subtile, than when it was first calcin'd.

Your *Calx* being thus prepared, take thereof about fifty pound, and as much *Fritt* of white *Tarso* beaten and searced, as directed *Chap. VI.* To these add eight Ounces of Salt of *Tartar*, finely searced and prepared as in *Chap. XV.* Mix all these Powders very well together in a Pot, and let it stand in the Glafs-house Furnace or Oven about ten hours to digest and purifie. Then take them out, and reducing them to an impalpable Powder, keep it in a close dry place for use. Thus must your Matter for Enamel be prepared to receive the Colours, but of that more hereafter.

C H A P. CXLIX.

To make Enamel of a Milk-white Colour.

THIS Colour of all others is the purest; 'tis used for the Ornaments of Virginity, the Emblem of Innocence, as also the Symbol of Candour and Chastity. Nay more, we may even from it form a pretty and impressive Idea of the Brightness and Excellency of Faith; and 'tis what has ever been esteemed and revered by all Nations.

We have already shew'd how to tinge Glafs of this Colour, in *Chap. LXX.* of the *Third Book*, and now we will shew how to perform the like on Enamel with no less Beauty, and very easily; thus: Take six pound of our *prepared Powder*, in the former Chapter, and forty eight Grains of *Magnese* of *Piedmont*, prepared as in *Chap. XVIII.* put them will together into one of your Furnace-Pots to melt and purifie over a very swift Fire, which will be

be done in a little time. The Matter being thus melted, take it out of the Pot, and throw it into very fair Water, and being afterwards dryed, put it again into the Pot to melt ; do thus with it thrice, changing the Water. When you have thus purified it, if you find it justly white, 'tis good ; but if it be greenish, add a little more *Magnese*, and 'twill become white as Milk, and fit Enamel for Gold, or other Metal. Take it off the Fire, and make it up into Cakes, and keep them for use.

C H A P. CL.

A Turcoise-blue Enamel.

THIS Colour of the *Turcois*, or *Turkey-stone*, is very fine for Enamel, but withal very difficult to make well, and requires a great deal of Experience. Now 'tis sufficiently known, that Practice will at length make the most uneasy Beginners Masters of their Trade, therefore we must not be discouraged if we fail in our first Tryals, because by continuing to repeat them, we shall at length be sure to perform well : 'Tis always supposed you understand your Undertaking, and are sufficiently qualified to distinguish when you are in the right or wrong, or you can never hope to succeed. For this cause we ought not to stand dozing on every Unsuccess, for Nature, which never fails, will still be ready to inform us, provided we have Judgment enough to determine her Precepts.

Though we have taken occasion from the *Turcois*, to make this Digression here, it may nevertheless be a convenient enough Consideration in Cases of a sublimer Nature, even in all the Undertakings of Man. Since we are so naturally apt to be impatient and disturbed

sturbed if we can't effect those Matters in (as it were) a moment of Time, which Nature it self takes a whole Age to perform: And this is what mostly arrests the Accomplishments of our greatest Designs, and imposes on us a seeming Impossibility in the most easie things: Thus Obscurity interposes in the brightest Essays of the Sun, and we can't enjoy one day, though never so serene and fair, that is not more or less over-shadowed with Clouds.

Thus far I have made my Attempt on this Thought, which I hope the Learned will freely pardon, because I have discoursed nothing but Truth, and what they already are much more familiar with, and satisfied of. But now for our *Enamel*, which to make of this *Turcois* Colour you must put of our *prepared Powder*, *Chap. CXLVIII.* six pound, into a white glazed Pot to melt and purifie it; then cast it into Water, and when dry put it again into the Pot, and being melted over again, add to it at four times, this Composition, *Scales* of Copper thrice calcin'd, as in *Chap. XXXIV.* three Ounces of prepared *Zaffer*, eighty six Grains of *Magnese*, prepared as in *Book I.* forty eight Grains, all these mixt and reduced into a very fine Powder, stir the Matter very well each time with your Iron Hook, that the Powders may incorporate, and for Reasons by us given elsewhere before.

Thus when your Matter is fully and well tinged, take the Approbation of a Goldsmith on some of it, as to the Colour, that you may have the more assurance before you proceed to empty your Pot. Your own Experience must shew you how to proportion the Ingredients for tinging the Matter more or less. If you perceive that the Tinging-powders are too predominant, add the more principal prepared Powder; if it be too faint, add the greater quantity of the Tinging-powders: And thus do to improve
or

or lessen the Colour until it be compleat or to Satisfaction.

C H A P. CLI.

To make a very fine blue Enamel.

FEW Persons but are much taken with this Colour, as being the most slightly agreeable of all others, both from the esteem of its natural Beauty, which makes it eminent above the rest of Colours, as it has resemblance to that of the Heavenly Arch, and is taken for the Symbol of Generosity.

You may make Enamel of this Colour with four pound of our *principal* prepared Powder in Chapter CXLVIII. two Ounces of prepared Zaffer, forty eight Grains of Copper thrice calcined, mentioned in the precedent Chapter; these reduc'd to a mixt impalpable Powder, must be put into a white glazed Pot; when the Metal is well melted, cast it into Water, and when 'tis dry return it to the Pot; after that let it stand upon the Fire until it be well digested and incorporate: Then take it off, and you have a very fine Enamel for Goldsmiths, which make into Cakes, and keep for use, as before.

C H A P. CLII.

Another blue Enamel.

THIS Enamel is altogether as gay as the former, only the Colour is not the same, for which reason we prescribe it here, which else would be unnecessary.

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To

To make it, take Principle Powder of *Chap.* 148. four pound, Plates of Copper calcined, as in *Chap.* 30. two Ounces, prepared *Zaffer*, as in *Chap.* 17. forty eight Grains, mix and reduce 'em to an impalpable Powder, put this into your white glazed Pot, and having melted the Metals until they incorporate, cast it into Water, whence being dry, return it to your Pot, and let it remain therein until it purifie; when the Colour is well mixt and even so as to fatisfie you, take it off, and Cake it as usual.

C H A P. CLIII.

To make a pretty Green Enamel.

THE Gaiety of the Spring being conceived by this Colour, renders it exceeding pleasant to the Eye; 'tis an Idea of Nature revived, a Triumph over its Death, and the Symbole of its Victory.

It may be very perfectly imitated if you put four Pound of the *Principal Powder* in your White glazed Pot, and let it melt and purifie ten or twelve Hours in the Furnace, afterwards cast it into Water, dry it and put it again into the Pot, and let it be fully refined; then take Scales of Copper thrice calcined as in *Chap.* 34. two Ounces, Scales of Iron at the Smith's Forge on the Anvil-Block, forty eight Grains, mix and reduce them to an impalpable Powder, and throw it at three several times and Portions into your Pot of Principal Matter, stirring the Metal very well that it may be equally tinged by the mixture of the Colours; if it be to your Fancy, and of a pleasant colour, let it stand a while in the Fire, until it be thoroughly incorporated; thus take it off, and you'll have a delicate Green Enamel very proper for all sort of Goldsmiths Work.

C H A P.

C H A P. CLIV.

Another Green Enamel.

THE colour of this following, is something different from the former, but no less excellent : Take six Pound of Principal Powder, two Ounces of *Feretto of Spain*, prepared as in *Chap. 23.* forty eight Grains of *Crocus Martis*, prepared with Vinegar according to direction in *Chap. 25.* make these into an impalpable Powder, and mix 'em well, and put them into your White glazed Pot ; let it remain in the Furnace to melt and refine the Matter ; cast it after this into Water, and again into your Pot, having dried it before, until it refine very well ; when 'tis melted, observe whether the colour be satisfactory, and let it stand some hours longer to refine, and when 'tis taken off, you'll have a very fine Green Enamel for Goldsmiths.

If the colour be too faint, add more tinging Powder proportionably enough to perfect it.

C H A P. CLV.

Another Green Enamel.

THERE is another way to make Green Enamel after this manner : Put into a White glazed Earthen Pot, four Pounds of *Principal Powder*, and let it refine in the Furnace a little while, cast the Metal afterwards into Water, and (being dried) again into the Pot ; then add at three equal Portions, this

Powder compounded of Scales of Copper thrice calcined two Ounces, *Crocus Martis* prepared with Vinegar, forty eight Grains, these well mixt and powdered together, stirring the Metal with the Iron Hook, to incorporate it, let it remain until it be well refined on the Fire, and when 'tis well and perfectly colour'd to satisfaction, take it off, and keep it for use.

C H A P. CLVI.

The Way to make Black Enamel.

THO this Colour be mournful, and representing the Image of Death and Darknes, yet 'tis the Symbole of Constancy, Prudence, and Resolution; the Life of Silence and Secresie, and, in short, of all things which are lasting.

'Tis most necessary in this Art, and can least of all be spared, because it has a peculiar Beauty which sets it off among the more splendid and sparkling Pieces; you may make a very fair Velvet-colour with 4 Pound of the *Principal Powder* in *Chap.* 148. two Ounces of prepared *Zaffer*, and two Ounces of *Manganese of Piedmont* prepared as directed before; mix and pulverize them altogether very well, and put them into a glazed Earthen Pot in the Furnace for some Hours; the Pot must be more than ordinary large, because the Metal will rise very much: When 'tis purified, cast it into Water and dry it, and return it into the pot to be refined over again, which will be in a little time; then see whether the Colour be to your Fancy, and accordingly as you find it, put in more or less of the former Ingredients, and having thus perfected it,
take

take it off and cake it; this Enamel will be a]good Velvet-black for Goldsmiths.

C H A P. CLVII.

Another Black Enamel.

THIS second sort is distinct from the other by the difference of the Quantities and the tinging Ingredients.

Take six pound of *Principal Powder*, two Ounces of *Zaffer* prepared according to *Chap. 17.* two Ounces of *Crocus Martis*, prepared with Vinegar as in *Chap. 25.* two Ounces of *Ferretto* of *Spain* assigned in *Chap. 23.* pound and mix them very well together, making an impalpable powder, and put it into your glazed pot in the Furnace to melt and purifie, when it is well digested cast it into Water, dry it, and put it again into the pot, where let it remain a while to refine; when 'tis for your purpose take it off and cake it as usual, and you'll have a very good and most convenient Enamel for the Goldsmiths to set in Colours, and Enamel with.

C H A P. CLVIII.

Another Black Enamel.

HERE is a third Way of making the Velvet-black Enamel much fairer and of a finer gloss, surpassing the former.

To make which, you must take four pound of *Principal Powder*, four Ounces of red *Tartar*, two

Ounces of *Manganese* of *Piedmont* prepared, reduce these to very fine powder, and put them into a glazed pot bigger than ordinary, because the Metal will rise; let it melt and digest in the Furnace, and cast it into Water, and (after it is dry) again into the pot, there to remain until it melt and refine anew; when you find the Colour sufficient for your use, make it up into Cakes, and keep it for the Goldsmiths.

C H A P. CLIX.

To make Purple-coloured Enamel.

PURPLE is a Colour highly in request with all Grave Philosophers, as if it did express the End of their Expectation, the Fulness of their Delight and Desire; it was so mightily esteemed by the Ancients, that among the *Romans* the Emperors, the Princes, the Renowned Chiefs, and other Magistrates of that Puissant Empire only made use thereof: And the *Lacedemonians*, who looked upon themselves to be the most Ancient People on Earth, cloathed themselves with it, that they might be the more eminently distinguished, so great an Affection they bore to this Noble Colour: The Emperors of *Greece* had so much value and regard for Purple, that they sought out the choicest and most exquisite to have the young Princes of the Blood Born in, intimating by this a Glorious Omen of their Generosity, the Colour truly implying a perfect Symbolc of Heroick Vertue, and by which their Illustrious Parentage, and Royal Descent from Kings and Princes, was most eminently shewn.

The Art of Dying in this Rich and Noble Colour was formerly fo very considerable among the Ancients, that fuch as practifed it in the City of *Tyre*, were exempted (as well as the Nobility or Members of the Government) from all manner of Taxes and Contributions; which Priviledges and Advantage have a very near refemblance to thofe which our *Art of Glafs* have received; and this costly Colour is equally eftimable in both; and beſides, the Employment of this latter admits only of Gentlemen, by whom alone ſuch Priviledges are enjoyed without derogation from their Nobility, as we have ſhewn in *Chap. 3.*

The grand Prerogatives of theſe two Gentile Arts, are Arguments which may ſerve eaſily to convince us that they have nothing in the practice of them either Mean or Vulgar, but have in them always ſomething of Elevation and Sublimity beyond all other Occupations: And 'tis obſervable, that ſuch as wrought in the fiſt, enjoy'd the Priviledges of Nobility, and that ſuch of the Nobility as Exerciſe themſelves in the latter, may do it without prejudice to their Birth.

Now to make Enamel of a Purple-colour, you muſt take four pound of *Principal Powder*, as prepared in *Chap. 148.* add to this two Ounces of *Manga-neſe of Piedmont*, prepared as we ſhall direct in *Chap. 164.* put theſe into a White glazed Earthen pot, allowing it large enough to bear with the Ebullitions and raiſing of the Metal: When it's thoroughly melted, caſt it into Water, dry it, and put it again into the pot to refine; then conſider whether it be well enough coloured, and accordingly make it up into Cakes, and keep it for uſe as before.

C H A P. CLX.

Another Purple Enamel.

WE will give you another Way to make Enamel of this Colour, no less delicate than the former, for all manner of Goldsmiths Work.

Take six pound of our *Principal Powder*, three Ounces of *Manganese of Piedmont* prepared, six Ounces of thrice calcined Scales of Copper, as we have before prescribed, reduce all these to an impalpable Powder, and let them dissolve and refine in the White glazed pot in your Furnace; afterwards cast the Metal into Water, dry it well, and return it into the pot to refine over again; examine the Colour, if it be right, take it off and cake it up for use as before.

C H A P. CLXI.

To make Enamel of Violet-colour.

THIS Colour as it is the nearest to it, succeeds the Purple, and is a mixture of Red and Blue, 'tis worn by the Fathers of the *Church Militant*, for their proper Livery, as being altogether Heavenly, and by which the Character which they bear is best signified.

To make it, take six pound of *Principal Powder*, as in *Chap. 148.* two Ounces of *Manganese of Piedmont* prepared, and forty eight Grains of thrice calcined Scales of Copper, make 'em all into a very fine powder,

powder, and being well mixt put them together into your White glazed Earthen Pot in the Furnace, let it melt and digest, then cast it into Water, and dry it, put it again into the Pot, and let it refine very well; try its Colour, and if 'tis agreeable, take it and cake it, and you'll have a very fine Violet-colour'd Enamel, proper for all manner of Goldsmiths Work of that fort.

C H A P. CLXII.

The Way to make Yellow Enamel.

YELLOW is the Colour of Gold, and may therefore deserve all its Commendations, which are so extraordinary great, that they require a whole Volume to contain 'em; but we'll only satisfy our selves to intimate, that it bears the likeness of the first and more perfect Body, which rouls under the Heavenly Arch: And can there be any other so great Comparison? 'Tis likewise the Symbole of true Nobility, and of all excellent Causes.

You may make this rich Colour with six pound of *Principal Powder*, three Ounces of *Tartar*, seventy two Grains of prepared *Manganese*, the whole reduced to an impalpable Powder, well mixt and put into a glazed Earthen pot large enough to dispense with the Ebullition and raising up of the Metal; let it stand in your Glafs-house Furnace to melt and incorporate; after cast it into Water, dry it, and leave it in the pot again to refine very well; then try the Colour, and if it be sufficient, make it up into Cakes as before directed, and you'll have a very taking Yellow Enamel for all sorts of Metal but Gold, which by its resemblance it would only dull and spoil the

the Beauty, unless it were placed among other Colours, as the Goldsmiths already are very well acquainted withal.

C H A P. CLXIII.

The Way to make a Crystal-Ground for our Red Enamel.

THE *Red* requires a *Chrystal* more lasting than any of the former, therefore we will give you a Composition here sufficient for that purpose.

Take twenty four Pound of Salt of *Polverine*, *Rochetta*, or *Soda* prepared as directed in *Chap. 5.* and six pound of *Frit*, as in *Chap. 6.* these mixt and finely powder'd, must be steep in Water to bring the Mass into a Body like PASTE; and then make it up into small thin Cakes, lay them on Tiles in a Lime-kiln, or Potters-Furnace for six Hours to calcine, or near the Glass-house Furnace Vault, or on the Upper Vault, taking special care that they don't melt, let them remain there for three or four Days, or until they be very well calcined.

This done resolve them into an impalpable powder, adding thereto four pound of Calx of Lead and Tin prepared and calcined according to directions in *Chap. 148.* and *Chap. 81.* four pound of White calcined *Tartar*, prescribed in *Chap. 5.* and elsewhere. These being all mixt and very finely pulverized, put them them into your glazed pot at the Glass-house Furnace to melt and refine; thence throw the Metal into Water, and again (when dry) into the pot to melt; cast it a second time into the Water, and dry it, let it melt and refine over-again in the pot for some Hours, and 'twill be fit for use.

Consider

Consider always the Lead which is among the other Ingredients, and be very careful that you let none of it remain in the pot when you throw the Matter out into the Water, for it will be apt to precipitate to the bottom, and this for several Reasons elsewhere given, too tedious and needless to be here repeated.

C H A P. CLXIV.

An Excellent Preparation of Fusible Manganese to be used in making of our Red Enamel.

WE have already given sufficient direction to prepare *Manganese of Piedmont*, in *Chap. 18.* for tinging these Matters, of which we have already discours'd, but for Red and Rose-colour Enamel, there are some more exquisite Ingredients and Preparations required, which we think proper to give account of here, before we speak of the Enamel itself.

Any other than *Manganese of Piedmont*, will not serve your turn, for that only is fit for our use to contribute to the Fairness and Life of the Colour; take therefore equal Quantities of this *Manganese* and *Salt-petre*, as much as you please, and let them reverberate and calcine in an Earthen pot in your Furnace twenty four Hours; take it off and wash it well in warm Water to separate the *Salt-petre*, dry it well, and the Mass will be of a red Colour: To this add an equal quantity of *Sal-Armoniack*, grind these on a Marble with distilled Vinegar, as Painters do their Colours; dry it, and reduce it to Powder, putting it afterwards into a strong Matrafs or Bolt-head of Glafs, big-belly'd and long-neck'd, there to sublimate

mate about twelve Hours; break your Matrafs, mix all the volatile and fixed parts together, adding the same quantity of *Sal-Armoniack*, as there are Flowers, and take care to weigh them before Composition; grind, pulverize, and sublime as before, repeating this until your *Manganese* remain fusible in the bottom of the Matras, and this is that which you must preserve to tinge Crystal with, and make it ruddy and diaphanous, or transparent as a Ruby.

C H A P. CLXV.

The Way to make a Fixt Sulphur, to be used in Compositions for Enamel.

THIS Fixt Sulphur serves for several uses in Chymistry, and very convenient for obliging young Artists.

Now, tho' it be not so unavoidably necessary for making *Red Enamel*, yet we will not omit it here, because it contributes to our prescribing two sorts of ways for it, as well as to satisfy the more curious Goldsmiths.

Put Flowers of Sulphur, as much as you please, into a Glass Cucurbite luted at bottom, pouring there-to Oyl-Olive as much as will drown the Matter by two Inches, set the Cucurbite on a violent Sand-Furnace, for a full Hour, then take it off, and pour in strong Vinegar, and the Sulphur will soon precipitate, and the Oyl ascend on the Surface of the Vinegar, decant this from the Sulphur into another Vessel, and put in more fresh Oyl as before, do thus thrice, and you'll have at length a fixt Sulphur to make use of for Enamel.

C H A P. CLXVI.

Another fixt Incombustible Sulphur.

THERE is yet another way for fixation of Sulphur for the same use, and several Chymical Operations, wherein it has very great Vertue.

Make strong Lye of Quick-Lime and harsh Oak-Ashes, put therein Flowers of Sulphur until the liquid Surface be four Inches upmost; boil it for a considerable while over the Fire, this will cleanse and purge the Sulphur from its Unctuousity and Corruption, and qualifie it for your purpose; separate the Lye from the Sulphur, and drying it, you'll have it white, fixt, and incombustible, exceeding proper for the Goldsmiths to make use of on Gold.

We cou'd prescribe several ways more to make Sulphur fixt and fusible, but these two already given are sufficient for our purpose; we reserve them therefore for some other place to be discovered among Matters more excellent, and of greater Curiosity, for the Advantage of such Persons who Study the improvement and profounder parts of *Chimistry*.

C H A P. CLXVII.

To Extract Spirit of Saturn, an Excellent Ingredient for Enamel and Glass-work.

WE think fit to propose all the Preparations proper for making a Red Enamel, before we shew the way to make it, because the Ingredients to be

be used must first be provided, or we can't proceed regularly to our Business.

Among the rest, this Spirit of *Saturn* is not to be laid aside, which tho considered here as useful only in Enamel and Glafs-work, may have other Vertues familiar to the Learned; but for our Business 'tis such as does very nobly heighten and much improve the Matter for our Work, and for any other not immediately relating to us here, we pass over in silence.

Reduce good Litharge, as much as you please, to an impalpable powder, and set it in a glazed Earthen Vessel over a still Fire; add to this good distilled Vinegar, till four Inches above it, mix 'em well together, and then let them settle until the Vinegar become Milk-coloured, which will be in a little time; decant this Vinegar off gently, and put on fresh, continuing to do thus until it admits of no more colouring; then put all the Milk-coloured Vinegar into a glazed Earthen Vessel, and let it stand until the Lead precipitate to the bottom; from whence pour off the clear Vinegar, which will be at top, and that Milk-colour'd Sediment which remains, is what we call Spirit of *Saturn*, tho improperly, and that which we'll make use of for the Enamel and Glafs.

If it do not precipitate well to your liking, and that the Vinegar at top be not very clear, cast among it some cold Water; if that won't do, and that your Vinegar still continues muddy, set all the Water and Vinegar together over a gentle Fire to evaporate, and thus you'll have the more Spirituous part of your Vinegar a Sediment in the bottom of the Vessel, which is exceeding useful for Glafs-work; keep it together with the rest of the *Saturn* for use.

This Noble Preparation which we call Spirit of *Saturn*, does indeed contain it, but you must have skill to extract it thereout; to say that 'tis all Spirit of *Saturn* is untrue, for 'tis that wherein the Spirit
is

is contained, and from whence it may be more easily and better separated, than from the Mass of Lead, I propose this first step towards extracting it as such, whereby the Curious may succeed with small trouble.

C H A P. CLXVIII.

The Way to make Enamel of a Blood-colour Red.

SINCE we have given a small Elogy to every other Colour, 'tis unjust for us not to continue the like on this, which is a true Symbole of Blood, by which the Glory of the *Martyrs*, who with so much Generosity and Courage shed theirs for the Faith of Christ, may be represented as well as of those many Brave and Heroick Persons, who have interposed for the Preservation and Support of Church and State, 'tis therefore an Illustrious Badge of Eminent Courage. Thus *Alexander, Hannibal, Scipio*, and very many other Great and Noble Princes, chose this Colour for their Livery, and for their Shields.

To stain Enamel of this Colour, take ten pound of common Frit, mentioned in *Chap. 12.* add thereto six pound of Glass of *Saturn*, prepared as in *Chap. 82.* the whole made into a very fine powder, must be put into a glazed Earthen pot at the Glass-house Furnace, to melt, boil and refine; after this cast thereon powder of thrice calcined Copper, as in *Chap. 34.* at discretion, stirring it all about that they may incorporate together with powder of red *Tartar*, until the Mass become red as Blood, observing whether the Colour be too pale, and if so, continue to put in more of these Powders of *Copper* and *Tartar*, until it be perfectly stained; and thus you'll have a delicate
deep

deep Sanguine Enamel fit for all manner of Work you can desire to apply it.

C H A P. CLXIX.

Another Blood-colour Enamel.

THIS Enamel will be very beautiful, and may serve instead of the Rose-colour Enamel hereafter prescribed.

To make it, put ten pound of Frit for Crystal, *Chap. 6.* and six pound of Glafs of *Saturn* before mentioned, into one of the Glafs-house Furnace pots, let it melt and purge well; after this cast it into Water, dry it, and return it into the pot; when 'tis well melted again, throw in at several times, five or six Ounces of powder of thrice calcin'd Copper, stirring the whole with the Iron Crook to mix and incorporate them well together, and also a like quantity of powder of red *Tartar*, still stirring it; this being well boil'd and refined, observe whether the Colour be perfect, if not, add equal parts of the Powders of *Copper* and *Tartar*, according to your Judgment, as much as you find necessary, to bring it to a perfection; let it remain to boil and purifie, trying it again and again, until you find it compleatly coloured.

C H A P. CLXX.

Another Red Enamel of a very Splendid Ruby-colour.

THE Beauty of this Enamel is very surprising, and of as lively a Lustre as the Ruby it self, which it communicates to all the Work wherein 'tis used.

For this fine Effect we must have recourse to the fusible *Manganese* in *Chap.* 164. add twenty Ounces thereof to each pound of Crystal ground, mentioned *Chap.* 163. let the whole be well purified, then try the Colour, and according as you find it, add the greater or lesser quantity of *Manganese*, or Crystal ground respectively, until it be brought to its just degree of perfection, as a *Ruby*, and which ought to be very admirable.

C H A P. CLXXI.

Another Ballas-Ruby-colour Enamel.

THE same *Manganese* must be had to make this fine Colour; put ten Pound of Crystal ground, in *Chap.* 163. in a glazed pot to melt and purge at the Glass-house Furnace; throw the Matter into Water, dry and melt over again; do thus thrice, and when the Mass is afterwards well melted, tinge it with the fusible *Manganese* as before, and 'twill become Purple-colour'd. Add to it at eight times impalpable Powder of Alom to bring it to a Red. Be very careful that the Alom do not blacken it, but rather make

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it Yellowish, and the *Manganese* dissipating 'twill become Red, and so make the Colour most perfect and just of a fine Ballas-Ruby.

C H A P. CLXXII.

Another Enamel of a Rose-colour for Gold.

NOTHING is fairer and of greater Gaiety than this, for all Work where it may be used, and therefore we'll give you several ways for its Preparation.

Take ten Pound of Crystal ground, in *Chap.* 163. melt it at the Glass-house Furnace in a glazed Pot, add to it at four times five Ounces of red calcined Copper, as in *Chap.* 33. stirring the Metal every time, then put into it *Crocus Martis*, *Chap.* 26. and *Manganese* as before prepared; then let it alone to clean for six Hours, and if the Colour is not true, put in by little and little more *Crocus Martis*, until it come to your liking, and be of a fine Rose-colour.

C H A P. CLXXIII.

Another very fine Rose-colour.

AMONG our Rose-colour Enamels this seems the finest; to make which, take four Pound of Crystal ground, of *Chap.* 163. let it melt in a glazed Pot at the Glass-house Furnace, cast it afterwards into Water, and melting it over again, add by little and little an Ounce and half of *Calx*, prepared

re

red as in *Chap.* 148. stirring the Metal every time to incorporate, then let it alone for a little while, until you perceive it of an Ash-colour; when it comes to that forbear putting in any more *Calx*, lest you make it too white; then refine the Mass, and after add to it *Minium* two Ounces, purge, refine, and throw it out into Water, and putting it into the Pot, let it stand to melt and purifie over again about eight Hours, then put in an Ounce and half of red thrice calcin'd Copper, and as much crude white *Tartar*, with a Dram of Blood-stone, and the like quantity of fixt Sulphur, in *Chap.* 165. these pulverized very fine and mixt together, stir the Metal and incorporate them very well together; afterwards see if the Colour answers your expectation; if it be too deep, add a little more *Manganese* to weaken it, if it be too pale, improve it with some more of the last Composition of *Copper*, *Tartar*; Blood-stone and Sulphur, until it be to purpose: And thus you have an Enamel of an exceeding fair Rose-colour.

C H A P. CLXXIV.

Another Rose-colour Enamel.

PRACTICE has already experienc'd so many ways to bring this fine Enamel to the most advanced Improvements, that 'tis impossible to expect any greater; and for such as wou'd make it, they may proceed boldly thus.

Set six Pound of Crystal ground, as in *Chap.* 163. in a glazed Pot at the Glass-house Furnace to melt and cleanse; then cast into it at four several times intermitting, four Ounces of *Calx*, as prepared of

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Lead

Lead and Tin, in *Chap.* 148. stir the Matter very well at each time until it incorporate, then let it all purge for a while, and cast it Ladle-full by Ladle-full into Water, and again put all into the Pot to melt and refine anew; after this add to it an Ounce and half of red Copper pulverized and calcined, as in *Chap.* 33. which will tinge the whole of a deep Colour, but cast it in at three Intervals, and stir it very well to incorporate; two Hours after, add to it at thrice, an Ounce and half of *Crocus Martis*, given in *Chap.* 24. mix it well as before, and let it remain to refine about three Hours, then throw on it six Ounces of *Tartar* calcined, as in *Chap.* 57. Chimney-Soot vitrified one Ounce, *Crocus Martis* again one Ounce and half pulverized, and all well mixt at four several Intermiſſions, and Quantities, stirring the Metal always with the Iron-Crook, lest it swell or boil over: After this let it repose and purifie about three Hours, stir it again and try the Colour, if it be red as Blood it's right, if not, add at discretion, a little more of each of these Powders of *Tartar*, Soot, and *Crocus Martis*, until the Colour be full and true, and so let it stand for a whole Hour, and try it again; if you find it perfect, proceed no further, but keep it for use, 'tis very proper to apply to Gold for Enamel.

C H A P. CLXXV.

Another Splendid Enamel of a Carbuncle-colour.

NOT to particularize any farther on the Carbuncle, which we have sufficiently enough discoursed of already, we will shew how to imitate the Colour ascribed to it with Enamel, and which
will

will be of a wonderful fine Beauty, as has been often experimented. Now the whole Secret of this Operation consists in calcining the Gold perfectly, and bringing it to an absolute and just fineness, which must create this precious Colour.

Take very pure Gold, and for the better assurance refine it your self, and dissolve an Ounce of it in three Ounces of *Aqua Regalis*, as directed in *Chap. 55.* let the Solution distil over a gentle Fire until the Gold precipitates, and thus repeat an Exhalation and Cohobation six times, and the last time take out the Gold, powder and put it into a Crucible covered and luted, on a Reverberatory to calcine; let it remain until it become of a very excellent and Scarlet Red, which will not be without a considerable allowance of many Hours.

This done, take of our Crystal ground, and melt a quantity of it in a glazed Pot at the Furnace of the Glass-house, and being well purged, throw in a twentieth part of the Powder of Gold, in proportion as the quantity of Metal, stirring the whole very well, let it alone for some time, then try it, and according as you find the Colour, put in more Powder until you bring it to a true transparent Carbuncle-colour.

We have given another way to calcine Gold in *Chap. 115.* no less sufficient than this, together with a way to make a fine Carbuncle, and this rare Colour may as well be given to the Stone as the Enamel by the Directions for preparing the Gold in either Chapter, the Curious may chooie which they will, they being equally sufficient.

C H A P. CLXXVI.

*The Way to calcine Copper for making Vitriol of Venus,
without Corrosive.*

WE promised in *Chap. 45.* to shew this fine Essay, which is certainly the Noblest Preparation can be made of Copper, so the Learned may take notice of it: If the *Caput Mortuum* of *Vitriol* has many excellent Vertues for tinging of Glass, this *Vitriol* it self, or rather Spirit, must have far greater and more extraordinary in Matters of a more sublime Nature: A famous Philosopher, very eminently recommendable and Judicious, was never weary of dwelling on the Praise of this hidden Treasure, and extolling its Vertues to the highest.

Tho this Vertue be known to many of the Learned, yet we may boldly say, 'tis unknown to very many indifferently so, who as soon as they have run over the Writings of some Sage Virtuoso, pretend to be acquainted with all the Secrets of Nature, and which they undertake to disclose and unravel as soon as they can force 'em to any sense conformable to their weak Capacity, tho never so different from the Author's meaning, to which they are altogether Strangers, and this gives us Authority enough to condemn them for truly ignorant.

Nature is veiled, and her Vertues not so plainly disclosed to all the World, she has those secret Recluses for them as can be opened by no other than her own Key, which can't be match'd, and therefore not to be found in the Hands of every Man; besides that, one must be lead by the same Genius as he that forged it, before one can truly find and distinguish it, and

we may assure our selves that none but the Wise are in possession of this rare and precious Treasure.

The greatest of those who have writ on this Art, have always held this Key as the last Secret; all the profound Arguments they have alledged, and Pains they have been at to screen those obscure Avenues, were designed to make them inaccessible to the Base and Unworthy, and preserve these All-Divine Secrets from being prophaned by the Hands of such as wou'd abuse them.

This Sacred Mystery does not only consist (as many fantasie) in the making of Gold and Silver, which is Ambitiously suggested by the meer Avarice of the major part of ail Mankind, but is indeed the meanest Excellency thereof; for Health, which it contains, is beyond all the Treasure in the World; besides, the Knowledge it affords us of an Omnipotency in the true God, and of all the other Most Holy Mysteries of Religion, wherein it gives an opportunity to make a perfect Discovery: Are not those much more sublime and eminent Vertues which lead us to a Blessed Eternity? Whereas on the contrary, all the Transitory Wealth on Earth has nothing in it but Imposture, and serves only to precipitate us into the Bottomless-Pit.

We'll leave this lofty Subject to be discoursed on by the Learned, and go on to the calcining of Copper, which is the first Preparation to be made in making the *Vitriol of Venus* without Corrosive, which is known to very few, and whereof we have already given an Elogy.

Take thin Leaves of red Copper, and put them into Crucibles, stratifying 'em lay upon lay with Powder of common Sulphur, filling your Crucibles until all the Copper Leaves be put in, as in *Chap. 22.* then cover well and lute the Crucibles, let the lute dry, and put them into the Furnace of *Chap. 52.* con-

tinuing a good Charcoal-Fire for two Hours; afterwards let them stand and cool, then take off the Crucibles, and you'll find your Copper calcin'd and blackish, inclining to a deep Purple Powder; searce it, and to each Pound add six Ounces of Powder of Sulphur, mix and put them into a round flat-bottom Earthen Pot, strong enough to bear the Fire, lay upon the Furnace a strong Earthen-Dish, fill it with very live Coals, and place your Pot thereon with the Copper; when the Pot grows hot, and the Sulphur takes Fire, stirring it with your long Iron Crook, lest it should stick to the Pot, or become concrete, continue thus till the Sulphur be all consumed and smoaks no more; take the Pot hot off the Fire, and empty the Copper out with an Iron-Ladle; pound it well in a Brass Mortar, and searce it all finely, and you'll have a blackish Powder, reiterate this Calcination thrice, with the like proportion of Sulphur as before, and the third time let it remain until the Copper become Red and Yellow; then take it off, and pound it in a Brass-Mortar, and searce it finely, pounding what remains over again, untill all be searced, and you'll have a very well coloured *Calx* of Copper, most effectual and proper for extracting this fair *Vitriol* of Copper, whereof we will give the Preparation in the next Chapter.

C H A P. CLXXVII.

To make Vitriol of Venus without Corrosive.

THOSE who make *Vitriol of Venus*, have not all one and the same method, most of them dissolve the Copper in distilled Vinegar, Spirit of *Nitre*, or some other Corrosive, for our part Water alone is the

the Dissolvent, or rather Agent to extract the Tincture, as we shall shew.

Take Glass Cucurbits as many as will serve your turn, to contain all your *Calx* of Copper, and put six Pound of fair running Water to a Pound of *Calx*, into each Cucurbite; place them on a moderate Sand-Furnace for four Hours, to evaporate until one third of the Water go off; let the Furnace cool, and afterwards decant the remainder of the Water into other Glass Vessels, and dry the Sediment in a Crucible on the Furnace; let this Water settle for two Days, and then you'll find in the bottom of the Vessel small Grains of Copper of a blackish Colour; you must filtrate, or strain the Water, and preserve all the Grains together, to add to the former Sediment, having first well dried them, and keep the Water.

Take all these Sediments, and to each Pound add six Ounces of Powder of Sulphur as before, putting it into your flat-bottom'd Earthen Pot to calcine as in the former Chapter; take care to stir it well as long as the Sulphur fumes, and it stands over the Fire, else it will stick to the Pot and not calcine; take it off and powder it immediately in a Brass-Mortar, searce the Powder, and you'll find it black; mix this again with Sulphur proportionably six Ounces to a Pound, and put it to calcine anew, stirring it very well as before directed; let it stand a while on the Fire to alter the Matter from a Russet to a Yellow; then take it off and pound it instantly in a Brass Mortar before it cool, and then searce it all finely over.

Put a Pound of this Powder with six Pound of Water, into each Cucurbit, and these Cucurbits on a slow Sand-Furnace, where let it stand four Hours to the consumption of one third of your Water, which decant into other Vessels; let it settle two Days, then filtrate these Waters, and pour them among the former, gathering the Sediments that remain in the
bot-

bottom, and mix them with these in the Cucurbits.

Dry the remaining Sediments as before, and repeat the calcination anew with the same proportionable quantity of Sulphur; then extract the Tincture, filtrate and mix the filtrated and tinged Waters with the former, exactly observing the Order already taught, and continue to do thus six times, so will the Copper remaining in the bottom of your Vessels, become as it were a soft impure Earth deprived of all its blueness, which throw away as fit for nothing, for all the Vertue of the Copper is contained in the Waters; put these all carefully together to extract from them this precious *Vitriol of Venus*, as hereafter directed.

C H A P. CLXXVIII.

*The Way to extract a fair Vitriol of Venus from our
our Coloured Waters.*

OF all the Preparations to be taught for this rare Work, this is the most easie and vulgar, there being no more required, than to evaporate and crystalize the Matter; but as we are to leave nothing in the Dark, we resolve to explain every circumstance thereof for the benefit of our Readers, and such as wou'd know it.

We have said you must mix together all your coloured Waters, now we will tell you what must be done with them; you must have a low Glafs-Cucurbit that will hold two * *Paris* Pints, or more, which put into a moderate Ash or Sand-Furnace; put there-

* London *Quarts.*

in three Pound of the Tincture to evaporate gently, and put the rest into Glafs-Bottles set round your Furnace, so that they may be heated, and ready to fill the Cucurbit as fast as the Exhalation consumes its Tincture, which may be done with a Glafs Ladle, or the Bottles themselves, lest the Waters being cold might cause the Cucurbit to burst, and so all would be lost.

Reduce ten Pound of this by evaporation to two and half, or three at most, which will be a very high Tincture, pour it into two or three glazed Earthen Vessels, and place them all Night in a moist cold place, and you'll find the *Vitriol* at bottom, and sticking to the sides of the Vessels, like little long Icicles, which will have the true colour of Oriental Emeralds, pour all the remaining Waters into the Cucurbit, and dry the *Vitriol* that it may not stick, preserving it in a close Vessel.

Place your Cucurbit again on the Furnace to evaporate anew at the consumption of half the Waters, and crystalize the strong Tincture as before. Thus whilst any Water remains evaporate and crystalize until all be consumed, to the end that none of this may be lost, whose Vertues are infinitely useful, not only in *the Art of Glafs*, and the *Metallick*, but in *Physick* too, for the curing of many Chronick Distempers, which we pass over in silence, as foreign to our Subject, and continue to prescribe the rest of this rare Work, to conceal nothing from the Curious, but give them entire satisfaction.

C H A P. CLXXIX.

The Method of drawing the Spirit of the Vitriol of Venus, which has a wonderful Blue, and how to separate the Caput Mortuum for tinging of Glass.

THE *Caput Mortuum* of *Vitriol of Venus*, which we prescribe to tinge Glass of a Sea-green, and whereof we discoursed in *Chap. 45.* has engaged us to give this most excellent and hidden Secret of Nature, which the Philosophers have never explained but by ambiguous Riddles, and veiled Parables to conceal the Knowledge thereof from the Vulgar.

We confess, 'tis not without some regret we condescend to it in this Ungrateful Age, wherein very few deserve to be instructed, or truly admire, and so perfectly love the Mysteries of Sage Philosophy, as to imitate the Vertue and Charity of its devoted Professors; 'tis however in consideration, and for the sake of this small number of Votaries that we have explained and delivered many excellent things in this Book, which we might (but out of regard to such) have laid aside (as foreign to *the Art of Glass*) but our desire to please them has promoted the opening these intricate Paths, and leaving them in a condition to be enlarged by our small Discovery under the serious Speculations, and smart issues of their own Wit.

Now to finish our precious Essay, you must take a Pound of this *Vitriol* into a Glass Retort strongly luted, as directed in *Chap. 52.* the lute being dry, set the Retort in a Sand-Furnace, sitting to it a very large Receiver, as directed for *Aqua fortis* in that Chapter;

ter; this done, kindle the Fire, and continue it gentle for four Hours to prevent a too excessive heat, which would drive out the Spirits impetuously, and so burst the Receiver, whereof great care must be taken not to spoil all: As soon as the Spirits ascend like white Clouds, improve your Fire by degrees, until they disperse and your Receiver clears again and cools, and all the Spirit comes together: Then let the Fire go out of it self, and after twenty four Hours, unite the Joynts, take away your Receiver, and put the Liquor it contains into Glafs-Bottles stopt very close with Glafs Stopples to prevent Air, which if they could draw, would disperse it all by Exhalation. This choice Liquor has that Noble Blue which affords us wonderful Tinctures, and other inestimable Operations, as well as such surprizing Effects in Physick, as cannot be equalled.

The strength of this rich Liquor may be known by its very penetrating acid smell, and if we were not afraid to prophane so sublime a Mystery which Persons much more Sage and Considerate than we, have kept so secret: We would enlarge more on its excellent Qualities, and disperse those Obscurities, but we should look upon our selves unworthy of the Light we have been able to acquire in this most important Matter, if we abandoned those Treasures to the ravage of the whole Earth, which ought only to be posselt by the Sacred, Wise, and Studious Members of the *Hermetick* Science and Philosophy.

But to return to our *Caput Mortuum* of this precious *Vitriol*, which has occasioned us to give its Preparation, and is what we make use of for this fine Water-colour, or *Egmarine* on Glafs, you'll find it in the Retort, out of which the white Spirit was distilled, whereof we have discoursed already; to get it you must break the Retort, then reduce it to Powder, with a mixture of *Zaffer*, as directed in *Chap. 45.*
and

and fo tinge your Cryftal of an admirable Sea-green-colour.

We were mistaken in *Chap. 45.* in faying that the *Caput Mortuum* must be expofed to the Air before you do pound it with the *Zaffer*, for that is not altogether incumbent in tinging of Glafs, tho this expofing of it cannot but add fomething to the luftre, for it draws thereby with a certain Magnetick Property, the occult Spirit of the Air, and fo from a Black, of which it was before, becomes of a pale Blue-colour, and partly affumes what it loft by Diffillation and Extraction of the Spirits, fo you may fave a great deal of time and pains by this Preparation, to your no fmall Advantage, in expediting the Matter.

Such as fhall comprehend the Vertues of thofe things we have fhewn in the four laft Capters, ought to be fecret, for many will read thefe things, and not apprehend, or only Laugh at them, whether it be that the Divine Power, for Reafons beft known to himfelf, will not let them difcern, or that they confide in a falfe Prefumption on their own Knowledge, as beyond all other Mens. God has nevertheless not confined to one only Wit, the whole Knowledge, or all the fublime Excellencies of Nature, but on the contrary, to declare his great and unbounded Charity, permits it to be communicated to many for his greater Manifeftation and Glory; yet he referves thofe more important Secrets to be revealed to his Faithful Servants, that fuch as would be acquainted with the fame Myfteries, may apply to this Father of Light, who alone can infpire them with fufficiency enough for penetrating into thefe which they could never do without his Affiftance.

Now the true Method thereof is obvious to all the World, a Holy and Regular Life opens the Passage, and continual Study and Application guides us through;

through; but we must add to these an upright Intention of making good use hereof, that we may not wander; a Love for our Neighbour conformable to the Will of God, to bring us to a safe Port, an extended Charity to the Poor, to lay open for us the Gate of Heaven; and in a Word, an unlimited and immense Love for this *Omnipotent Creator, Eternal, and Incomprehensible*, to Hand us to his very Throne: This is the prevailing Attractive, which all the Judicious Philosophers made use of to draw down this Divine Intelligence, and which I most heartily wish to all that would imitate them.

The End of the Sixth Book.

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G L A S S .

B O O K VII.

Containing the Way to Enamel in all Sorts of Colours on Gold and other Metals: The Order of the Fire and Furnace: The Preparation of Colours for Pourtraying with Enamel, and how to do it.

C H A P. CLXXX.

THO this Undertaking depends not altogether on our *Art of Glass*, being no more than an Application of Matters delivered in the *Sixth Book*; however we resolve to lay down this Manner of Enameling and Pourtraying on Metals, to bring this our Work to an higher perfection.

The

The Ancient Works of Enamel on Metals, were only of Black and White, with some few Tinges of Carnation, or Flesh-colour, as may be seen in the *Linoge* Enamel; in *Francis* the First's Time it became more improv'd, and they made use of *Lights* and *Shadows*, but the Enamel on Gold was of no better Stuff than that on Copper, and all the Works of it on Gold, Silver, and Copper, were of Transparent Matter; such as wrought it on thick, couched each Colour by it self, as is done now a Days in Enameling some particular Pieces of *Relief*, and not otherwise.

Since then they have found out the way of Enameling with opaque, and thick stuff, and the Art of compounding the Colours, is much more improving and handsomer than that of the Ancients, as is visible in all our Modern Works; but we must without all Exception, own the fair Works upon Gold, representing Pourtraitures, and entire Histories, so neatly, and to the Life, and coveted as much as Picture done in Oyl, over which it has the advantage of Natural Lustre and Varnish, which is never tarnished, to be the Invention of this latter Age, and the Improvements we owe to the Study of the *French* therein.

All sorts of Enamel are not to be promiscuously employed on all sorts of Metal; Gold which perfectly bears with as well all the Opaque as Transparent, cannot agree with clear Purple, its Yellow mightily changing the Colour thereof, and produces but a very ill Fancy; on the other side, this Purple is very fine on Silver; so the Egmarine, the Azure, and Green, all other Colours, as well clear as Opaque, disagreeing therewith, and Copper suits with every thick Enamel, but cannot endure the Limpid, unless prepared for it beforehand, as shall be directed in due place.

Observe that good Enamel must be hard and lasting, such as is soft being full of Lead, and subject to change Colour, easily becoming sullied and soiled; of the clear Enamel some is harder, some softer, the hardest is always best, however even of these there is choice; some lose colour in the Fire, some are more or less lively and sparkling, but if you employ constantly such as we have prescribed in the *Sixth Book*, you'll never be exposed to those Inconveniencies; for the Ingredients being perfectly cleared, will endure all degrees of Fire, any change of Colour or Quality not ensuing.

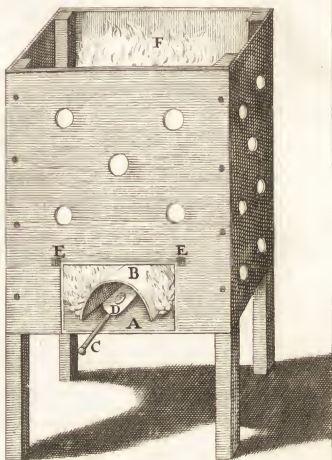
C H A P. CLXXXI.

Of the Furnace for Enameling and Pourtraying.

THE Enameling of Metals, as well as the colouring of the Stuff, cannot be effected without Fire, and is wholly different in this point from Painting with the usual Colours in Oyl, which may be dried in the Air only, without other help.

It would be very hard to believe the Fire would not spoil the mixture of the Colours, if our daily experience which we made, did not vouch the contrary; however care must be taken not to let the Work be in the Fire too much time, but draw it out as soon as you find it is polished.

The Fire must be Reverberatory, or rather without any Suppression, and never to be under the Stuff; 'tis the same as is used for cleansing of Metals, whether in the Mints or Goldsmiths Shops, which is very familiar to all the World.



- A The mouth of the Furnace*
B The Cover
C An iron Peel
D The Enamel to be melted
E The Grates
F The inner part of the Furnace

You must have a Furnace round or square, either of Iron or Earth, it's no great matter, how (or whether of these) it is, which must be hollow in the middle, to contain the Work with a good Charcoal-Fire all about, and over it, to make it melt the better; and you must have it so as to be able to take your Stuff out, and put it in again, as occasion requires: You may, for better conveniency, make use of a Goldsmith's Muffle; 'tis a small Arch made of Crucible Earth, in the shape of half a Crucible, cut length-wise, and they place it on the Area or Floor of the Furnace, the Opening of it lying just against the Mouth of the Furnace, to put in and draw out the Work easily; and for more conveniency they place a small Grate over it, which must not touch it, for fear of breaking it; and on this Grate make a good Fire, and so round about the Muffle, to heat the hollow very well, under which they put the Work to be Enamel'd and Painted; and the Essays, or Trials they have a mind to make on a little Iron-Shovel, to draw the easier out; but for making Essays of Ingredients for Enamel, it must be a little Blade of White Enamel, which ought to be provided purposely for that use.

C H A P. CLXXXII.

The Way to Enamel Gold.

WE have already said, that Gold, Silver, and Red Copper may be Enamel'd; now to make true Work, you must use only pure Gold; because Silver makes White Enamel appear Yellow, and Copper rises in Scales, and makes Vapours; for tho' all Enamel sticks to it, yet it is but very imperfectly,

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and

and may be easily divided and peeled off again; besides, the Colours are so wretched on it, and lose much of their Charm and Lustre by the Impurity of that Metal.

Therefore if you would have good Work, let Gold only be your Subject, and of the purest, if you employ clear Enamel, because on impure Gold they grow dull, and become imperfect, that is to say there appears with this a certain obscure and Cloudy Vapour in the Enamel, which deadens and takes away the Life of its Colour.

The Gold Plate ought to be rising, and when it is forged very even, the Goldsmiths apply white Enamel over and under it, tho it is to be wrought but on one side; but this is necessary for two Reasons: First Because the Work is neater and fairer for it: And again, Because if it were only Enamel'd on one side the Fire would swell it, and so make it rise, and that in Bubbles; because it is always as it were tormented, especially when the Pieces are great, and the Enamel carelessly laid on; this makes it produce Blisters, which disfigure the Work; the *French Chymists* call such *Vegeter*, but their Goldsmiths *Petite Oeuillets*: This disfiguring of the Work, you may avoid, by laying Enamel on both sides of the Plate of Gold, and thicker over than under, this will keep it equal and even on both sides, the first lay of White Enamel remaining smooth in this condition, serves for a Field to place all your other Colours on as we will further discourse of in the Art of Portraying.

Oyl of *Spike* is used for dissolving thick and opaque Enamel before it can be applied; for the Transparent you need use nothing but fair Water, as we shall shew in *Chap. 185.* and then 'tis couched flat and bordered with the Metal, and sometimes we don't border at all, the Field being all Enamel, but this is

troublesome, because the Limpid Enamels as they melt, often mix, and so confound the Colours, which constantly happens when the Pieces are small.

Red Enamels are not so, unless by chance, and come generally Yellowish out of the Fire; as soon as 'tis applied to the Gold, it alters the Colour; one may soon bring it to a perfect Red Enamel, by turning it at the Mouth of your Furnace, when you are taking it out from the Fire; and then it is that the Workmen say they make it Red, and give it its compleat Colour.

Gold, as we have already said, admits of all sorts of Enamel, clear or opaque, bright Purple excepted, which is altered by the Yellow-colour of the Gold, and does not take so good effect there, as on Silver, on which it ought still to be used. The Way of working every sort of Enamel, is alike; not to make any useles Repetitions, we will satisfy our selves only to advise you to employ all those Enamels prescribed in the *Sixth Book*, which have every illustrating and convenient Property to be wished for in this Work.

- G H A P. CLXXXIII.

To Enamel on Silver,

WE have already taken notice in our former Chapter, that Silver agrees not with all sorts of Enamel, as Gold. We repeat it here again to prevent the use of any but such as serve to produce perfect and agreeable Effects.

You are to make least use of White Enamel on Silver, because there it becomes Yellowish, and un-

pleasing, but nothing can suit better with it, than bright Purple, Green, Blue, and Egmarine, because the Whiteness of the Silver is then clearly eminent, and gives its just splendour.

The Work and manner of Enameling on Silver, is no way different from that of Gold, in forging the Plates evenly to prepare 'em for the Enamel, you may make use of White on the under side, since the Enamel there serves only to qualifie the Risings and Disturbings of the Metal in the Furnace, which would cause unevenness, or disagreements in the surface, and prevent its becoming just and handsome.

We need not repeat again that way of placing the Enamel on your Plates of Gold or Silver, and so to put them into your little reverberatory Furnace spoken of in *Chap. 181.* to melt, and as soon as polished to be taken from the Fire.

C H A P. CLXXXIV.

To Enamel on Copper.

THO we have before touched upon the way of Enameling on Copper, yet lest the Reader should too slightly apprehend it, as not in order, or a distinct Chapter, therefore we are obliged to enter it here to avoid Imperfection.

The less use is made of this Metal in this Work the better, for the Enamel never sticks to it perfectly, but is easily scaled, divided, and broke off, which never happens to Gold; besides, the Copper is so impure, that its Fumes destroy the Beauty of the Enamel so much in the Furnace, that they quite lose their Charm and Splendour by the Malignity of those Vapours.

Tho

Tho the Copper receives easily all thick or dark Enamels, it can't be brought so well to endure the clear and limpid; now if you would make use of these last, you must first lay a lay of Green, or Black, and thereon a Leaf of Silver to receive the Enamel suitable for that Metal mentioned in the former Chapter; so that in the main 'tis much better to make use of Silver for the Transparent Enamels, since the Copper is so apt to foul, and the charge in either much the same.

In Enameling on Copper, you must take a Plate of red Copper forged smooth, and even applying your Enamel of what Colour you desire above and under the Plate as before; then put this into the reverberatory Furnace, and when it receives its polishing, draw it out.

C H A P. CLXXXV,

To prepare the Enamel for the Metals,

BEFORE you apply your Enamel on the Metal, you must give it this little Preparation, which is the easiest, and best approv'd on by the Goldsmith; we will instance it in White Enamel, because that is more generally made use of than any other.

Take White Enamel of the *Sixth Book, Chap. 149.* pulverize it very fine, pour on it a little *Aqua fortis*, and let it afterwards purifie and refine in a small Glass Cucurbit.

Wash it afterwards often in Fair-Water, dry and keep it in a close Vessel for use.

To make use of it, first pound a quantity thereof in a Stone Mortar, wetting it with a little Water, and so spread it on the Plates, and into the Furnace with it as before.

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Thus

Thus do with all your clear and transparent Enamels, and you'll have all your things in a readiness to go on with your Work as you think convenient.

C H A P. CLXXXVI.

To prepare the Colours for Painting on Enamel.

NOTHING can be more splendid than the Paint on Enamel, and for this use must be chosen the liveliest and most Noble Colours, and such as will easily vitrifie and melt.

All these assigned throughout the *Sixth Book*, are as equally sufficient for this, as for Enameling; if you grind them first on your Marble with the best Oyl of *Spike*, or mix 'em together with the other Ingredients for that purpose, as we shall give a fuller account in the next Chapter, and of all the Matters to be used with calcined Enamels, which serve to make up the Paint for Enamel mixing them well together as Painters do on their Pallets: When you want some Colours of Enamel, you may with Blue and Yellow make a good fair Green; a Blue and Red mixt, will produce a fine Violet; a Red and White creates a Rose-colour; a Black and White forms a gallant Gray, and so of others.

Every Workman has his own Secret, and peculiar way of Working, but most of them make use of *Foraille* for varnishing their Colours, which has an ill effect, because of too much Lead, which is not perfectly purged off; this lessens the Life and Splendour, and it always continues as it were tarnished, cloudy, and dull.

But our Enamel being well refined, will produce Work so fine and agreeable, that 'tis not possible to

find any thing so illustrious and accomplisht; and such as for their one private diversion, would work herein, and have not the conveniency of a Glass-house, may easily be furnished, by proceeding to make one according to the directions already given.

Notwithstanding the sufficiency of our Enamel for affording all sorts of Colours and Tinges in painting on Enamel, we will yet prescribe other means for this, no way inferiour thereto, to answer the Advantage and Curiosity of those who Work at this Excellent Art.

C H A P. CLXXXVII.

To make White for Painting on Enamel.

THE best Workmen, for the most part, use the White Enamel ground, which they can manage with address enough to heighten and illustrate their *Lights*, which is necessary to be done to all their Colours, as in Miniature: But as it is difficult to preserve the Ground justly for improving those other Colours, and ordering the Compositions (all one as in Carnation) you must take of our Crystal ground prepared with Tin and Lead purged and refined as in *Chap. 158.* or rather of our Milk-colour Enamel in *Chap. 159.* which is the fairest can be made; cleanse it with *Aqua fortis*, wash, dry, and grind it afterwards with Oyl of *Spike*.

Or you may prepare another White Ground without Lead, thus: Take very pure Tin calcined, as in the Chapter aforesaid, and let it vitrifie in a Glass-house Pot, with eight times as much Crystal Frit, as we have directed the Preparation in *Chap. 6.* pulverize these

these very fine, and proceed precisely according to Prescription for Purification, &c. in *Chap.* 158.

C H A P. CLXXXVIII.

To make a Black for painting on Enamel.

THO the Black Enamels prescribed in *Chap.* 156. and those succeeding it may serve to Paint on Enamel with this Colour, without any other Preparation than grinding it with Oyl of *Spike*; yet we will add here another Black no less excellent and fine, arising from equal parts of Black-Enamel, and *Peregrine* well calcined, mix and reduce them to an impalpable Powder, and then apply Oyl of *Spike*, and you'll have a Colour which will take with great facility on the Enamel.

C H A P. CLXXXIX.

A Yellow for Paint on Enamel.

WE will only make use of our Enamel, prepared in *Chap.* 162. mixt and purified with *Aqua fortis*, and after washed in clean Water, as in *Chap.* 185. dry and grind this Powder with Oyl of *Spike* on your Marble, and 'tis fit for use. With this Yellow and a Blue, as we have already hinted, may be made a fair Green; but those Enamels described in *Chap.* 153. and the succeeding, are so just and fine, that 'tis needless to use any other for that purpose; this Preparation for the Yellow here laid down is sufficient also for it, without any further trouble.

C H A P.

C H A P. CXC.

A Blue to paint on Enamel.

THE *Enamels* of this Colour assigned in *Chap.* 151. and 152. are the Noblest can be used in this Work, purifie them with *Aqua fortis*, and grind them with Oyl of *Spike*, as before directed for the other Colours.

You may because it is vitrified, make another fine enough Blue thus. Take Painters *Enamel* prepared, add to this (put into a Glafs-Bottle) best rectified *Aqua-Vite*, enough to drown the Stuff by four Inches, stop it well, and set it in the Sun-shine for five or six Days, shaking the Bottle well three or four times a Day, that the purer *Enamel* may dissolve, and the grosser fall to the bottom; take the *Enamel* out of your Bottle, and steep the *Faces*, letting them precipitate as useless; then evaporate your *Aqua-Vite*, and dry your *Azure*, which will be a very fine well cleansed Matter for all sorts of this Work; grind it after on your Marble. This *Enamel* so prepared, is most proper for Painting, and far beyond the *Ultra Marine*, so much made use of.

We shall in the *Tenth Book* prescribe some other excellent Methods to make Blues very fine, with a Receipt for *Ultra Marine*, and several other Colours in favour of those who affect that Noble Art of Limning.

C H A P. CXCI.

A Red Paint for Enamel.

THERE can nothing exceed the Perfection of our *Enamels* of this Colour, taught in eight several Chapters of the *Sixth Book*; the like may be said of our *Blood-colour*, *Rubies*, *Rose* and *Carbuncle*, which is the most exalted Ingredient for *Enameling* Metal, or making Paint on *Enamel*; and those who practise this fine Art, use no other than that of the *Glass-house*, or such as they make accordingly. Now this *Red Enamel* is prepared as the other Colours with *Aqua-fortis* to purifie it, wash'd, dry'd, and ground with Oyl of *Spike* for your use.

There is yet another tolerable Red, which they Paint with on *Enamel*, in which is employed calcined Gold; but this would be much more improved, if instead of their *Rocaille* they made use of our Matter made of *Cryſtal* and *Saturnus Glorificatus* in *Chap. 113.* or of our principal prepared Powder prescribed all along the *Sixth Book*, for these are exceeding well purified, whereas the *Rocaille* has too great a Surcharge of Lead, the Impurity whereof always renders the Work defective.

See here their way of calcining Gold, which is not near so fine as that we have given *Chap. 115.* and as there are an hundred several ways, so every Man makes use of his own as most excellent, and thinks it better than another's.

One takes an Ounce of fine Gold in very thin Plates, these dissolved in eight Ounces of *Aqua-fortis*, and regulated with *Sal-Armoniack*, or old strong Salt, in a small *Glass Matraſs*, this is put into a *Glass-Cucurbit*,

curbit, wherein was already pour'd eight *Paris* Pints of Spring-Water, and six Ounces of *Mercury*, the Cucurbit is placed on a still Fire, and after four and twenty Hours the Gold descends to the bottom in a light Land-red Powder, then the Water is poured off leisurely into an earthen glazed Receiver, or Pan; and the Powder gathered and dryed by a moderate heat, and with a *Shamois* Skin they separate the *Mercury* from the Gold, and grind this Powder with twice its weight of Flowers of *Sulphur* together, and then put all into a Crucible over a small Fire, where the Sulphur will communicate it self with the rest, and then evaporating they find the Powder somewhat ruddy, which ground with *Rocaille*, is what they make use of on the *Enamel*.

We own this Calcination to be tolerable as to the Gold, but as for mixing the *Calx* with the *Rocaille*, without melting them together to incorporate is disputable: We believe that in grinding them together with Oyl of *Spike*, they may in some sort incorporate as other Colours, but can never so perfectly unite; besides, the Crystal Matter does not so well receive the Colour of the Gold this way, as if it were done by fusion.

Others make Red inclining to Vermilion, which they use in Painting after this manner. Take Vitriol calcined in two Crucibles well luted together, and set for an Hour over a slow Fire; then purge it with *Aqua-fortis*, wash it in fair Water, and grind it with Oyl of *Spike* as before, and so make use of it for *Enamel*.

All *Red Enamel* which is good, ought to be hard, and not easily consumed in the Fire; for that which is otherwise, contains much Lead, and soon becomes dull and sullied, and is not of so lasting a substance, which the Workmen ought to be cautious of.

To finish the Preparation of *Enamel*, and before the manner of painting 'em is prescribed, take notice, that all the Colours before mentioned, which are not pure *Enamel*, ought to be incorporated with a Crystalline Matter, such as we prescribed in *Chap.* 148. to the end they may vitrifie the better, which else they'll not easily do, tho' most Workmen make use of their *Rocaille*, whether to avoid the trouble of making (or that they are ignorant how to prepare) a better Matter; and this has obliged us to give several ways very good and true for their purpose to make fine and perfect Work by.

C H A P. CXCI.

The Way to Paint on Enamel.

THIS Art is revered by all Nations, 'tis so fine and so excellent, that the first and Noblest Persons of the World practise in it, as we have said elsewhere: It is certain that the Art of painting on Enamel is modern, but no less estimable for that, since its effects are so wonderfully beautiful, so infinitely lasting, of so Natural a Gloss, and their Splendour never to be defaced.

If it were possible to make large Works of Enamel, as is done in Picture, they would be inestimable because of their Lustre, and so far surpass what Antiquity has had such great respect for, and which these latter Ages still caress with extraordinary esteem.

This way of painting on Enamel, seems much more difficult than Limning; Practice however convinces us, that they are equally easie, and we can with as little trouble represent any History on Enamel, as in Limning; the difference lies only in preparing the Colours.

Colours, which is not done the same way; for we dry and varnish our Enamel-paint by Fire, whereas that in Limning is done by the Air.

To paint on Enamel, you must have a Plate of Gold enamel'd with White, on which delineate and pourtray your Design. This done, draw it over again in dark Red: The Piece being perfectly done off, and the Lines compleat to the Subject, set the Tablet, or Piece in the Muffle, on a reverberatory Fire, to settle as before directed.

Your Tablet being taken out, apply the Colours in a just order as in Limning, with this difference only, that here you make your White Ground serve for filling, where that Colour is required to set off the heightnings and lustre of the *Lights* as is done in Miniature; and because it mightily contributes to the heightening thereof in the other Colours as to improving their *Lights*, we have given a most excellent Receipt in *Chap. 187.* which very excellently serves upon this occasion.

When the Piece is thus finished, put it again into the Furnace to fix the Colours, and as soon as you perceive it varnish or polish, draw it out lest the Colours mix and spoil each other.

You may take out the Work again, and revise it as often as you please, only putting it still into the Furnace until it receives its just Gloss, &c.

This way of renewing and revising the Tables, is done in Limning with Oyl; and the Painters observe that the Pieces must not be handled until they are well dry'd in the Air, so those in Enamel must be let alone until they receive their perfection from the Fire.

This is all to be observed in Painting on Enamel; it remains only for us to shew how to prepare your dark Red for tracing the Design; you may have it thus,

Take

Take the *Caput Mortuum* which remains in the Retort, after the *Aqua-fortis* is made of your *Vitriol* and *Nitre*, grind it with Oyl of *Spike*, and so you have the dark Red ready for your use; or you may make it with *Crocus Martis*, ground with Oyl of *Spike*.

The End of the Seventh Book.

O F

O F T H E
A R T
O F
G L A S S .

B O O K V I I I .

*Containing the Way to make China, or fine Earthen Ware;
how to Enamel, Paint, and Gild them.*

C H A P. C X C I I I .

POrcelaine, Fayence, China, or fine Earthen-
Ware, is enamel'd with our White Stuff,
which we have already prescribed for Metals;
and its Painting the same, and of such Colours as we
have propos'd for *Enamels* in the foregoing Book,
and this obliges us to discourse thereof in this our
eighth Book.

The Custom of enameling on Ware, is of greater Antiquity than that on Metals, for in the time of *Porcenna*, who generously undertook the Restauration of *Tarquin* to the *Roman* Government in the Consulate of *Valer. Publicola* and *Horat. Pulvilius Ann. Mund. 3444*, five hundred and four Years before the coming of *Jesus Christ*, or thereabouts, the practice of enameling on Ware was used in the *Estates* of that Prince; and what gives us very good reason to believe this is the Name *Porcelaine*, which has an Affinity to *Porcenna*, tho altered by the corruption of Time, so it is also called *fayence* from *Fayence* in the Dutchy of *Urbain*, where in the Time of *Michael Ange*, and *Raphael Urbain*, this Art was practised.

And as the Secrets of Nature are daily more and more discovered, so has time employed the Invention of Man to improve this, and make it more excellent, not only condescending to enameling, but proceeding also to Painting and pourtraying thereon several Curiosities, to which at length is added the Ornaments of Gilding.

These Pieces of Ware are of a very general use over all the World, as for Ornaments over Chimney-pieces, on Cabinets and Tables, or Boards. The choicest come to us from *China*, and next to those are done at *St. Cloud* and *Rouen*; but there are very good made in *Holland*, at *Savonne* in *Italy*, and several other places in *France*.

The painting and enameling on these, is what we are properly obliged to take notice of in our Art; however we shall slightly touch upon the Composition and Molding the Ware, and for this we will prescribe fine and delicate Methods sufficient enough to answer the Satisfaction of such as employ themselves in this Art, and of those Persons whose Curiosity leads them to enquire after things, whereof they are not already informed.

C H A P. CXCIV.

The Furnace for making of China,

MUST be large, with an *Opening* proportioned to the Vessel you are to place therein; of these there are several sorts, but the most commodious must be made as follows.

You may shape this Furnace round or square, but the square is best, because of the *Opening*; it must be made of good Brick and such Stuff as can mostly endure the Fire, of what bigness you please, with three Divisions; the lowest for the Ashes must be a Foot high, that the Air may be communicated through its *Opening* to the Fire; the middle Story is for the Fire, and must be underlaid with a very good Grate to separate it from the under Story, with an *Opening* for the Fuel, and be vaulted above about a Foot in height: According to the Size of your Furnace this Vault must be made like that of an Oven, and have an Hole in the middle of the same shape as the Furnace, round or square, and proportioned to its bigness, through which the Flame may transmit it self to the uppermost Story, where the Vessels are put to bake in; this last Story is to be at least two Foot high, and its *Opening* fourteen or fifteen Inches, to put and draw the Vessels easily in and out; the top must be vaulted too with such a round or square hole, and over that a Funnel, for the conveniency of the Flame and Smoak which it draws out.

All the *Opening*, especially the two uppermost, must be of strong Brick, or Crucible Earth, or rather of Iron, well luted within side, which must shut and open calily, and be very exact and fit, that the

Fire may not suck in any cold Air, which might break the Vessels.

This Furnace will serve also for many other uses, as to Melt, Reverberate, Calcine, Cement, and several sorts of Works in the Laboratory of *Chimistry*; because in all the degrees of Fire may be found by the help of the lower Opening, and the Funnel of the Chimney.

You may else for Baking your *China*, make use of the Furnace hereafter described in *Chap. 202.* where we discourse of Painting on Glafs, putting thereinto your Vessel of Crucible-Earth for Baking the Ware in, and then cover'd over with a vaulted Coverlid, with a hole at top to let out the Flame and Smoak of the *Reverberatory Fire*; for this reason there will be no occasion in this sort of Furnace for any other Opening, because the Baking Vessels with your Ware, are put in a top before the Coverlid is laid on, and so the Fire circulates about it, and it becomes very Red, whereby the *China-Ware* is Baked, as is done in Baking of Pipes.

C H A P. CXCIV.

To make your Stuff for China-Ware.

THE Composition for this must be very fine, because of the Ware, and not such as is used for ordinary Vessels, we will therefore prescribe the Manner of making it, to prevent the unsuccessful Attempts of such as may be ignorant.

For this you must take of Shells of every sort which are White and Transparent, grind them well on a Marble, then searce and reduce them to an impalpable Powder.

To

To make your Paste of this Powder, first dissolve an Ounce of very white *Gum-Arabick* in a Pail of Water; when 'tis well dissolved and mixt with the Water, dissolve therein about a quarter as much *Quick-lime* as your Powder weighs, then stir and mix it very well, and afterwards put in the Powder and stir all together, and knead it as they do Mortar; of this Stuff form your Vessels according to the different sorts you desire, let them half dry, or more, in the Air, before you polish them with your smooth Instrument of Copper, or Iron for that purpose, and so leave 'em until they dry thoroughly: Being very well smoothed and dried, glaze them over with your White *Enamel*, prepared as we'll direct in the next Chapter, and so set them in the Furnace to Bake and finish, where having kept them a convenient time, let the Fire go out of its self: When the Furnace is cold, take 'em out and paint them and put them in again to Bake a second time, observing what directions we have already given concerning these Matters, and when the Fire is gone out, and the Furnace cold, you have the Ware in perfection ready to take out for use.

You may make your *China-Ware* also of pure Earth; let it not be red tho, but White or Gray; you may try the sufficiency of it after 'tis prepared, by Baking some beforehand, and when it comes out of the Furnace sound and uncracked, 'tis good and fit for your purpose.

The Preparation consists in drying it well, and reducing it to a very fine Powder; then put it into fair Water, wherein has been already dissolved a little *Gum-Arabick*; but most of those that make it, employ only Water without *Gum*; after this you may make your Dishes, set 'em to dry, Polish, Dry, Glaze, Bake, Paint, and finish them as before; all which;

those who work at them know better than I can express it.

C H A P. CXCVI.

How to Enamel the China.

FOR this take of our Milk-white *Enamel Chap. 149.* grind it very fine, as Painters do their Colours; put the Powder afterwards into a Glass-Cucurbit, pouring some *Aqua-fortis* thereon; let it digest a little to cleanse off its Impurities, and become fine and transparent; then pour off the *Aqua-fortis*, washing the Powder in Water over and over again, grind it afterwards with a little Gum-Water on your Marble, and so glaze the Vessels with it within and without, dry them in the Air, and Bake them as before in the Furnace.

Or you may heat the Vessels to a Redness in the Furnace, and melt the Enamel; when it is in a perfect Fusion, dip the smaller Vessels therein, and pour of it on the larger, for they will take no more on them than will serve them, set them by turns in the Furnace, stopping it very well to avoid the Air: Bake, cool your Furnace, and finish them as before, then take out the Dishes, Paint and Bake them over again, observing all our former Directions.

C H A P. CXC VII.

To paint the China.

THIS is done as the Enamel discoursed of in *Chap. 192.* but much more easily, the Figures being only just dash't over in comparison to them; however you must grind your Colours with Oyl of *Spike* on the Marble, as we have said already, and so paint on the Dishes Story, Landscape, or any other Fancy, but you must never expect to have them thereon so compleat and handsome, as those painted on the enamel'd Plates, because the former are finish't standing, and so enlarge in length or breadth, whereas the other are done on flats, and lying; besides the Dishes are for the most part round, and not so easily painted; for if they cou'd be as neatly done as the Enamel, they would be excessive dear.

C H A P. CXC VIII.

To Gild China.

YOU must first grind some *Shade-Earth* on a Marble, with *Linseed-Oyl*, prepared as shall be shewn in *Chap. 200.* with which trace out your Figures, which must be two whole Days a drying; after this apply very thin Leaf-Gold, and with a sharp Graver, shape the Figures, and then put the Dishes in an Oven, as soon as the Batch of Bread is drawn out, let the Heat be no greater than one's Hand may endure, else the Vessels would crack; leave them in

it for two or three Hours or more, if the Oven be not too hot; you may else make use of our own Furnace, by giving it the same moderate degree of heat, as experienced Persons are well acquainted with.

C H A P. CXCIX.

Another Way.

THIS is much more handsome and lively, besides that it cannot be effaced; you may with it gild Vessels entirely, or border, or give them any lustre you think convenient for Ornament, and it will look as well as fine Gold.

You must first wet over the Places you would gild with Gum-Water lightly, then apply your Leaves, and so let them dry, this is enough for plain Gilding; but if you would have it carved, or figured, you must make use of a Steel-Graver, and afterwards bath the Gold with Water, wherein *Borax* has been dissolved, powdering it in the mean time with Crystalline Powder, or Milk-white Enamel reduced to a very fine Powder; then set the Dish on a Reverberatory Fire to melt and be polisht; thus you'll have as fine a piece of Ware as can be.

C H A P. CC.

*The Way to prepare Linseed-Oyl for Gilding of
China.*

IT is but just we should discharge our Promise of prescribing this Preparation.

Take a *Paris* Pint of Linseed-Oyl in an Earthen Pot which will hold about two *Paris* Pints, put this on a Fire, and when it begins to boil throw in twice the bigness of a small Egg of *Gum-Arabick* pulverized, stir all well until it be dissolved, then put in an Onion of an ordinary size, and the like weight of Garlick cut small; when the Oyl boils well, and swells up by the force of the good Fire which must be underneath, pour it out into another such Pot, and so in and out of each Pot to the other until all be very well mixed; then put it on the Fire again, adding half an Egg-shell of Powder of *Mastick*, and stir it very well; as soon as it boils again, it will foam and have a great Froth which must be scummed off, and then take it off the Fire and brew the Ingredients together with the two Pots as before, continue to do thus with it, or stir it on the Fire until it rise no more.

This done, take a very dry Toast of White Bead to take off the Grease (the Oyl still boiling) and when you put in the Toast, you must at the same time put in some Pin-Dust; stir all well together and let it stand for twenty four Hours afterwards, strain the Oyl through a Lina-cloth, in which is some very fine Sand, the better to filtrate it, and take off the Grease, and so you'll have it pure and clear, which Bottle up for your Use.

Or

Or you may (both ways being good enough) first mix with the Oyl two Ounces of Gold *Litharge* pulverized, adding the *Gum-Arabick* as soon as it begins to boil, and to purifie it let it filter through a Linen-cloth full of Sand, while it's hot, into a Glafs-Bottle, wherein is already half an Ounce of fine Camphire Powder, shaking the Bottle very well until the Oyl be cold ; afterwards lay it in the Sun for fifteen Days, and it will be entirely purged, and the longer 'tis kept will be the better.

This is all we have to say at present about *China-Ware*, until we have further enlarged our Knowledge in the Matter, which we have not much study'd, because we did not intend to treat of it ; however we afterwards thought it incumbent on us so to discourse thereof as an Art dependant on ours ; and we hope the Reader will take this in good part, until we may give him something more at large.

O F T H E
A R T
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G L A S S S.

B O O K IX.

Shewing the Method of Drawing all sorts of Story, or Figure, on Glass, in Paint, Gilding, Marbling, &c.

C H A P. CCI.

THE Art of Painting has been still so Noble and Excellent, that all those great Persons, who have practised it, were always distinguished among the most eminent of their Age; those celebrated Pieces we have of it in our Days, to the Ornament and Admiration of all *Europe*, has settled so great a Veneration for their Memory, as will eternize it to Posterity.

The

The *Dorians*, *Corinthians*, *Ionians*, and *Romans*, were the People that paid the most esteem to this Noble Art, for which they conceived so great Opinion and Delight, that they lookt upon the famous Painters of their Time as Demi-Gods, and ranged them among the first and most Learned Men in the World.

The Ancients did not only pay a Deference and Honour to the Nobility and Illustrious Birth of Great Men, but to their Worth and Vertue too: Hence the *Athenians* erected a Statue in Memory of *Aesop*, who was but a poor Slave: Would they have done it if this eminently Ingenious Fellow had not possessed so many excellent Parts? No, 'twas not for the sake of his Picture which was too deformed and ugly to please or Charm 'em, but to convince Posterity how the way to Glory is not shut up from the meanest Persons.

Can there be any thing more taking, or compleat, than the Natural Imitations which issue from Painting? Has Nature any thing more considerably admirable? Do we not see her display'd in the Pourtraits of those Excellent Masters, who with so much Art and Delicacy have express'd all whatever she has produced in this sublunary inferiour Orb, so that 'tis not possible to see them without admiring, or to admire them without Astonishment.

What wonderful Fancies too have they drawn from the Superiour and Heavenly! They have so lively shewn the Rising and Setting Sun, Night and Day, the Face of Heaven sometimes Calm and Serene, and again darkned with Clouds, the Thunder Showers, Storms and Seas raging, with all their Wrecks, and in the Microcosm, or little World of Man, they have express'd his Joy, Sadness, Smiles, Tears, Pleasure, Dissatisfaction, Life and Death; in short, all the Alterations which Creatures are liable to, whereof the enumeration would be very tedious.

This

This fine Art, as well as that of Glass, does not lessen the quality of its Practitioners, the contrary whereof happens in all other Arts; for Princes, and many of our Monarchs, have granted the Privilege of Nobility to several Masters thereof, to intimate to Posterity the extraordinary Esteem they had for them, upon the Excellency of those Incomparable Pieces which their Pencils had produced.

Though painting on Glass be very ancient, 'tis yet much more modern than that of Painting on Wood, or Cloath, as being of no longer standing than this Art of Glass-work: The first who painted on Glass, did it only in *Distemper*; that is, in Colours mixt with Glue, but this not abiding the Injury of Time, they invented the way of doing it with *Fire-Proof* Colours, which are incorporated with the Glass, by Baking and Melting them together; and as soon as this Secret was discovered, every Body took delight to practice the Draught of Figures, and entire Histories thereon for Ornaments, whereof we have still some remaining Pieces on old Church Glass; but those Figures before the Year 1500, had not half the sufficiency of *Base*, or *Relief*, as is required in Painting.

Those who would fain Work in handsome and lively Colours, made use of Glass-Frit, tinged in the Glass-house, as well for *Carnation* as *Drapery*, whereon they drew the first Lines of the Visage, and other Parts of the Body in Black, and so Shadowed 'em with Strokes and Dashes.

But Painting having since received an Improvement in *France*, those Works became more perfect, and in so short a time with such advantage of making fair and most exquisite Pieces, as are even at this Day the Admiration of the Learned, of which, all the Honour must be ascribed to the *French*, who were
the

the first Discoverers of this great Perfection in the Art.

We might easily assign several ways of this Painting among the Ancients, but since they are out of Practice, and the latter Methods much more excellent, we shall satisfy our selves in prescribing only such as may suffice, and gratify the Curiosity of those who love this Art.

And not only the Method of Painting, but also how to prepare the Colours, to bake and finish 'em in the Furnace; of this we'll give a short Description in the next Chapter; that Secret of ordering the Fire, which is the Life and principal Agent of all the Works, with that of Gilding, Marbling, &c. as will be shewn in the Sequel of this Book.

The most part of Ingredients useful for this Service of Painting, will also tinge the Glass well enough, and we will make use of those mentioned elsewhere, to avoid useles Repetitions on the Subject.

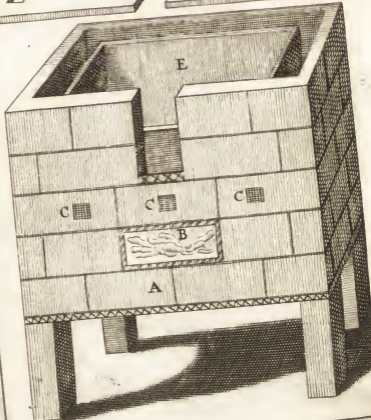
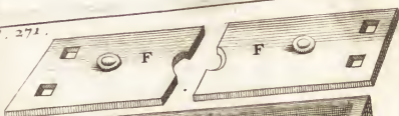
C H A P. CCII.

A Furnace for Painting the Glass, and Setting the Colours.

WE have mentioned this Furnace in *Chap. 194.* but did not take notice of its Form, or Appurtenances, because the Business which obliges us to speak of it there, is very different from this.

This Furnace must be Square, of good Brick, two Foot high, and so much every way, and have three Divisions; the undermost for the Ashes, must be six Inches high, the middle one for the Fire must be six Inches high, and have its Opening five or six Inches broad, and four deep, with a good Iron-Grate,





Grate, and three square Bars of Iron across to support the Earthen-Stove hereafter described: The uppermost Division must be a Foot high, with a little Opening about the middle before of four Inches high, and two wide, to put in and draw out the Ware a Baking, to see if it be well done.

In this uppermost Division must be put the aforesaid Stove of good Fire-proof Crucible Earth, the Bottom an Inch and half thick, and from thence up to the Brim ten Inches full; it must be square as the Furnace, and have two Inches room from on all sides, that the Fire may flame round about it to Bake the Work, and therefore placed exactly in the middle of the Furnace; there must be also in the Fire-part of this Stove, an Opening just against, and of the same Size and Form as that of the Furnace, for the conveniency of putting the Ware in and out.

Take this Method of distinguishing the Furnace in all its parts, and to lay down a clearer description thereof, observe,

The Letter A is the Ash-hole for the Ashes that fall from above through the Iron-Grate; and note, That the wider the Opening is, the more violent will the Fire be.

The Letter B is the Fire-place.

The Letters C are three Square Iron-Bars to support the Pan for the Ware.

The Letter D is the Opening of the Furnace and Pan, through which the Ware must be conveyed in and out.

The Letter E is the Earthen Pan, wherein all the Painted-Ware must be Baked.

The Letters F are two half Lids of Potters Earth for covering the whole Furnace above: As soon as the Stove is full of Ware, they must be well closed and luted together, to prevent the Air coming in any where but by the four square holes at both ends of the Lid,

Lid, and the two Semicircles in the middle, which make a round Hole for a Chimney; when the two half Lids are closed, those five Holes are for letting out the Smoak and Flame of the Furnace.

C H A P. CCIII.

To make White-Ground for Painting on Glafs.

NOW to pursue our Work, we will begin with the Preparation of all the Colours to be used in Painting Glafs; for before we proceed to prescribe the Rules, how to work the Materials must first be considered.

The White is compounded of several Ingredients: The first are small White River Peble-Stones heated red over a Fire, in an Iron-Ladle, and thrown afterwards into an Earthen-Dish full of cold Water to calcine them, and this must be repeated several times, until they be prepared; afterwards being dried, pound them with a Stone, or Glafs-Pestle in a Stone-Morter, and so grind them upon a Marble to an impalpable Powder; then mix a fourth part of *Nitre* with it, and calcine them in a Crucible; then pound and grind them again, and calcine them a third time over a smaller Fire than your former, and so take them off for Use.

This done, when you would Paint with it, add equal parts in weight of *Gip*, a sort of *Talc* found among *Plaster-mold* baked on the Coals to a Whiteness, and reducible to Powder, and *Rocaille*, whereof we have already spoken, grind them all three very well together in a hollow Plate of Copper, with *Gum-Arabick* Water; thus have you your White in good condition to Paint withal.

C H A P. CCIV.

To prepare Black for painting on Glass.

AS this Colour cannot be omitted in any sort of Painting, so in this; the manner of using it is much the same, and the Preparation easie. You must grind Scales of Iron from the Smith's Anvil-Block, for three Hours on the shallow Copper-Bason, or Plate; add to this one third of the same weight of *Rocaille*, with a little *Calx* of Copper, to hinder the Iron from turning Red in the Fire; grind it to as impalpable a Powder as you can bring it to, and so keep it in a close Vessel for use.

C H A P. CCV.

To prepare a Yellow Paint for Glass.

THIS Colour requires a more costly Preparation than the precedent, because it cannot be well done without a tenth part of prepared Silver, as we shall shew hereafter.

Take fine Silver in Plates from the Coppel, stratifie 'em in a Crucible, with Powder of *Sulphur*, or *Nitre*, the first and last Lay being of the Powder, and so calcine them in a Furnace; this done, cast it out, as soon as all the *Sulphur* is consumed, into an Earthen-Bason of Water, and afterwards pound it in your Stone-Mortar until 'tis fit for the Marble, and so grind it with some of its Water wherein it was cooled, for six Hours; then add nine times
T
its

its weight of Red-Oaker, and grind them together for a full Hour, and 'tis done and fit for Painting on Glass.

C H A P. CCVI.

To make a Blue for painting Glass.

THE whole Secret of this Preparation, depends on the calcining the Ingredients, and goodness of the Crucible: Take two Ounces of *Zaffer*, two Ounces of *Minium*, and eight Ounces of very fine White Sand; put all these into a Bell-metal Mortar, and pound them very well, and so into a Crucible covered and luted over a quick Fire for an Hour; then draw off the Crucible, and pound them again as before: This done, add a fourth of its weight in *Salt-peter* powdered, and having mixed all very well together, return them into a Crucible covered and luted, which place again in the Furnace for two Hours at least, continuing such another Fire as the former: The Crucible being off and cool'd a second time, grind the Mass as before, and so put it into a Crucible again, with a sixth part of *Salt-petre*, and let it remain on the Fire for three Hours; then take off the Crucible, and immediately with an Iron-Spatula red hot, take out the Matter lest it should stick, being very clammy and hard to be emptied.

'Tis convenient to have strong Crucibles for this Calcination, because it remains so considerable a while in the Fire, and they must be luted with an extraordinary lute; you may use that we have given directions for in *Chap. 109.* adding Powder of *Borax*, to the Powder of Glass vitrified, which helps the Fusion of the Glass, which we have omitted there; but

but the greatest stress lies in Baking the Crucible afterwards in a small Fire, to cement the Pores, and make the Earth compact as Glass, which would be very much furthered, if you threw on it a considerable quantity of Salt as it comes out of the Fire, this would glaze it, and capacitate it for retaining the Spirits in the Fire.

C H A P. CCVII.

To make Red Colour for Glass Paint.

THIS requires as much caution as the Blue: You must take Scales of Iron, and Litharge of Silver, of each a Dram, *Feretto* of Spain half a Dram, *Rocaille* three Drams and half; grind all these for half an Hour on a shallow Copper-Plate, in the mean time pound three Drams of Blood-Stone in an Iron-Mortar, and add it to the rest; then pound a Dram of *Gum-Arabick* in that Mortar to an impalpable Powder, to take off the remains of your *Blood-stone*, and so add it to the rest, grinding them still continually, lest the Blood-stone be spoiled.

The best manner of grinding these is to pour Water by little and little on the Ingredients as you grind them, neither wetting them too much, nor too little, but just as much as will keep a good Temper as for Painting: Afterwards put all into a foot Glass, and so drop on it through a small hollow Cane of Wood, or with your Finger, as much Water as will bring it to the consistence of an Eggs-Yolk buttered, or a little more, then cover the Glass to preserve it from Dust, and so let it stand three Days to settle. After this, decant the clearest and purest of the Colours that rise at top, into another Glass, without

disturbing the Sediment; and two Days after it has settled anew, pour off again the purest of the Colours as before. This done, set it in the Body of a broken Matrafs, or Bolt-head, over a gentle slow Fire, to dry easily, and so keep it for use.

When you have occasion for it, take a little fair Water in a Glass, and with it moisten as much Colour as you think convenient, that will be excellent for *Carnation*; as for the *Faces*, which are very thick, dry 'em too, and you may moisten these in like manner with Water for *Drapery*, *Timber-colour*, and such other as you think convenient.

C H A P. CCVIII.

To make a Purple-colour for painting of Glass.

THE Preparation of this Purple-colour, is exactly like that of the Blue, for this Reason we need not use any tedious Repetitions: You must take an Ounce of *Zaffer*, and an Ounce of very pure and clean *Perigeux*, two Ounces of *Minium*, eight Ounces of very fine white Sand, pound all these in a Bell-metal Mortar, and reduce it to an impalpable Powder; put it afterwards into a good Crucible well covered and luted, in the Furnace; keep a very good Fire to it for an Hour, then draw it out, and as soon as it is cold, pound the Mass over again in the same Mortar; to this add a fourth part of its weight of *Nitre*, mix them together, and put them into the Crucible, and so proceed as directed in *Chap. 206.* until you have a fine Purple-colour.

C H A P. CCIX.

To make a Green Paint for Glass.

THE Change of the Ingredients makes this Colour, but the Method for incorporating them is the same as the former: Take two Ounces of *Æs ustum*, of *Chap. 35.* to this add two Ounces of *Minium*, and eight Ounces of very fine white Sand, pound these together in a Metal Mortar to an impalpable Powder, and put it afterwards in a Crucible luted and covered into a Wind-Furnace, giving it a good Fire for an Hour; after this draw it off, and let it cool, then pound it again, adding a fourth part its weight of *Nitre* in Powder, grind and mix them well together, putting them afterwards into the Crucible, luted and covered, in the Furnace, for two Hours, and so forth as in *Chap. 206.* Thus you'll have a very fine Green.

C H A P. CCX.

Of other Colours in general for Painting on Glass.

WE have directed how to make the first Master-Colours for Painting on Glass; now we proceed to shew what other depends on them without enlarging on these Preparations.

The Red in *Chap. 207.* serve for Carnation, but there ought to be one part of *Feretto* of *Spain*, as in *Chap. 21.* in the Composition, and another of *Rocaille*,

of which we will give the Preparation in the next Chapter; grind these on your Copper Plate, imbibing the Powder with Gum'd Water, until it be made fit for use.

The Red Faces there also mentioned will serve in Drapery, and to describe Timber-work, Trunks of Trees, Hair, Brick, and such other things; you must take an Ounce of *Feretto* of Spain in Chap. 21. as in the former Composition, an Ounce of Iron-Scales, two Ounces of *Rocaille*, grind them well together upon the Copper-Plate, moistening them with Gum-Water, till they be brought to the proper consistence, neither too thick nor too thin, so you'll have a Red inclining to a dark Yellow, very fit for use.

There be several more made use of in this, as well as in other Painting, but are compounded of the principal Colours, as we have intimated in our Discourse of Colours for Painting on Enamel, in Chap. 186.

C H A P. CCXI.

The Way to make Rocaille.

ALL Haberdashers of Small-Ware, sell this *Rocaille*, which are Green and Yellow Grains, whereof they make Beads, and sell them to the Country People; much also of these Trangums are exported to the *Indies*, to *Africa*, and the adjacent places, where the Inhabitants wear 'em about their Necks, and on their Scarfs, Bracelets and Waist-belts.

It is used also in Painting on Enamel and Glass, very frequently, though ill qualified and full of impure Lead. We have already taken notice of this before, and tho' to avoid this they make choice of the
 most

most clear and transparent *Rocaille*, and such as is least charged with Colour, yet still 'tis very far from being sufficient; 'tis true, it contains less Lead, however even that which still remains is likewise impure, and not at all purified.

We have directed such as work in Enamel, and we cannot avoid it also here to advise you instead of *Rocaille*, to make use of our Crystalline Matter made with *Saturnus Glorificatus*, Chap. 112. or such other-like Ingredients, as we have prescribed, which are perfectly cleansed; however to please every Body, we will give a Preparation of this *Rocaille*, and how to compound it, which is very easily done: Thus,

To make the Yellow Grains, you must take a Pound of fine white Sand, three Pound of *Minium*, mix and pound them together very well in a Mortar, and put the whole into a strong Crucible covered and luted, dry the lute, and put it afterwards into the Glass-house, or Wind-Furnace, where the Fire is violent, to reduce this Matter into Glass, as that of *Saturn*, made in Chap. 82. having thus finished the *Rocaille*, make it up into Grains, or any other Shape you please.

The Way of making the Green, is quite contrary to that of the Yellow: Put three Pound of fine white Sand to every Pound of *Minium*, and it will be very compact. This Stuff will alter its Colour, and become a pale Red in melting; and these are the Compositions and way of making this *Rocaille*, which most Workmen use: Thus you see there can be no preparing it without Lead, which makes it so full of Impurity.

C H A P. CCXII.

The Way to Paint on Glass.

THE Painting on Glass is of such fine Effect, as becomes the Admiration of the Learned in all Noble Arts: Nothing can be more wonderful to the Sight; besides, its continuance, and resisting all the Efforts of every Season, and badness of Weather, for several Ages, tho' this last Excellency was unknown to the first Practitioners, and reserved for this latter Age, however the Honour is due to them, since they made the first Secrets and Discoveries in this Art, and 'tis much easier to improve, than form a new Invention.

If Glass were malleable, and discharged of its Natural Frangibility, nothing could equal the Paint thereon; 'tis not to be tarnished, but always maintains its primitive Beauty and Splendour, without any obstruction to the Transition of Light; and there may as fine Fancy be done on it, as on Limning, there would certainly be nothing on Earth so rich or precious as Glass, whether Painted, or Tinged, if it had this principal Perfection of Malleability, which many Learned Men have studied for, and daily find; but such is the Corruption of this Sinful Covetous Age, that those Wise Seniors of this Art, do rather chuse to pass for *Ignoramus's*, than run the Risque of Perpetual Confinement, by exposing so fine and delicate a Secret, which would incur the Envy of the Great: and this they take care wisely to avoid.

We have already taken notice that such as formerly Painted on Glass, were both Painters and
Glass.

Glass-makers, and that such Gentlemen as were of them, received neither lessening in Birth nor Quality, as in case of other Arts, for this Prejudice is exempted in the *Art of Glass*, and our Kings have that Esteem for the Curious therein, that they have granted them such ample Privileges.

Now to proceed to the Manner of Painting on Glass, which is the Subject of this Chapter, wherein are several Particulars to be considered, which we will endeavour to distinguish as well as possible.

First choose such Glass as is usually called Glass of *Lorrain*, tho there be such and as good made at *Nevers*; for this sort of Glass receives the Colours better than any other, because 'tis best compact and able to resist the Fire; 'tis very easily known; 'tis not altogether White, but of a Whitish Yellow. But to proceed.

You must have the Original you Paint by, ready drawn and proportioned, on strong Cap-Paper, in all its Colours and Perfection; for your better advantage in Pattern, lay it on a Table, and so choose your Pieces of Glass to be Painted, and take care to fit them so to each other, as they may joyn easily afterwards without any prejudice to the Draught from displacing them, and so confounding the Figures and Pourtraits, or from the Lead which must joyn them afterwards, by obscuring any parts of the painting; then mark out each piece on the Tablet, by No. 1, 2, 3. for better distinction, and so trace them over with the Black given in *Chap. 204.* with a Pencil, as we shall further shew; do this very exactly, neither too slightly nor too thick, and so let it stand two Days to dry, before you paint it.

Then having all your Colours in readiness, so as directed in the foregoing Chapters, fill your Pieces off with Colours, for which use the Nib of the Pencil, especially in *Carnation*, where you must be very exact;

exact; you must also be very Circumspect and Expeditious, and take a great deal of care not to blot or blur the Tracings, and chose rather to paint on the other side of the Glafs.

All the Colours, except Yellow, may be applied on the same side, and that you must do on the contrary side, because it is apt to mingle with the other Colours, and if near the Blue, will compose a Green; so that for want of such precaution the whole Work may be spoil'd; if the Yellow transmit it self perfectly through the Quarre, it is as well as if it had been done on the same side; and take notice by the Way, that the other Colours have not so ready a Transition, because they consist of a Grosser Body.

The Yellow ought to be very equally and justly laid on in a greater or lesser quantity, as you'd have your Shadows; observe this too in the rest, especially to lay them on as quick as possible, as we have already said, particularly the Azure, Green, and Purple require the most exactness of any.

Now to set off and heighten the Lights, in piling a Beard, describing Hair in Drapery, or otherwise, use the Handle, or But-end of the Pencil, a small pointed Stick, or Quill, wherewith take off the Colours in those places you would Enlighten, which is easily done.

Such Works as are done in *Grisaille* you must paint after this manner: Trace your Piece with Black, and let it dry for two Days entirely, do it over very lightly and equally with a Wash so thin laid on, as not to efface the first Lines, and let it dry for two Days; after this run it over again with the same Wash where you find it convenient to give a second Tinge, and let it dry two Days longer: Then to give it the *Lights*; and convenient Heightnings, take the sharp But-end of your Pencil, or pointed Stick,

Stick, or Pen, as before, and take off the Colour of the first Wash, in the most necessary places, and so your Work will be finished.

To make this Wash is easie: Take a small Pewter Cup, or other Vessel, and put therein a quantity of black colouring, then dissolve *Gum-Arabick* powdered in its weight of Wine, and throw this on the Black in the Pewter-dish, or Saucer, that it may be very clear, and not easily dry'd, and that you may have your Wash for painting Glass in *Griffaille*, or Gray.

C H A P. CCXIII.

How to order your Glass in the Furnace after Painting, and to manage the Fire.

AFTER your Glass is fully painted, and the Draughts perfectly finished, the difficulty will be to Bake the pieces, so as to give it a consistency with the Glass, by penetration, which may be thus done. You must work with the Furnace mentioned in *Chap. 202.* and its Stove of good Crucible Earth, to contain all the Work, which must be stratified on this manner.

Take good Quick-lime well digested, searced, and finely pulverized; and for the better security let it digest thrice in a Potter's Furnace, and so powder and searce it; then make a very even lay thereof, about half an Inch thick, on the bottom of your Stove, and then a lay of pieces of broken Glass, and afterwards another lay of Powder, and so another of Glass, then another of Powder; the reason of making this Stratification of powder and old Glass, is to prevent any injury from the violence of the Fire, which

which will be very smart under the Stove; this done upon the third Bed of powder, lay a lay of painted Glass, and so continue S. S. S. each lay of powder and Glass being equally or evenly made, untill all the pieces of paint are put in, or the Stove full, and upon the last lay of Glass lay the uppermost of powder somewhat thicker than the former; then cover the Furnace with its Shrowds of Earth, joyning and luting them well together, all round with the best lute, so that it may admit of no respiration, but through the fire holes, or the Opening of the Furnace, whilst you draw out the proofs or Tryals you make, as we have hinted elsewhere.

Your Furnace being thus ordered, and the lute dry'd very well, begin to heat it gently with some Charcoal on the outside of the Furnace, at the entrance, and so by degrees, and very leisurely improving it, lest the Glass should be broken, or the paint spoil'd; continue thus for two Hours, then thrust the Fire in further, and let it remain there for an Hour, putting it in by little and little under the Stove, where leave it for two Hours longer, then increase the Fire by degrees for two Hours, and continue to apply Fuel until the Furnace be full of Charcoal, and you perceive the Flame convey itself through every hole of the Cover; keep it thus very violent for three or four hours, shutting the Door of the Furnace; you must be very cautious and circumspect, during the whole Work, from the first two hours that the Fire remains at the Entrance.

Observe from time to time to draw forth your Tryals, or pieces of proof in your Stove, to see if the Colours be melted and the Yellow qualified, you may perceive how the Work goes on by the sparkling of the Iron-bars under the Stove.

As soon as you find your Colours almost done, improve the Fire with some very small Billets of dry Wood, they must be very little for ease in putting them in, and to prevent Smoaking, and to make the Flame environ and reverberate over and round about the Stove, which must be continued until you have finished, this will be in twelve or fourteen hours; then let the Fire go out and the Work cool of its self, and so take it out, and 'twill be finished.

C H A P. CCXIV.

Another Way to Paint on Glass.

THO the former way be very fine and lasting as can be, yet we will here shew another more easie, and altogether as effectual.

Take very White Glass, varnish it very thin on one side with a White Varnish, then having before made choice of some fine Impress, or Cut, on Paper, just fit for the piece of Glass you design to paint its Fancy on, dip it in Water, and letting it soak and dry a little, clap the Picture-side thereof to the Varnish-side of the Glass, as exactly, plain, and evenly as possible, and so let it dry thoroughly; afterwards moisten the Paper on the Blank-side, and with a blunt Graver draw off and trace the Lines of the Picture, which will afterward remain perfect and distinctly on the Varnish-side of your Glass Quarre.

This Draught is for the Model you must paint your Fillings in, and observe that the Tracings and Strokes of the Picture are to serve you in Shadowing, which cannot be rejected without disadvantage to your piece.

The manner of painting on Glass, is quite contrary to that of Limning, or Painting on Cloath, or Wood; for in this the paint being but on one side, is plainly visible on the other; here the Settings-off are first done, then the compound Colours just run over, and so continuing until perfected; whereas on Linen, &c. the Settings-off, or Heightnings, are the last strokes, and their Ground-colour, or first, is that which we end withal, and make our last lay with in all pieces done on Glass.

We do not shew the Way to make up the Colours, nor how to mix and finish the Artificial ones, for that relates immediately to the *Art of Painting*, of which several pieces are extant, and not to this *Art of Glass*; and these noted herein are the same as in the other *Art of Painting on Cloath*, and not very uneasily prepared.

You must also paint on Glass, just as in *Miniature*, with Water-Colours, laying your Picture underneath it, as before, and this will shew finer than if done in Oyl; besides, the Colours dry in a moment.

Your pieces being thus done in Oyl, or Water-colour, may receive a very additional and improving Beauty, by over-laying all the Colours, except the *Ground*, with Leaf-Silver, which will appear very glorious and lively on such as are transparent; to wit, Lakes, Verditors, &c.

C H A P. CCXV.

The Manner of Gilding on Glass.

WE promised to shew this Way of Gilding on Glass after we had done with Painting, and this we will discharge here.

Take any Glass you please, and moistening it over where you design to gild, with Gum-Water, apply your Leaf-Gold, and so let it dry; cover the Glass over with any piece of hollow Glass, and set it on an Iron-Plate at the Mouth of the Furnace to heat gently, and when 'tis well heated, move it in further, and in a very little time it will be red hot; then withdraw it, and let it cool slowly at the Furnace Mouth. Thus if you have laid your Gold well on at first, you'll find it so well communicated to the Glass, that 'tis impossible for any Tryal to endamage the Gilding.

And after this method you may do with Globes, and give them a wonderful Beauty, which no Dust, nor injury of Time can alter.

C H A P. CCXVI.

Another Way to Gild Glass.

THIS second Way is altogether as fine as the other; besides, the Gilding is better coated, and less exposed to Injury.

Take a Glass and moisten it every where, you design to Gild, with Gum-Water, and lay on your
your

your Leaf-Gold, letting it dry; this done, run the Gold over with Water wherein *Borax* has been dissolved, and so dust it with impalpable powder of Glass; set it afterwards by degrees into your Furnace, until it become red hot, and the powder on the Gilding be melted and run; then draw it out leisurely, letting it cool at the Mouth of the Furnace, and you'll have your Glass very finely Gilded; so that nothing in Nature can spoil it, unless it be broken.

Or you may Gild on Glass with Linseed-Oyl, &c. as in *Chap. 198.* after the same manner as on *China*, but the Ways we have just now given, are so fine, that we look upon them to be more excellent; such as would make a choice may work by Directions in this present Chapter.

C H A P. CCXVII.

To imitate Precious-Stones in Colours, on Globes, or other Vessels of White Glass.

THIS Way of tinging is different from what we have already given; and because we would not willingly leave out any thing that may serve the Curious, we will give the Method in this Chapter.

You may thus tinge any Vessel of White Glass, either Globular, or Concave, with Mouth-Glue, letting it soak in Water for two Days, and so boil it afterwards until it be all melted, and let it cool a little.

Pour it Milk-warm into your Globe, or other Vessel, shaking it therein to wet it all over, and so pour it out again: Then your Colours being all ready in Powders, first blow in the Vermillion through a hollow Pipe, so as to represent Clouds or Wavings

in

In like manner blow in the Blue-Enamel, Scales of Copper, Orpiment, and Lake, all in fine powder; these Colours will stick in Undulations, because the Glew is moist; you may do thus with any other Colours: This done, take Plaister well pulverized, and put a good quantity thereof into the Vessel, and shake it well all over before (and until) the Glew be quite dry, and it will stick all round, then shake out what remains loose, and you'll have the outside finely party-colour'd and Marbled, &c.

When these Colours are well dried, they will stick so to the inside, that they will never come off, but remain always fine; set these Globes on Stands where they may be for Ornament, and the pleasure of those who shall see and consider their Admirable Beauty.

The End of the Ninth Book:

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B O O K X.

Shewing how to Extract the Essential Tincture of all Herbs, or Flowers, as Yellow, Red, Green, Blue, Violet, Purple-colour'd, &c. With their respective Lakes : To make Ultra-marine, German-Blue, &c. as well for the Art of Glafs, as Painting.

C H A P. CCXVIII.

NOT to omit any thing which at all concerns the *Art of Glafs*, we thought convenient in this *Tenth Book*, to give the Publick a Method of Extracting all manner of Essential Tinctures from Herbs, as well as Flowers ; a Work not only necessary for *Painting*, but the *Art of Glafs* too : We shall also

also give Directions to make Lake of several Colours, *Ultra-marine* of *Lapis-Lazuli*, with *German-Blue*, &c.

The manner we prescribe for making these Colours, does equally qualifie them for tinging Glass, Stones, Enamel, and for Paint on Enamel and Glass-work, and all this so prepared, as not to press on the Diversions, or pall the Pleasure of the several Artists, or other curious Persons, who employ themselves that way for Recreation.

What can be more admirable, than the Products, and Liberality of Nature, in bestowing such excellent Enamel on Flowers and Plants, as contribute to furnish Painting with such fine and lively Colours, which the Industry of Mankind can extract, and so well adapt to the Conveniency of Art, as to produce Effects, finer, and more beautiful than any other whatsoever.

The use of Flowers and Plants, is not wholly confined to this Noble Art, but they are also proper for Dying, and have much more excellent success in *Physick*, where their Vertues are infinite, &c.

No Product in Nature is useles, but the very meanest has its necessary Properties; and those which seem the most abject and venomous, (even the greatest Poisons) have admirable Effects in Medicines, when duly prepared; and this the Professors of *Physick* are not unacquainted withal, tho' very many pretend to those Studies, whose Endeavours are far short of handing them through the secret Excellencies thereof.

C H A P. CCXIX.

How to Extract Lake from Broom-Flowers.

WE will give several ways of making Lakes of several Colours: The first with a *Lixivium*, or *Lee*, made of *Soda* of the Glass-house, and fresh *Quick-lime*, which must be pretty strong, in which put your Broom-Flowers, over a small Fire, until all the Tincture be drawn from them, the Flowers become White, and the Lee receive the Yellow Colour: Then take out the Flowers, and put the *Lixivium* into a glazed Earthen Vessel to boil, adding thereto as much *Koch-Allom*, as it can well dissolve; then take it off, and put it into a large Vessel, mixing it with fair Water, so the Yellow will separate and descend to the bottom, let it rest there a little, and afterwards decant the Water off gently, and so put in more fresh to it again and again, until the Water has drawn off all the Salt and Allom from the *Lixivium*, and it become clear: Thus the Colour will be very well cleansed of the Salt and Allom, and remain exceeding fine and bright, spread it on pieces of White Linen, and let it dry in the Shade on new-baked Tiles, and you'll have a most admirable Yellow-Lake for Painting.

C H A P. CCXX.

To Extract the Tincture of Poppies, Iris (or Flower-de-luce) Red-Roses, Violets, and all sorts of Green-Herbs, for making Lake of their Colour.

TO avoid unnecessary Repetitions, we have thought fit to bring all these under one Chapter, because the Method for extracting their Colours is the same in one as in t'other, and done with the former *Lixivium* of Soda and *Quick-Lime*.

You must steep and boil each sort of Flowers, or Herbs by themselves in the *Lixivium*, giving it time to draw off the Colour entirely, which you'll soon perceive when the *Faces*, or Flowers grow white, and the *Lixivium* deepened with the Tincture; then pour off the *Lixivium* gently into your Earthen glazed Vessels, and set them over a Fire, putting in as soon as they begin to boil as much *Roch-Allom*, as they can well dissolve, and so take them off.

After this pour all together into a large Earthen Vessel glazed, and pour into it fair Water, to make the Colour precipitate; let it stand and settle, then pour off the Water, and put in fresh; and thus continue to change the Water until it pour off as clear as you put it in, and taste flat, or insipid, so as you may conclude all the *Soda*, Salt of *Allom*, and *Lime*, are drawn off: Thus you'll have at the bottom, a very fine Tincture to make a pure and delicate Lake withal, of the same Colour as your Flowers, or Herbs that were used; spread it on pieces of Linen, dry them in the Shade on new-baked Tiles as before. After the same manner you may draw any

other Lake, from whatsoever colour'd Herb, or Flower you please.

C H A P. CCXXI.

Another Way to Extract the Tinctures of Yellow Flowers, of Field-Poppies, Irises, ordinary and deep colour'd Violets, Carnation, and Red-Rose, Borrage-Flowers, Red-Coleworts, Flags, &c. Together with the Verdurers of Mallows, Burnet, and other Herbs.

WE shall not give the same in this, as in the foregoing Chapter, that Preparation is common to all those in the Title thereof, and so is this to these. To avoid Prolixity and Repetitions,

You must have the Flowers, or Herbs newly gathered, fresh enough to stain a Card with their Juice pressed thereon, else they'll not serve your turn; put these into a Glass Cucurbit with a pretty large Mouth; pour in among them good Strong-Waters to drown them by four Inches, joyn a Recipient to it, and lute the Joints very well, letting them dry; this done, place the Alembick on a Sand-Furnace, keeping a very gentle Fire under it, giving the Matter time to digest, increasing it by very little and little, and so the Strong-waters will rise on the Leaves, and draw off the Colour, then improve your Fire to distil your tinged Strong-waters, into the Recipient, out of which you must take and put them into another Alembick, luting well the Joints, and let it distil in *Balneo*, or over a very slow Ash-Fire, and the Strong-water will distil off in their own Colour, without any Tincture, and may be kept for the like occasion again: The Essence you'll have

have at the bottom of the Cucurbit, let it dry gently: Thus you may have Lakes from all manner of Herbs and Flowers whatsoever.

C H A P. CCXXII.

To make a Scarlet-colour'd Lake.

THE Design of this Chapter, is only to order the first Preparation for obtaining our Scarlet-colour, whereof we will make a very delicate Lake.

Take Shearings of White Woollen-Drapery, let them be fine as possible, steep them a whole Day in cold Water, pres them afterwards very well to take off all the Greasiness, and Allume it thus.

Put four Ounces of *Roch-Allom*, and two Ounces of Crude *Tartar* in Powders, into a small Kettle, pouring thereon two Quarts of Water; when this begins to boil, put to them one pound of the Shearings, and so let it boil a full Half-hour; afterwards take it off and cool it for six Hours; take out the Shearings and wash them in clean Water, leave 'em to steep about two Hours; pres them after this, and dry them, keeping them for the use we shall prescribe in the next Chapter.

C H A P. CCXXIII.

To Extract Scarlet-colour from Kerm-Berries, for making a Fine Lake.

THE Name of *Kermes* is purely *Arabick*, for in that Country these Berries grow on a small Tree, or Shrub, and from that their Native Soil, were transplanted into *Spain*, *Portugal*, *Provence*, and *Languedoc*, where they now are plentiful; several would perswade us, that 'tis a sort of Oak, called in *Latin*, *Coccigera*, but the Leaves which are prickled like those on *Holly*, only smaller, shews us the contrary.

These Grains, or Berries, have several other uses than in Painting, being of excellent Vertue in Physick: Of them the Apothecaries make their Syrop called *Alkermes*, and from the remainder of them which is left behind in the Strainer, they draw a substance for the Dyers, which is used in colouring of Stuffs.

Several ways may be given to extract the Tincture of these Grains for making Lake; we'll only insist on two, the first is indifferent long, but very excellent, and produces a Tincture whereby is made a most admirable fine Lake.

The way of making the Lake in *France*, is very modern, and 'tis but of late they have had this Secret in *Paris*, which was brought from *Venice*; now since few are familiar with it we are willing to publish this, that many may know how to Work therein.

Take

Take four Quarts of clear Water, and four Pound of Wheaten-Bran, two Drams of Oriental *Piraster*, and as much *Fænugrec*, set all in a Kettle over a Fire, till the Water be Milk-warm; keep your Hand in it until you can bear the heat no longer; then take it off, cover it with a Cloath, that the heat may continue the longer, let it repose for twenty four Hours, then run off the *Lixivium*, and keep it for the following purpose.

Get a clean Earthen-Pot, and put therein three Quarts of fair Water to half the *Lixivium*; order a Fire, and let this boil thereon, which when it begins to do, put in an Ounce of the Grains pounded impalpably in a Brass-Mortar, and searced; then pound a little crude *Tartar*, to take off the remaining parts of the Grains on the bottom and sides of your Mortar, and so put it in with the Grains; when the Water begins to boil again, take it off in an instant, and set it to cool.

This done, and the Water cold, take the Shearings prepared in the former Chapter, and let them stain therein about half an Hour: Afterwards squeeze it into another Pot by expression; and after you have thus drawn off all the Tincture, put the Shearings into the last Pot, stirring them about very well with a small Stick; that they may stain the sooner, boil all for about half an Hour over a small Fire, else the Tincture will become black, then take the Shearings out, and put them well tinged into a Vessel of cold Water; about half an Hour after pour off the Water gently, and so put fresh on again, then press and spread them to dry in a clean place, where no Dust can come at them.

This done make the following *Lixivium*. Put on a Hempen-cloath doubled, Vine-stalk-Ashes, or Ashes of Willow, or some other lighter Wood; pour thereon, by degrees, cold Water, letting it strain through

through into a Vessel set underneath ; pour it again on the Ashes, and when it is all run through, set it to settle for twenty four Hours, that the Ashes which it carried off, may fall to the bottom ; this done, pour the *Lixivium* by degrees, into another Vessel, rejecting the Sediment, put your Shearings into this, having warmed it : When it begins to be cold, let it boil over a gentle Fire, and it will become red ; take a little of the Shearings, press them well, and if it remains without colour, take off the Kettle immediately, for the *Lixivium* has extracted it entirely, spread a Linen-cloath o'er a Free-stone Bowl, set the Shearings therein, and pour on the *Lixivium* by little and little to strain and yield the Tincture, then squeeze the Cloath and the Shearings therein, to press out all the Colour that remained in them, throw away the Cloath, wash the Shearings clean and keep them for the like use another time.

Then put twelve Ounces of *Roch-Allom* well powdered, into a Glass Body full of cold Water, letting it dissolve quite ; when this is perfectly done, spread a Linen-cloath over two Staves, and set underneath a large Free-stone Vessel, put all the *Allom*-Water into the Bottle of Tincture, and strain it afterwards through this Cloath ; the *Lixivium* will go through it clear, and leave the Colour behind, but if it shou'd not be coloured, 'tis only straining it through again, and you'll have done.

Now to get the Tincture, you must mix all that remains on the Cloath, and gather it together, spreading it afterwards over new-made Tiles (which have not yet been allowed time to moisten) on the pieces of Linen, then mold them into Troches to dry suddenly, without moulding, which wou'd spoil them ; therefore you must take great care that the Tiles be not at all moist, and if so, to change them, that it
may

may dry the sooner, and thus you'll have a Lake of admirable colour for Painting; you must lessen, or improve the Colour as you find, by a greater or lesser quantity of *Roch-Allom*.

C H A P. CCXXIV.

A readier way to Extract the Tincture of Kerm-Berries.

THOUGH the *Menstruum* given in the last Chapter, made with Shearings of Cloath, be a very good one for this purpose, yet the following is a more easie and as effectual.

Take Strong-waters of the first Run, or Distilling, and put it into a long-neckt Glass Body; dissolve therein a Pound of *Roch-Allom*, adding an Ounce of *Kerm-Berries*, finely powder'd and searced; let it digest well, shaking the Matras from time to time, and the Strong-waters will draw to them all the Tincture of the *Kermes*, and be very finely colour'd; then let all settle four Days, and afterwards pour it gently into a glazed Earthen-Vessel.

Dissolve four Ounces of *Roch-Allom* in running Water, and pour this into the Strong-Waters, or Tincture of *Kermes*, to cause a separation; filter it through a Linen-cloath, and the Strong-Waters will fall through White, leaving the Tincture behind; if they be any thing coloured, strain them again and again until they be clear: Take up the Lake, or Colour, with a clean Wooden-Spoon, and make it into Troches, drying them as directed in the former Chapter: Thus you may have a quantity of this Colour, or Lake, as fine and good as the former.

C H A P. CCXXV.

To make Lake, or Tincture of Brazile.

THE *Brazile* which *Dyers* make use of, is meant here; take of the finest which comes from *Fernambouck*, that being the best.

The way of extracting this Tincture is the same as the former from *Kermes*, and may be effected two ways, either with the first prescribed *Menstruum*, or the Strong-Waters, observe only not to put as much *Allom* to each Ounce of *Brazile*, as to the Berries, for that Tincture is deeper than this from *Brazile*, and consequently requires more Stuff; use therefore as much here as you find reasonable, for Experience will give you the best instruction.

Take notice too that when you do it by the first *Menstruum*, there is a greater quantity required of *Brazile* than was prescribed of *Kermes-Berries*, to each Pound of Shearings; in every thing else follow the former Directions, and you'll have a fine Colour, or Lake, less chargeable, and altogether as good as the Tincture of *Kermes*, for Painting.

C H A P. CCXXVI.

To Extract Tincture of Madder for Lake.

Madder is the Root of a Plant common enough, but generally comes from *Holland* and *Zealand*, and used by *Dyers*; if good, 'tis red; 'tis finer than *Brazile*, and before you use it, must be finely powdered to give the better colour.

You may use either of the former *Menstruums* of Shearings, or Strong-Waters, ordering your Quantities, as directed for the *Brazile*, if you follow the Preparation given in *Chap. 223.* you'll have a fine colour from this Root, which make into Troches, drying them as before, this will be a perfect Lake, and very fine for use.

C H A P. CCXXVII.

How to make Ultra-marine, of Lapis-Lazuli.

THIS Rich and Noble Blue drawn from an *Azure*-Stone, commonly called *Lapis-Lazuli*; 'tis an *Opaque*-Stone, of a fine Sky-colour, or *Turkish*-Blue, or like the Blue-Flowers which grow in *Cornfields*, 'tis embellished with small Streaks and Sparkles of Gold-colour; the best is that which is fixt, that is, can endure Fire without altering colour, and comes from *Persia* and the greater *Indies*; it is also supposed it may be had from *Africk*, as well as *Asia*, but questionless, there does not come that plenty thence as from the other places.

There

There is also found in *Germany*, and *Hungary*, a kind of *Lapis-Lazuli*, but not fixt, tho' as hard as the former; they call it *Iesurstein*, and its colour *Afurbleau*; but its colour changes in some time, and becomes Greenish; 'tis used however by Painters.

The fixt *Lapis-Lazuli* has great Vertues in Physick, and much more excellent ones than are ascribed to it by most Persons, who indeed are ignorant of them, and so are many of the Learned too; but we'll pass these over here, and reserve them for another time in some other place. This hint however may serve to advise the Curious to pry into the Matter, and possibly discover its further Excellencies and Vertue.

'Tis called *Ultra-marine*, because brought to us from beyond Sea; or rather, because the first that ever came into *France*, was out of the Kingdom of *Cyprus*, a Maritime Country; for so are those Countries called, which border on the Sea-Coasts.

Before you proceed to Extract your *Ultra-marine*, take some account of the Manner, to know whether the Stone be good, for unless it is singularly so, you'll lose your labour: Put pieces thereof on live Coals, and blow them continually for an Hour, if they retain their first hardness and colour afterwards, you may conclude them good, but if they crumble between your Fingers, they are naught: It may be tried otherwise in an Iron-Ladle put into a Furnace with some of the Stone to heat, and so quench it in strong Vinegar; if the Colour remains still unchanged and splendid, you may assure your self 'tis good.

When you have made this Tryal, calcine it, which to do the easier, break the stone to pieces, as small Hazel-Nuts, wash them afterwards in warm Water, and set them in a Crucible, on a Wind-Furnace, or into an Iron-Ladle to re-unite; then

cast

cast them into a glazed Earthen Vessel of distilled Vinegar to quench them in, do thus seven times, to prepare them by Calcination for Powdering, and to prevent their sticking to the Mortar.

Thus calcined, dry 'em well, and so powder them in a Stone-Mortar well cover'd, and accordingly searce it with the same caution, as Perfumers do their most delicate and finest Powders, lest the best should go off, and dispel its self in the Air: And thus preserve this precious Powder with all imaginable care.

C H A P. CCXXVIII.

To make a Liquid for Moistning and Grinding the Powder withal, &c.

'TIS impossible to give all the Preparations for the *Lapis-Lazuli* in one Chapter, they are too tedious for that purpose, and can't be so confined without Confusion; this we intimate to justify our division thereof into several Chapters.

For moistning and grinding your aforesaid Powder of the Stone, take a Pound and half of running Water, and put this into a new Earthen-Pot, add to it an Egg-shell full of raw Honey, boil it until it have no more Scum; take the Pot off, and keep this Hydromel, or Liquid for use in Bottles, as we shall give occasion for hereafter.

This done, take four Scruples of the best *Gum-Dragon*, grind it on your Marble, with some of the *Hydromel*, and then put it into a Glass; add thereto as much *Hydromel* as you find convenient, to bring it to a Violet-colour, so cover it, and preserve it for use: This Liquid is good for your Powder of *Lapis-Lazuli*,

Lazuli; if the Colour be too Violet, add the less hereof, if otherwise the more, as your Judgment, or Experience shall direct.

Put half a Pound of Powder at a time into a small Porphyry, or Marble Vessel, the larger the Mortar the worse, for you'll lose more, and be longer at grinding; pour leisurely by little and little thereon, some of your Violet Liquid, grind these together for a full Hour, still wetting it; you may use three or four Ounces of Liquid to the half Pound of Powder, and you'll have it very good; you must take care of grinding it too long, for then it will lose its colour.

When 'tis thus ground, dry it on a Marble or Flat-stone, where the Sun does not come at all, cover it well to preserve it from Dust; when 'tis dry, 'twill Powder easily between your Fingers, if it be rightly done; if so, let it alone on the Marble, but if it be clammy, or stick, take it off, for it has still some unctuousness of the Honey in it, which must be cleansed away by a Cement.

Your *Lapis* being thus dry, wash it well before you put it to the Cement, for which you must use a glazed Earthen Basin round above like a Barber's, and well glazed within, put your *Lapis* therein, and pour thereon some of the mild *Lixivium* in the next Chapter, as much as will rise above the Surface four Inches; wash the *Lapis* very well with your Hands, and then let it settle, and 'twill precipitate: The Liquid being clear'd again, decant it into a large Copper, or Earthen-Vessel, then let the *Lapis* dry in a Shade in the same Vessel 'twas washed in, and spread it afterwards on the flat Marble, or Porphyry, and there let it lie until quite dry: Thus 'tis prepared for mixing with the Cement, of which we will give the Preparation in *Chap. 231.* and those next succeeding it.

C H A P. CCXXIX.

To prepare a mild and a strong Lixivium for the Lapis-Lazuli.

WE have promised to give this Preparation here, and the manner of making hereof, which we will shew, together with another stronger, to wash the *Lapis* withal, when 'tis mixt with the Cement, as hereafter directed.

To make these *Lixiviums*, take ten handfuls of Vine-stalk-Ashes well searced; put this into a large Vessel that will hold thirty Pound of Water, with a Faucet at bottom; press the Ashes very well, and put to them twenty Pound of warm Water; when 'tis sunk to the bottom, open the Faucet, so as it may only drop into an Earthen-Vessel; when 'tis all come out, stop the hole, and strain this *Lixivium* through a Felt Strainer, and so keep it in a Glass, or glazed Pot well covered: This is the strong *Lixivium*.

Again, pour in on the same Ashes, the like quantity of warm Water, and do as before, so you'll have an indifferent strong *Lixivium*, which keep as the former.

Do this a third time, and you'll have the mild *Lixivium* mentioned in the preceding Chapter.

These three are very useful both for moistening, and to draw the Powder of *Lapis-Lazuli* from the Cement; wherewith it must be mixed, as we shall shew in the succeeding Chapters, which Separation being sometimes hard to perform, we are obliged to have recourse to these Varieties of *Lixiviums* stron-

ger, or weaker, as we find them convenient for the purpose.

You may yet make another *Lixivium* to take away the greasiness of the Cement, thus: Boil *Calx* of *Tartar*, as much as you please, in clean Water, for about a quarter of an Hour, and keep it for use as the former. This is excellent for washing the *Lapis-Lazuli* with; it strengthens and improves the colour thereof, is good for the *Itch*, *Scurvey*, &c. and to take away the Witherings in the Fair Sex.

C H A P. CCXXX.

The Form of the Glasses for preserving the Liquids in, which are employed on the Lapis-Lazuli.

THERE always remains some of your colour in the Waters, or *Lixiviums*, wherein the *Lapis Lazuli* is prepared throughout all the Process; you must therefore have a very large Vessel of Brass, or Earthen-Ware, glazed and polished very well at bottom, wherein must be three Holes; one in the middle of the side, the next a little lower, and the last about two Inches from the bottom; stop these Holes without-side very close to prevent leakage.

Then pour all your Waters into this; tho' you then perceive no colour at all, yet after ten Days you'll have it at bottom, whither it will descend gently; and to get it, you must go artificially to work, first opening the first Cock, or Hole, and let out the Water above that, before you open the other two; and thus you may get the colour without muddying, or losing any by the Waters, which mix with the rest.

C H A P. CCXXXI.

To make strong Cement to mix with Lapis-Lazuli, to separate the finer and better Stuff from the other.

ONE cannot so easily part the finer *Lapis-Lazuli* from its grosser parts, without making use of this Cement to unbind the parts: Take four Ounces of very pure and clear *Venice-Turpentine*; six Ounces of *Rosin* of the *Pine*, six Ounces of *Grecian-Pitch*, three Ounces of very good *Mastick*, three Ounces of fresh *Wax*, an Ounce and half of *Linseed-Oyl* cleansed, as shall be directed in *Chap. 233*.

Put the *Turpentine* into a new glazed Earthen-Pot, very clean, to dissolve over a slow Charcoal-Fire, and continue stirring it with a Wooden-Spatula, throw into this by degrees, the *Rosin* of the *Pine*, in small pieces, and stir it still very well; thus put in successively the *Pitch*, the *Mastick* in Powder, and last of all the *Wax* sliced small, stirring all continually about to mix and incorporate: Take great care of your Fire, lest the Cement should blaze, or burn, all the Ingredients being hot of themselves, and combustible: Having well incorporated them, pour in the *Linseed-Oyl*, stirring it as before, and so let it boil gently for a Quarter of an Hour.

To try whether the Cement be enough, drop some of it off the Spatula into a Vessel of cold Water; if it spread 'tis not enough; but if it do not, 'tis sufficiently boil'd; so take it off. Or else you may wet your Fingers, and take a drop thereof, roul and draw it out in length; if it snaps and breaks of it self, 'tis a sign that 'tis enough; take it off and pour it boiling hot into an *Hypocrass*-Bag steeped before

in hot Water; take care to let it go all through into a Vessel of cold Water; and for the better security, squeeze it along from top to bottom with two flat Sticks, that none may remain in your Bag; afterwards work it well with your Hands, till all the Water be drained from it, and because being hot it may stick to your Fingers, you may anoint them with some of the Linseed-Oyl.

The Cement being thus prepared, keep it in a Vessel of cold Water, shifting your Water every Day, or every second Day, and by this Method you may keep it for ten Years.

C H A P. CCXXXII.

To make a weaker Cement for separating the Colours of Lapis-Lazuli.

THIS second Cement, which is the softer and milder, ought to be first employed on the Powder of *Lapis-Lazuli*; it draws the colour much quicker and better than the strong Cement, which ought not to be used till after the milder, the whole Secret of separating the Colours, consisting in using the Cements, for without a due care hereof, it cannot be done perfect.

To make this Cement, you must take four Ounces of very pure *Turpentine*, four Ounces of Rosin of Pine, six Ounces of *Grecian-Pitch*, one Ounce of fresh Wax, six Drams of Linseed-Oyl purified, mix and incorporate them successively as before; observe only that this is sooner done than the former, because 'tis weaker, and will give the colour soonest, therefore you must manage accordingly.

C H A P. CCXXXIII.

To purifie Linfeed-Oyl.

THE use we have for Linseed-Oyl in our Cement, obliges us to give this Preparation, and way of purifying it, as we promised, whereby 'tis made more fit for our purpose.

Take good and clear Linseed-Oyl, of the colour of *Saffron*, and put it into a Glafs, shaped like an Oxe-horn, with an Hole at bottom to let out the Water, which you must mix with the Oyl, letting them settle until the Oyl rises all upmost; then open the Hole, and let the Water out, and the Oyl remain behind; then shake the Oyl again, with more fresh Water, let it settle, and the Water run out, as before; do thus eight or ten times, till the Water comes out as clear as it went in, and so the Oyl will be pure and fit for your use; keep it well stopt in a Glafs-Bottle. If you can't get Linseed-Oyl, you may use Oyl of Bitter-Almonds, without purifying, for it needs none; but take notice, the Linseed-Oyl is best of any, tho cheaper than t'other.

C H A P. CCXXXIV.

How to incorporate the Powder of Lapis-Lazuli with the strong, or weaker Cement.

WE have given in *Chap.* 228. the way to prepare the Powder for mixing with the Cement, to extract the Colours; we now come to shew how to mix it with the Cement, in order to extract the *Ultra-marine* from them for Painting.

Take a Pound of the Powder, and the like quantity of Cement assigned in *Chap.* 231. observing always to take the first that was workt with the Hands; cut the Cement small, and the pieces being a little wet, put them into a glazed Earthen-Pot, over a Fire of red-hot Ashes, to melt, and take care it does not boil; if it should, you must prevent the the damage which it might cause, by putting in some Linseed-Oyl. The Cement being thus melted, anoint all your Spatula over, from the Handle downwards, with the same Oyl, and so put in the Powder by very little quantities, and taking a great deal of time, that they may the better incorporate; and be sure to stir it all the while very well with the Spatula, so as to make it all alike, until it become like an Oyntment, or Salve; then off with the Pot, and throw the Stuff boiling hot into an Earthen-Bason of cold Water, and at that very instant take off all that sticks to the sides of the Pot; when 'tis cold enough to be handled, if it appears well coloured, 'tis a sign you have work'd it well: This done, rub your Hand with Linseed-Oyl, and work it as they do a Paste of Bread, or Dough, for one Hour, that it may be
thoroughly

throughly compact. The longer you work it, the better and easier the colour may be drawn; afterwards make it up like a Loaf, or Brick, and set it in an Earthen-Dish to dry, pouring thereon some fresh Water; let it steep for fifteen Days, the longer the better for extracting the *Ultra-marine*.

C H A P. CCXXXV.

To Extract the Ultra-marine.

NOW we come to take out the *Ultra-marine*, from its Confinement to make it appear Triumphant, and in its full Glory.

Take therefore the Loaf of Cement and Powder, washing it in the same Water extraordinary well with your Hands; weigh it to know the quantity of Oyl it requires, and put it into an Earthen-Bowl, or Dish, very smoothly glazed, rubbing first the Bottom with your Linseed-Oyl; then pour in Water scarce warmed, until it arise two Inches above the Matter; let it stand in this condition a full quarter of an Hour (or less in the Spring-time;) pour this Water afterwards into the Vessel mentioned *Chap.* 230. adding more warm Water to your Matter, and so 'twill soften: Continue thus whilst there remains any Tincture thereon; by this means all the substance that is good for any thing, will be separated from the Cement, which cannot be done otherwise.

Whilst it is imbibed in the warm Water, you must move and roul it gently round with two Sticks, or Spatula's of Box, or any other well polished Wood rounded at the ends smooth like a Walnut; let them be about an Ell long, and an Inch thick. Whenever you perceive the Matter stick to the bottom of your

Dish, rub your Hands with Linſeed-Oyl, and ſtir it about leiſurely ſo as to colour the Water, which you muſt put along with the former, in the mean time holding up the Matter with your Staves, leſt it ſhould ſtick to the Veſſel.

Take notice that a little ſteeping at firſt will tinge the Water very much, and when the Cement is juſt yielding its colour, it will diſcover certain Bluish Streaks on the Water, like the Sun-Rays, and then you muſt ſtrain this Water out among the other, through a Searce, that the groſſer part of the Cement may remain; afterwards pour in by little and little the freſh warm Water, ſtirring the Cement eaſily, that it may not dilate too much, and give its colour all at once. After you have thus ſtir'd it about five or ſix times, cloſe and amaſs it anew, by which means you'll ſee how much 'tis diminished, and what quantity of colour it has given.

If the *Lapis* be good and right, you'll find it will the firſt Steepings yield about four or five Ounces of *Ultra-marine*, which keep apart by its ſelf as the beſt and fineſt colour, tho' it appear groſſer than the others of this ſort, by reaſon of the Gold-coloured Veins, which are peculiarly therein.

For the ſecond, whereof you'll have thrée or four Ounces, you muſt follow the Proceſſes aforemention'd, this indeed will be finer than the other, but not ſo good a Colour; keep it alſo by it ſelf.

Draw off a third, and this will be ſtill finer than the former, but paler and more bright coloured. You muſt ſtill purſue the ſame Directions to extract it, letting your Water be but half luke-warm, and take care to manage the Cement dextrouſly with the Spatula's, and ſo preſerve the Colour apart.

You may extract a fourth Colour after this rate, but the Water must be hotter, and you must press the Cement very well with the Spatula's to squeeze out the Colour, and if meer Water will not do, make use of the mild *Lixivium* of Chap. 229. this last Colour will be Grayish, or Ash-colour'd, and of no great value, and therefore not at all to be mixt with any of the rest.

Observe here that you can't take up less than eight Hours full, to extract the Colours, nor than ten or twelve to allow the Water for settling, and if you perceive the Colour does not come out free enough with the warm Water, add a third part of our mild *Lixivium*, and if that does not do, use all *Lixivium*, but let it be cold, and when that fails too of effecting it sufficiently, you must make a *Lixivium* of Vine-stalk Ashes, and this being strained, let it boil for half a quarter of an Hour, until it be sharp enough to bite your Tongue; and then let it settle and grow clear; this is your last shift for extracting your Colour, and with this heated, wash your Cement very well, and set it aside: The whole design of all this trouble, is only to serve for obtaining the greater quantity of *Ultra-marine*, and this consists in the goodness of the *Lapis Lazuli* and the Cement, which the Circumspection and care taken in all their Preparations must advance.

C H A P. CCXXXVI.

The Method of cleansing the Ultra-marine when 'tis separated from the Cement.

AFTER you have extracted all your Colours out of the Cement, and the Water quite settled and separated from them, pour on some of the mild *Lixivium* before prescribed, and so wash them with your Hands (but don't rub it between them) thus you'll take away all the Grease of the Cement; afterwards wash it three or four times in fair Water, and let the Waters settle well before you put them into their proper Vessels.

You may else another way purge the *Ultra-marine*, thus. Take the Yolks of Pullets-Eggs, that have been fed only with Corn, and not with Greens, prick these with a Pin, and so moisten the Colours, kneading the Mass with your Hands, and washing it afterwards with your mild *Lixivium*, until the *Lixivium* falls off clear again. This done, wash them three or four times over with fair Water, letting the Waters settle well before you put them into their Vessels.

This last way of purifying the *Ultra-marine*, is mighty effectual; but here is another help to be used with it, which is a very great Secret, and performed thus: After the Colours are quite washed according to former direction, as well as possible, you must cast therein by little and little, a Bull's-Gall, rubbing it by degrees with your Hands; so wash them often in clear Water, and you'll have the Colour in full perfection.

C H A P. CCXXXVII.

To strain off the *Ultra-marine* already Washed and Purified.

IT is necessary to strain off the *Ultra-marine*, and the rest of the Colours, that if any Grease, or Unctuousity of the Cement remain, it may be taken quite away, for these Colours require a Perfect and Extraordinary Purification.

For this Purpose, take a fine Searce, and pour thereon the last Waters, with which you washed the *Ultra-marine*, and so strain them afterwards through another fine Searce, and a third time through Red *Quintain*, or Crape; but you must observe when you strain them, to let them stand till you perceive them limpid and clear, and so soak off the Water dextrously with a Sponge, and be sure not to strain them promiscuously all together.

This being done to all the Waters, let your Colours settle in their proper Vessels, and dry in the Shade; when dry, put them into little Leather-Bags; tie these close, rubbing and pressing them with your Hands; this will make them very subtile, and when the Bags are opened, they'll shew much fairer than before.

C H A P. CCXXXVIII.

To Correct the Colours just before prepared.

FEW Persons, unless such as are very curious of their Work, make any use hereof, because of the time it takes up, tho it would turn very much to their account; for one Ounce of this Colour corrected, will go farther than three that are not.

If you would make your Colours just before prepared, much finer and effectual than they are, mix them again with a strong Cement, and let them remain therein for three Days; afterwards proceed according to the last directions, to separate them again; reiterate this over again, and you'll have them exceeding good, and tho they diminish somewhat in weight, yet that Loss will be repayed considerably in the Beauty and Value.

C H A P. CCXXXIX.

Another Way to make Ultra-marine, and draw off the Colours with more Expedition.

THIS Method of making *Ultra-marine*, is much more ready than the former; and Experience will shew whether the Colour be a gainer or loser thereby.

Take a Pound of *Lapis Lazuli*, calcine it in a Crucible, and quench it afterwards in Vinegar, so let it dry, and then reduce it to a very fine Powder; grind it on a *Porphyry*, with fair Water, and
so

so set it in a glazed Earthen Vessel in the Shade, until it be dry; if you find it coagulated all in a Mass, you must Powder it again.

This done, make a Cement of three Ounces of *Grecian-Pitch*, four Ounces of Rosin of the *Pine*, three Ounces of *Mastick*, three Ounces of *Frankincense*, two Ounces of Oyl-Olive; set these over a slow Fire in a small Earthen Pot, into which pour first the Oyl, and when that's hot, put in the Rosin, then the Pitch, then the Incense, and last of all the *Mastick*, stirring them continually with the Wooden Spatula, and let them boil a little.

Having made the Cement, get another Earthen Vessel, and put therein the *Lapis Lazuli*, and pour on it the Cement hot, stirring the whole together with the Spatula very leisurely, until they perfectly incorporate; let this stand a whole Day, and when you would draw off the Colours, pour thereon boiling Water, stirring it very smartly.

When it begins to cool, pour it out, and so put in more hot Water; do thus till the Water begins to draw off the Colour, and so continue until it be quite extracted; you may distinguish the Waters, and so set them apart, and obtain the Variety of Colour, as in the former way.

If your Colour seems to be clammy, or nasty, you may correct it thus. Add thereto *Tartar* dissolved in Water, as much as will drown it, and let it repose for one Day at least, so wash it in warm Water, and you will by that means have it very correct, and well purified.

C H A P. CCXL.

Another Way to make Ultra-marine.

GRANTING the two former ways to be sufficient, we will however here give a third, which we believe may as well be pleasing to those who are not satisfied with the other; as to such Persons as have a Curiosity for these sorts of Work; and thus we propose to proceed.

Not to discourse of the Ways to try the goodness of the *Lapis Lazuli*, which we have mentioned sufficiently already, you must break it into gross pieces, as small as Nuts, then set these in a Crucible into the Furnace, till they redden with heat, and so cast them into cold Water; do thus six or seven times, and so reduce them to impalpable Powder in a Porphyry-Mortar well covered over, lest the Powder which is very subtil, should disperse away into the Air, and then searce it with a fine Searce also covered.

After this, take of Rosin of *Pines*, ordinary black Pitch, *Mastick*, fresh Wax, and *Turpentine*, of each three Ounces, of Incense, and Linseed-Oyl, each one Ounce, melt all together in an Earthen Vessel, stirring them very well, that they may mix; this Stuff being well incorporated, cast it into Water, and keep it for use.

To each Pound of *Lapis Lazuli*, add ten Ounces thereof, and set them to dissolve in a Pot over a small Fire, first melting the Cement, and then casting on the *Lapis Lazuli* by little and little, observing such an order in this, and continually stirring the Mass with a Stick, that they may mix insensibly together;

gether; afterwards cast the Mafs into an Earthen Veffel of cold Water, and anointing your Hands with Linfeed-Oyl, mould it up into a number of Cakes, or Rolls, which leave in cold Water for five Days, shifting the Water every other Day.

This done, put them into a large and very clean glazed Earthen Veffel, pouring on them some clean hot Water; when that cools, pour in more hot, and do thus till the Paftils soften with the heat of the Water: This done, put them into hot Water, and let them be until it receive a Bluifh colour; ftrain this Water to referve the groffer pieces, and fo put it into another glazed Earthen Veffel very clean, adding more to the Paftils, which ftrain through a fine Searce afterwards among the former; continue this until all the Colour be extracted, and no more remain behind.

Your Water must be only warm, otherwise it will occasion a Blacknefs in the Colour, which is to be taken care of, and imports very much.

All your coloured Waters being in the Veffel, you may cleanse them of any Unctuousity, by reposing them for twenty four Hours, in which time the Colour will ftick to the bottom; then you may pour off the Water gently into another Veffel, and it will carry off the Greafe along with it; ftrain it afterwards into the Veffel where the Colour is again, through a fine Searce, and all the Greafe and Nastinefs will be left behind; do thus thrice, stirring the Colour very well every time you return the Water to it, that the Filth and Greafe may afcend from it, and it will always ftrain on the Searce behind the Water.

This done, let the Colour precipitate entirely, and fo pour off all the Water very leifurely, for fear of disturbing it; dry this Colour, and you'll have delicate *Ultra-marine*.

If you would imitate this Colour at little charge, make use of our Blue-Enamel, after the same manner, and instead of the *Lapis Lazuli*, observing without exception, the like Regimen and Prescription just now delivered in every respect, and by this means you'll have a very pretty agreeable Colour to Paint with, and for tinging of Glafs.

Many other Ways might be given here for making *Ultra-marine*, besides these we have already laid down, but because the principal part of the Preparation is in every one the same; we look upon these as sufficient, and that it would be but needless to repeat any more.

That the *Lapis Lazuli* may be made by Art as fine and good as the Natural, which is gotten from the Mines, we allow, and should freely assign the Method for it, if there were a scarcity thereof in *France*, but since we have of it in abundance, 'tis much better to employ the time in working the usual way, than spend it unprofitably by taking a more tedious Method.

C. H. A. P. CCXLI.

To make German-Blue.

NOTWITHSTANDING we have in the preceding Chapter shewn how to imitate very nearly the *Ultra-marine* Blue, with ordinary Enamel, whereof we have given the Preparation in *Chap. 190.* yet we will shew too the Way to make *German-Blue* by Art, which is a Colour very fine and convenient to Paint withal.

Take four Ounces of *Mercury*, or *Quick-silver*, six Ounces of Flower of *Sulphur*, and a Pound of *Sal-Armoniack*;

Armoniack; pound these very well in a Stone-Mortar, till all the *Mercury* be quite suppress'd, and no longer precipitable, then put the Mass into a Glass Body; the bottom luted up to the middle; set this on a very slow Ash-Fire, let it stand uncovered until all the moisture be exhale'd, then head it very close, and so improve the heat by degrees, until you bring the Mass to a Sublimation; and thus you'll have a very fine and delicate *Azure*, or *German-Blue*, which reduce to very soft Powder on a Marble, or *Porphyry*, keeping it afterwards for uses in Painting.

The End of the Tenth B O O K.

Y O F

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B O O K X I.

Wherein the Manner of imitating all sorts of Pearl is shewn, and done so effectually, as to give them an equal Splendour and Beauty with those which are Naturally produced in the Sea.

C H A P. CCXLII.

ALL the Ancients who have treated of the several Sorts, and Properties of Precious Stones, have at the same time discoursed of *Pearls*, because they claim a place among the first and best of Jewels, in respect of their Value, as well as their Beauty, and the fixt Quality which they contain, they having been at all times sought after,

after, for the Ornament and Pleasure of Ladies, as they are at this Day ; for these Reasons we thought it convenient to give them a Place among our Works, that (from our Experience) the Curious might be informed how to make such Artificially as fine and splendid, as those which Nature forms in the Depth of the Ocean.

We avow that the Production of Pearls, is very different from that of Precious-Stones, because the latter proceeds from the Earth, and the former quite contrary, from the Shell-Creatures which are shrouded in the Bottom of the Sea ; these receive their Nourishment from the same Liquid Substance which contributes to the Growth of the Shells, and this Slimy Substance is resolved from the Watry Humour of the Creature, by three several Processes. The first dries it by degrees, the next brings it to an hardness, and last of all, 'tis at certain times employed by the Animal, for the Increase of its Shell, and the place where this is effected in the inmost enveloped recesses thereof. Now the first Principle of these, and all other Precious Stones, descends from Above, to wit, the Universal Seed, which alone can give Birth and Increase to all the Tenants of this vast Universe ; and these Precious Stones, as well as the Metals, are nourished in the Womb of the Earth, so the living Creatures bear each other the *Fœtus* within its Parent, &c.

The Oriental Pearls are generated in the Fish, which contains them with the *Mother* as the *Occidental*, or *Western* in our Oysters, but the Beauty of these two, is very different, the Oriental being of a Silver White, and exceeding splendid to the Occidental ; the best of these latter seldom arriving to any higher than the Colour of Milk. We will not here take notice of the particular Places of the *East*, where they are found, but only inform you, That

the best and most beautiful come from the *Persian-Gulf*, about the Isle of *Ormuz Bassora*: They are found in *Europe*, not only in the Sea, but in Rivers, and Fresh Water; we have them from *Scotland*, *Silesia*, *Bohemia*, *Frisia*, *Lorrain*, &c. in all which Places they are found very fine, only those of *Frisia*, are very small.

'Tis thought the Fish wherein the Pearl is generated, becoming Sickly and Weak, and not able to dispose of the Slimy Moisture for the Growth of its Shell, it remains in the Body thereof, and is dried: Hence the Birth of the Pearl, and so by a continual supply of the like Substance still coating it a-new, it becomes large, just as the Stone in the Bladder of Man, and other Creatures, engenders, and is fed by a Clammy Humour, which cannot be emitted by Urine, but remains behind, and so hardens and becomes a Stone: After the like manner the *Bezoar* Stone is bred in the *Indian* Goats of the Kingdom of *Golcondea*, and in the Galls of Wild-Boars in *India*, and the Hedgehogs of *Malacca*; so several other Stones, to which they give the Name of *Bezoar*, are found in the Galls of Beeves, Deer, Goats, and other Animals in *France*, and elsewhere, all which have great Vertues in *Physick*.

How great and effectual those Pearls are in Physical Matters, and what Successes they reach there, is not to our Purpose; we only intend to shew the way of imitating their Beauty by Art so finely, and with such exactness of Lustre, as not to leave it in the power of any to distinguish them easily from the true and Natural ones, they being made of the very finest sort of Paste that can be, and the same Stuff as the true ones.

Poverty and Pride are two inseparable Companions among our *French*; such Ladies as make use of pure Pearl, are those that can afford it, and the little

tle Creatures that cannot reach the Price, but would however appear gay, are obliged to have recourse to the Counterfeit, and content themselves with Imitation only of Nature: 'Tis some Years since the Use of these latter was introduced in *France*, which now, not only the Puny Ladies, but those of Birth and Quality do wear; this proceeded all from that Fashion which insensibly reached still at the larger Pearls, which these Ladies coveted for Ornament; and because they could not be furnished enough with true, they made use of the Artificial; whence the Common Sort of Persons receiv'd the Advantage to vie with Persons of the First Rank and Quality; which they don't fail to do, without Consideration of either Estate, or Condition, but only to conform with the Mode.

The Counterfeit Pearls, which are usually made, are just the Colour of the Pastes, and of no Continuance but for the present; they are done with a Composition of Brittle Glass and Wax a little melted; and for Colouring, they use prepared *Mercury*, Mouth-Glue, or any other Drug, to give them a Brightness, which soon Peels off, and Scales away, especially in the Heat of Summer: The Way which we will give, is not only very good and solid, but exceeding fine, being effected with Seed Pearl; we grant these Pastes to be much dearer than the former, but consider their Fiaeness, and that they'll last for ever; we shall also shew how to make the Counterfeits finer and harder; and we are persuaded, that the Preparation of those we shall assign, will appear so ealie, and yet produce such fine Imitations, as shall be very satisfactory.

C H A P. CCXLIII.

To imitate fine Oriental Pearl.

THE Difference between those which are at present wore by the Ladies, and such as we shall prescribe, as to the Goodness, Hardness, and Fineness of the Stuff, we have already endeavoured to clear.

But before we proceed any further, take these remaining Parts of the Furnace in *Chap. 52*.

The Letter *O*, is the *Balneum Maria*.

P, The Vessel for containing the Sand, or Ash-Fire.

Q, The Eyes, or Holes of the Furnace.

R, Their Cover, which when they are set on, draw in the Air, and increase the Heat for Fusion ; the others are Crucibles.

We did also intend to give the Description of another Furnace at the close of the Fifth Book, as well for the Service of the Matters in that, as the Sixth Book : You may, however take it along with you here.

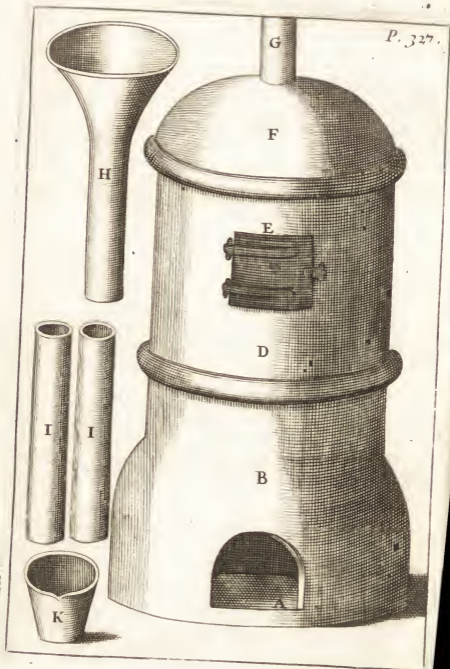
A, is the Ash-hole ; you may add to it an Hovel, for sucking in the Air, which must be luted to it very firmly.

B, is the Inside where the Ashes fall into ; this ought to be lofty for drawing the Air.

C, is the Grate, and must be of very strong Iron Bars.

D, is





D, is the Opening through which the Crucibles and Fuel is put in, this ought to be of well tempered Iron, and luted within side with very good Lute, at least three Inches thick.

E, is the Chamber where the Works are Baked.

F, is the Coverlid of the Furnace, which is to be Vaulted firm, and made of the same Earth.

G, is the Chimney, over which you may set several Iron Plates one above t'other, for drawing the Air.

H, is the Hovel, or shelving place of Iron for the Ash-Hole.

I, are Funnels for the Chimney Plates, and the Hovel.

K, is a Crucible.

If this Furnace be made five or six Inches thick, it will bear all degrees of heat, and serve very conveniently for Private Persons, by making it of a suitable largeness instead of the Glass-house Furnace: When you make your Fire of Wood, there will be no occasion for the Hovel of the Ash-hole. But to go on with our Pearl.

You must take two Pound of thrice distilled Vinegar, one Pound of *Venice Turpentine*, mix them together, and so put the Mass into a Glass Cucurbit; fit to it the Head and Receiver, luting the Joynts; let them dry, and so set it on a Sand-Furnace to distil the Vinegar; keep a gentle heat, lest the Stuff swell up.

Afterwards put the Vinegar into another Glass-Cucurbit, wherein you must hang a quantity at discretion, of Seed Pearl, strung on a Thread of Silver or Gold, done about with a piece of very thin Silk; these must hang in the middle of the Body, so as not to touch the Vinegar; This done, head

your Cucurbit with a Blind Head, and lute it very well; fet it in a moderate B. *Maria* well closed, there to remain for a Fortnight; the heat of the B. will elevate the Fumes of your Vinegar, and they'll continually circulate about the Pearl, and so soften and bring them to the Consistence of a Paste, which being once performed, take 'em off and mould them up in what Form you please, round, long, or Pealike, and as big as you think fit; do this with Moulds of fine Plate gilded within; you must not touch the Paste at all with your Hands, but altogether Work it with a Plate Spatula, which will fill the Moulds, then bore them through with a Porkers Bristle, or Gold-Wire, and so let them dry a little; then Thread them again with Gold-Wire, and set them in a closed Glafs, which lay in the Sun, to dry them to a hardness; set them afterwards in a Glafs Matrafs, in a Stream of Running Water, leaving it there for twenty Days; and about that time they assume their first solidity and hardness.

To give them Transparency and Splendour, you must prepare some *Mercury*-Water, after the Rate we shall prescribe in the next Chapter. When you have taken them out of the last Matrafs, wherein they were for twenty Days, as the Running Water, hang them in a Vessel of Glafs where the *Mercury*-Water is, and so they'll moisten, swell, and assume their Oriental Beauty: This done, shift them out of this Water into a Matrafs closed Hermetically, for fear that any Water should be admitted into it, and so down with it into a Well, leaving it there for eight whole Days; then draw it up, open the Matrafs, and you'll have them as fine and good as any Oriental Pearls whatsoever.

This Method is a little long, but withal 'tis effectual and sure; however 'tis not thus the Philosophers,

phers, or *Virtuosi* Work, for they have another Way, much shorter, having regard only to one Spirit; nor have I Experience enough in their Matters, to make a Discovery thereof; and if I had, it cou'd not be done without disobliging them irreconcilably; therefore take what I have delivered on this Important Subject, in good part; and be assured, that if you were acquainted with that Secret which they so closely reserve, there could be nothing done more by it as to Goodness and Beauty in this Work, than by our prescribed Method, which is very estimable, and more precious than you'll imagine, whereof I can assign you no better, or other Argument, than Experience, to convince you.

C H A P. CCXLIV.

To make Mercury-Water for giving Transparency and Splendour to the Pearls.

HAVING promised this Secret of making *Mercury-Water* to compleat the Transparency, and Natural Lustre of your Pearls, which is a Matter so highly valuable, that a very considerable Sum has been offered in our Presence, for the Discovery thereof, to a certain Person; yet we are free, that Experience should have its due course of informing the Ignorant, and shall, for our part, generously acquit our Engagement.

You must take Plate Tin of *Cornwall* calcined, let the *Calx* be very fine and pure, amalgamate one Ounce thereof, with two Ounces of prepared *Mercury* well purified; wash the *Amalgama* with Water, until the Water remains clear and insipid; then drying the *Amalgama* throughly, put it into a *Matrafs*

trafs over a Furnace, keeping ſuch a degree of heat as is required for Sublimation; when the Matter is well Sublimated, take off the Matrafs and let it cool, and ſo take out the Sublimate; to which add one Ounce of *Venice* Sublimate and grind them well together on a Marble, ſo put them into another Matrafs, cloſe it very well, and ſet it topsy-turvy in a Pail of Water, and the whole Maſs will reſolve its ſelf in a little time, all into *Mercury*-Water: This done, filter it into a Glafs Receiver, and ſet it on a gentle Aſh-Fire to coagulate, and it will be brought to a Crystalline Maſs; take it off, and with a Glafs Peſtle and Mortar pound it very well to a very fine Powder, which ſearce through a fine Searce, and put it into a well ſtopt Matrafs in *B. Maria*, letting it remain till it reſolve again into Water; and this laſt ſhall be the *Mercury*-Water which you muſt preſerve to employ on your Pearl.

C H A P. CCXLV.

Another Way to make theſe Pearls.

THIS is an eaſier way than the former, for by Baking them, (as we ſhall ſhew) you very much ſhorten the time which the Preparation would elſe take up; however you muſt not expect them ſo Delicate and Natural as the firſt, the Cauſe whereof is eaſie enough conceived; for theſe Pearl having enlarged themſelves in the Water, as we already noted, 'tis reaſonable to believe the hardning them afterwards in the Cold, will be of a much more Natural Effect, than if done with heat.

Take very fair Oriental Seed Pearl for this purpoſe, and reduce it to impalpable Powder on a Marble

ble, to dissolve afterwards in *Mercury*-Water, or clarified Juice of Lemons; if this be not effected quick enough, set it in a Cucurbit over warm Ashes, and be very careful to take the Cream (which in a little time will appear at top) immediately off, so withdraw the Dissolution from the Fire, and let it settle a little; this done, pour it gently into another Glass Body, and keep it a-part, you'll have the Pearl in a Paste at the bottom, with which fill your gilded Plate Moulds, made to what bigness, or form you think fit, pressing the Paste with the Silver Spatula, and so shut them up four and twenty Hours; after you must take and bore them through with a Forker's Bristle, close up the Moulds, and leave them in the Oven in a Paste of Barly Dough, which being half Baked draw out and open, taking away all the Pearl, and steep them in the Dissolution just before directed to be kept a-part, putting them in and out several times; so close them in their Moulds and Bake them again with the like Paste as before, only let this last be almost burnt up before you draw it out; thus you'll have the Pearl well baked and hardned.

This done, draw it out, open all the Moulds, take away the Pearls and string them on one or more Gold or Silver Threads; steep them in *Mercury*-Water, given in the former Chapter, for about a Fortnight; after this dry them by the Sun in a well closed Glass Body, so you'll have very fine and splendid Pearl.

C H A P. CCXLVI.

Another Way.

THO this be a more common way than the preceding, we will not omit it, because every one may have his choice to take that Method which best suits with his Apprehension, or Conveniency.

You must, as in the former, take very fair Oriental Seed Pearl ground to an impalpable Powder, and dissolve it in Allom-Water, then rack off that Water, and wash the Paste of Pearl which remains at bottom, first with some distilled Waters, then in Bean-Water, and set it in *B. Marie*, or Horse-dung, to digest for a Fortnight; afterwards take out your Vessel, and the Matter being come to the Consistence of a Paste, mould up the Paste in the gilt Silver-Moulds, as before directed, bore them with a Bristle, string them on Gold or Silver Thread, and hang them in a very well closed Limbeck of Glafs, to prevent the Air from coming in to spoil them.

Thus dried lap them one by one in Leaves of Silver, and split open a Barble, as if you were to Fry him, and so close them all up in his Body, make a Paste of Barly-Meal, and Bake him in it, as you would a Batch of Bread, and no more, afterwards draw it out, and let them dry.

To give a Transparency and Splendour to these Pearls; if you don't care for using our *Mercury-Water*, instead thereof, take the Herb *Gratiola* squeezed in Water, put into this Water six Ounces of Seed Pearl, one Ounce of *Salt-peter*, an Ounce of *Roeb-Allom*, an Ounce of Litharge of Silver; the whole being dissolved, take your dried Pearls, heat them

them first, and then cool them in this Dissolution; thus do for about six times at least, heating and cooling them at this rate therein.

If your Pearl should happen to fail of coming to a sufficient hardness, you may correct and make them exceeding hard by Baking them a second time after this manner.

Take two Ounces of *Calamy*, or *Lapis Calaminaris*, in impalpable Powder; add to this two Ounces of Oyl of Vitriol, and two Ounces of the Water of White Eggs; put all these into a Retort, lute thereto a Receiver, and let them distil, you'll have from them a very fair Water, with which, and some very fine Barly-Meal, make a Paste, Coffin your Pearls in this, and Bake them in an Oven as before, they'll thus become exceeding hard, and recover their Natural Transparency.

There are many other Ways very good to make Pearl with Oyls, which add to the Growth and Largeness of the Seed Pearl, as much as you will have them, but all these Preparations being very tedious, and our Book large enough already, we are of Opinion, 'tis best to let them alone for the present; besides, we have said enough to hand the Intelligent Readers to those Secrets discoursed off, and taught them herein, reserving the more enlarged and fuller Instructions for the first Edition we make hereof in two Volumes.

C H A P. CCXLVII.

How to blanch fine Pearl.

THE Beauty of Pearl consists entirely in the Brightness of their White Colour, such as are Spotted, or of a dark Yellow, being the least estimable; you may however restore these last to a true Luster and Whiteness, by letting them soak and cleanse first in Bran-Water, then in Milk-warm Water, and last of all steep them twenty four Hours in the *Mercury-Water* assigned *Chap. 244.* This done, string and hang them in a well closed Glass Body, to dry in the Sun, as before.

The Bran-Water is made by boiling two good Handfuls of Wheaten-Bran in a Quart of Water, until the Water has drawn all the Strength thereof to it; and thus you are to use it afterwards for cleansing the Pearl; you must string and lay them all together in a glazed Earthen Pan, and pour thereon one third of this Water, when they have soaked, until the Water be tolerably cooled, that you may endure the heat, rub them with your Hands gently to cleanse them the better; continue so until the water be cold, throw out this cold water, and pour on another third part of the Bran-water still boiling, and so use it as the former, throwing it away when cold, and then pouring on the remainder of the water, proceeding still after the former manner; after this, just heat some fair water, and pour it on them, to refresh and take away the Remains of the Bran; shift this water, pouring on more fresh warm water; do thus thrice without handling them, then lay them on a Sheet of very clean white Paper,

to

to dry in a Shade, and last of all steep them in your *Mercury-water*, to bring them to Perfection.

C H A P. CCXLVIII.

Another Way to Blanch and Cleanse fine Pearl.

THERE are several other easie ways to cleanse and whiten the Pearl, which may serve on indifferent occasions, and for ordinary uses.

Pound Alabaſter to impalpable Powder, and rub the Pearl with it very gently, this will cleanse them, or you may let them remain in this Powder twenty four Hours afterwards, they be still much the better for it.

White Coral has also the same Effect as the Alabaſter, using it after the like manner.

Tartar calcined white, and divested of all its moisture, as we have shewn elsewhere, is very good for the same use.

Clary, or Old Salt dissolved, filter'd, coagulated, well dried and ground, is as effectual as any of the former things, for cleansing and blanching of Pearl, by rubbing them therewith a considerable time; you may afterwards lay them up in some *Millet* ground large, and it will contribute to them a Natural Brightness.

There are several other ways to cleanse and whiten Pearl, but those we have here proposed, are sufficient.

C H A P. CCXLIX.

To make Counterfeit Péarl, very like the Natural.

THIS Rêceipt for making Counterfeit Péarl has a much more fine and solid effect than any now a-days in use.

Take Chalk well purified, and separated from its grosness and Sand, make Paste thereof, and so mould it up like Pearl in a Mould for that purpose; pierce these through with a Bristle, and let them afterwards dry before the Sun, or for more dispatch in an Oven, till they receive a just hardness; then string them on a very fine Thread of Silver, colour them over lightly with *Bole-Armoniack*, diluted in water of Whites of Eggs, then drench them with a Pencil and Fair water, and so apply Leaf-Silver all over, and let them dry; this done, burnish them with a Volf's Tooth, till they shine very finely.

To give them the true Colour of Pearl, make a Glue of Parchment, or rather Vellom Shavings; thus. Wash the Shavings in warm Water very well, and boil them after in a new Pot to a thickness, and strain this Glew.

When you use this Glue, you must warm it on a flat Vessel, then dip the string of Pearl therein, so as not to fill the interval Inches between each Pearl, but that every one may be done all over equally; after this let them dry; if you observe any Baulk, or Defect on them, you may dip them in a second time; thus they'll assume a finer and more transparent Whiteness, and will have a certain Darkness within, and Lustre on the outside, which compleats and
brings

brings them to the Natural Beauty of real fine Pearl.

You may after this manner do with Transparent Beads of Alabaster, and very white Mouth-Glew, and it will add very much to their Beauty ; but Leaf Silver does certainly contribute most of any thing else whatever to their Splendour.

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B O O K XII.

*To make Crystal Looking-glass: How to Grind, Polish,
Diamond-Cut, and Silver them: To Make Glass and
Metal Mirrours, &c.*

C H A P. CCL.

THIS is the Twelfth and last Book of our *Art of Glass*, which should have indeed succeeded the First; but we waited some Memoirs on the Subject, nor we have not yet found them; this made us put it off, and place it here: Besides, there is such a Coherency of Matters, in the Order of the Second Book, as we could not possibly dispose of any other way, without breaking their

their due Courſe, and the Affinity and Connection they have with each other, which the Reader may eaſily perceive; but what matter is it where we place this, ſo that it may be found among our Works; and we deliver nothing therein, but what we have been familiar withal.

That of Looking-glaſſes is undoubtedly the fineſt and more admirable part of Glafs-Work; 'tis the moſt perfect Maſter-piece of all the Art. We preſume the Order we have given in placing it here, will be approved of, ſince 'tis the Subject of the laſt Book, and the *Twelfth*, which is a perfect Number, and comprehends all other in Sacred Philoſophy.

Twelve, the Number of Grace and Perfection, has been highly eſteemed at all times for thoſe Wonderful Properties aſcribed to it; 'tis very much celebrated in Holy Writ, and the Divine *Plato* has uſed it with the ſame Deference in his Works, if the Account which thoſe, who were intimate with this Famous Number *Twelve*, have left of it, were not Foreign to our Deſign, we could give the Curious ſuch extraordinary Relations, as would create a Mighty Reſpect in them for the ſame.

We already noted in the Firſt Chapter, that 'tis about Two Hundred Years ſince the Invention of Looking-glaſſes, and alſo how they were found out: Before theſe the Ladies made uſe of Steel, or Copper, or well poliſhed Marble Mirrours, theſe have been in uſe for many Ages: We can by the help of Hiſtory, look back on them as far as the Time of *Ozias* King of *Juda*, which was about the Fourth or Fifth *Olympiad*; and as many Years before the Building of *Rome*; Seven Hundred and ſixty four Years after this, our *Chriſtian Era* commenced. Now tho' the *Tyrians* were very converſant in Glafs-work, yet they had not the Knowledge of making Looking-glaſs.

Among all the Excellencies of the Art, none comes near this, nothing can be finer, or admit of greater Admiration, than to see that all the Actions of the Beholder, are so justly and lively represented in these Glasses, that he has an opportunity of discovering what is to be valued on him, and correcting what's amiss; these Truths are too apparent for any to disprove; for the Experience of them are at this Day to be made as easily by the Meanest as the Greatest Persons.

We shall discourse but very briefly of the Metal for making these Glasses; for 'tis the same Crystal we have prescribed throughout the First Book, but we will enlarge on this Matter a little, for the conveniency of making the Mirrours of Metal, &c. whereof we'll shew how to compound the Stuff, and the way of working them.

C H A P. CCLI.

The Way to make Looking-glass.

ALL those who employ themselves in *the Art of Glass*, do it always without derogating from their Quality, as we have noted in *Chap. 3.* which our Kings have always taken care to maintain.

The Undertakers of the *Royal Glass-Manufacture*, in *France*, when they obtained their Grants of Priviledges, did at the same time require, That all Persons of Quality, who should associate in the Manufacture, might do it without lessening their Quality; to which his Majesty agreed with Exemption from their *Taille*, and several other Privileges, as Quartering of Soldiers, &c. for all such, their Substitutes, Servants, and Domesticks.

The

The first Grant of Priviledges to this Manufacture, bears Date in *October* 1665. in Favour of *Nicholas du Noyer*, for Twenty Years, which was renewed by Letters Patent of the last of *December* 1683. for Thirty Years to *Peter Bagneux*.

The second Privilege for the *Manufacture Royal of Large Glass*, was granted *Decemb. 14.* 1688. to *Abraham T'Hevert*, for Thirty Years, with the saving Privilege of Nobility as the former: These having settled at *St. Gobin*, near *La Fere*, did by Letters Patent of *February* 1693. obtain Exemption from the *Tailles*, (or Subsidy on the Third Estate, which is a constant Tax) and other Impositions, as well for themselves, as their Deputies and Servants.

And to avoid all Contest, these two Manufactures were united by Order of the Council of State, *April* 19. 1695. and Confirmed *May* 1. following, under the Name of *Francis Plaistrier*.

Now for making these Glasses, the same Crystal assigned throughout *Book* 1. is sufficient; the Difference is only instead of Working it as you do there, to cast it flat and not blow, as in *Chap. 3.* to which we refer the Reader.

The Manner of Casting the Metal, did not commence with the Invention of Looking-glass; for the Workmen at first, used to take a piece of Metal very large, clipt and done on the Marble into Quarries as big as they'd have them; these they set afterwards on a Pallet of Iron in the Furnace, till they were in a Fusion, and so spread and united; hence they took and put them into another little Furnace for that purpose, *S. S. S.* with fine searced Ashes to Bake; this done, they raised the Fire by degrees, and so let it go out again, and drew off the Glasses, working them after our manner in the next Chapter.

Thus too they wrought their little Round Glasses, or Mirrours, first shaping them out of a long piece of Metal, by Circumvolution, and afterwards clipping them as the former, so finished them in the Furnaces, and made them fit for Polishing.

Since that time having attempted to make them very large, they fell upon the Way of Casting the Glass like other Metal on Sand Beds, such as the Founders use; and to perform it the better, they have a Roller of Metal to run over the Surface of the Glass Metal for enlarging the Plate, and to smooth and compact it withal.

For such as would make them very large indeed, as are wrought at *Muran* near *Venice*, and in our Royal Manufactures, they had a much better, and easier Method than doing them on Sand, *viz.* in large Tables of well polished Copper, whereon they cast the Metal, but these not having strength enough to abide the Heat, we have since made use of Iron, which will sufficiently perform the Effect.

These Tables whereon the Glasses are at first sight Cast to their proper Largeness, must have their bottom sunk as low as you intend the Thickness of your Glass-Plate, and have a Conveniency to push it out, as soon as ever 'tis prepared thereon.

Some make use of Marble ones with Covers, over which they have a Plate, or Runner of Metal, to slide and press it on the Glass Metal, that the Glass Plate may be the more compact and even.

Thus are large Glasses made, which are no less surprizing than pretty, and 'tis a very considerable Improvement they are brought to at this Day, of making them so extraordinary large for Mirrours: One would admire to what Perfection the Wit of Man may arrive at, and is capable of bearing from the advantage of Serious Application and Study in profound Matters.

C H A P. CCLII.

To Grind, Polish, and Cut the Looking-Glass.

AFTER you have it from the Furnace, you must lay it on Sand, in a convenient place to strengthen, else it will break in Working it; then grind it on very fine Sand and Water.

This time 'tis that the Workmen give it the first Fashioning; then they do it over again with Powder of *Emery* instead of the Sand, and so give it a second Improvement; when they have done it enough with these two, they do it a third time with *Tripoly* instead of *Emery*, this Polishes the Glass perfectly; others give these Glasses a fourth Process with *Calx* of Tin, to bring them to a very extraordinary Lustre and Polish.

The Diamond-Cut is done by Grinding the Crystal on Drift Sand and Water, as much as you think convenient.

These are the several Methods for finishing the Looking-glass all to the Silvering, which must be disposed thereon, as in the next Chapter before it has the Quality of a Mirrour.

C H A P. CCLIII.

To File, or Silver the Looking-Glafs.

THE Glafs is not perfected, till it be Silvered ; for without that, it is impossible it should distinctly shew the opposite Objects; 'tis the Filing, or Silvering therefore which gives it its just Perfection.

For this you must have a firm well smooth'd Table, much greater than the Glafs, whereon spread one or more Sheets of very fine Tin, let them be as thin as Paper, and so prepared, as not to have any Rump, Furrow, or Spot, else the Glafs will be spoil'd: Over these Sheets spread good *Mercury*, quite covering them with it ; when the *Mercury* has soaked in well, place the Glafs thereon, and it will stick to them ; then turn it, and spread Sheets of Paper on the Filing ; press it gently, smoothing and stroaking it with your Hands, to take off the Superfluous *Mercury* ; then dry it in the Sun, or by a soft Fire, and it will become perfect.

But because 'tis not so easie to file the Large Glafes as the small, you must have recourse to a Table for the purpose, with a Diamond-Cut rising Border, to keep the Sides of the Glafs firm, whereon you must lay it, with the Backside, (which is to be filed) upwards ; then lay on the Sheeted Tin very smooth, and closely ; over these the *Mercury*, to dissolve them ; then with the Sheets of Paper cover all, and so smooth, and run it over with your Hands to take away the Surplus of the *Mercury*, and so dry it as before.

The rest of the Work depends on the Framing them, and giving the suitable Ornaments accordingly.

C H A P. CCLIV.

How to make Spherical Concaves, and Convex Glasses, commonly called Burning Mirrours.

BEFORE we discourse of the Metal Mirrours, we will shew how to do such of Glass: The Use of these Glasses is to unite the Sun-Beams, and so kindle a Flambeau, Wood, or any other Combustible Matter. By them Metals also may be dissolved in a little time as easily as in a Crucible on a Furnace, or at a Forge.

The Whole Mystery of making them, is to have the Moulds of a Round Shape, otherwise they have but a very weak Effect on the Sun Beams; the Moulds must be so exactly made, as neither side shall differ from the other.

To make the Concave Glass, you must have the Mould Convex, and the Convexity thereof must be made by a Sphere, according as you have it greater or less; and 'tis from this Sphere the Convexity of the Mirrour must be taken: As for instance, Take a Sphere of what bigness you please, divide it equally, and also one of the Hemispheres in three equal parts, by Planes parallel to the great Circle, the Convex Segment shall then be the sixth part of the whole Sphere, and the Measure of your Mirrour: To do this you may have recourse to the Works of *Archimedes*, *John Baptista Porta*, *Kircher*, and many other Authors.

If you would make the Mirrour a Convex Glass, you must have the Moulds Concave, and these you may do two ways, thus : Take the two Concave Sides of the Mould, and closing them together equally, as the Founders do their Frames, pour in through the Mouth of the Mould your Crystal Metal, letting it fill the Mould, and afterwards cool. Another way is, to take two Concave Mirrours, and joyning their Faces, solder them well all about, only leaving a small Orifice, through which you may fill it with some *Aqua Vita*, and so stop the Hole, and frame them with Wood, or Metal : This sort of Mirrour, has a more ready Influence on the Sun Beams than any other ; we'll say something of the Effect thereof when we come to speak of the Metal Mirrours, but upon the whole Matter you must have these Glasses all very well polished.

These Burning Glasses may be made Parabolick, or Spheroidal, and such have still a better Effect than the Spherick : You must proceed in Moulding them as with the former ; you must observe a just proportion in doing them ; for when they are too much raised, they are hindered by their Deepness from having a good Effect ; and upon this depends the Whole Nicity of the Art.

C H A P. CCLV.

How to make Metal Mirrours, Concave Sphericks, or Parabolicks, usually called, Steel Burning Mirrours.

THE Authors cited in the former Chapter are very useful to be consulted on this occasion to demonstrate the Method, Use, and Excellency of these Mirrours; for which reason we shall say but little on that Subject.

The Moulds for them are prepared as in the former Chapter, whether Concave, or Convex, and for such as are flat, they may be cast on Sand.

The Metal of these Mirrours is called *Steel*, because it is of a very hard and bright Composure and Temper, and the harder the Metal, the better the Mirrour, and the easier to polish; the Whiteness of it is very convenient for giving the Quality of Burning, and not only for that, but several other Uses; if it be too Red, or Black, it alters the true Distance and Colour of its opposite Objects; you must therefore make them of this following Composition.

Take three Pounds of Copper, one Pound of fine Tin, half an Ounce of White *Arsenick*, an Ounce of *Tartar*: First, melt the Copper, then put the Tin in immersed in the Copper, else it will fume away in the Melting, and leave the Copper behind; these two being well melted together, cast in the *Arsenick*, and *Tartar*: After this let all melt for two or three Hours, and so Mould it.

Some Persons dose with the former weight of Copper and Tin, half a Pound of White *Arsenick*; others instead of *Arsenick*, put in a quarter of a Pound
of

of *Antimony*. Here is another way to compound this Stuff of the following Ingredients; and after that another Composition much more excellent than either.

Take a Pound of well refined Copper, melt it, then add three Pounds of fine Tin; as soon as these are well melted, add six Ounces of Red *Tartar* calcined, one Ounce of *Salt-petre*, two Drams of *Allom*, and two Ounces of *Arsenick*, let these melt for three or four Hours, that the Salts may evaporate, and the Stuff will be fit for moulding; this Stuff is more solid and hard than the former, and much better to make the flat Mirrours for Looking. You shall be shewn how to polish them in the next Chapter.

We having promised to assign a much more excellent Stuff for Concaves than the former ones, will give it here; because of the hardness and compactness thereof, it is more capable of polishing, and consequently much better than the rest.

Take Plates of Copper one Pound, mince 'em that they may be put into a Crucible, imbibing them with Oyl of *Tartar*; then powder a quarter of a Pound of White *Arsenick*, and put these S. S. S. as we have shewn the Method elsewhere, until you fill the Crucible; pour on them afterwards Linseed-Oyl to cover the *Arsenick* and the Copper; head and lute your Crucible, and when the lute is dry set it on a Sand-Furnace, letting the Sand arise no higher than the Head; heat the Furnace very gently till it arrive at a just degree, and the Oyl begins to evaporate; by this time the Oyl will prepare the Copper for retaining the *Arsenick*, which must enter the Copper as easily as Oyl does Leather; set it again on fresh Sand, and increase the heat of the Furnace, giving it the same degree as before, until the Oyl evaporate and boyl up; then take off the Crucible, let it cool, and break it, you'll find your Copper of several Colours,

lours, and would be much better, if instead of *Arsenic*, you made use of *Orpiment*.

Take of this Copper one part, of Latten two parts, melt the Latten on a smart Fire, and so put in the Copper; when they are well melted, cast the Metal Drop by Drop into a glazed Earthen Vessel full of Water, over which lay a Bush, or Broom for the Stuff to go through; thus you'll have a Metal not to be touched with a File, nor Brittle, as good as any Steel for all uses whatsoever.

Take of this hard Metal three parts, and best Tin of *Cornwall*, which has no Lead in't, one part; melt the Metal before you put in the Tin; after these are well incorporated, you may fill your Moulds, &c.

This is the best of all our Compositions for making of all sorts of these Metal Mirrours; 'tis white, hard, not Brittle, and very easily polished exceeding fine.

C H A P. CCLVI.

To Polish the Steel Mirrours.

WHATSOEVER Exactness you use in Moulding these, they do never receive their true Shape and Perfection, until they are Polished and Burnished; in doing which, least you should spoil, or endamage them, you must Work away the Outside at the Wheel, with the Sand-stone, which the Pewterers and Brasiers make use of, and then apply the Handle, and Polish them sufficiently by rubbing with Water.

This done, take it off this Wheel, and put it on the Second, where rub it with *Emery* prepared, that
it

it may be finely polished, so as the Scars may be scarce perceptible. Do this in an Oblique Line.

Then take it off this, and set it on such another; rub it with Blood-stone prepared, and afterwards use *Calx* of Tin, working it for a long time, until it have its due Burnish and Perfection, still doing it in the same Obliquity.

You must keep these Mirrours from the Moistness of the Air, and Steams; or if they should happen to be endamaged by any such, you may restore them by rubbing on them a piece of Deer, or Goats Skin, humouring the Oblique Line; you must not use any Woollen, or Linen Stuff, for they spoil these Mirrours.

These Mirrours may be also polished with Lead Artificially melted, with Emery and Water, for the First Process; and very fine Emery and Lead for the Second; and in the Last, with Blood-stone and Tin Dross; these make a finer Burnish than the former; for the Mirrour is highly polished by the Tin-Dross.

This is all we resolve to give account of on these sort of Mirrours, for attracting and uniting the Sun Beams. There are many other, as Cylinders, Pyramids, whereof we forbear to discourse, since the Authors which have writ of them, have done it with much more sufficiency than we pretend to.

They ascribe the first Invention of Burning Mirrours to *Prometheus*, when he stole the Fire from Heaven to carry to the Earth. *Archimedes* made very happy use of them in defence of his Country, when he burnt the Fleet of *Marcellus* before *Syracuse*, by placing his Burning Glass on the highest Turret in the City, whence proceeded such a mighty Conflagration, as destroy'd that vast Flota in spight of *Neptune* and the Waters. *Proclus* too, a Brave and Famous Mathematician, burnt the Fleet of *Vitelian*,
that

that came to Besiege *Constantinople*; which he preserved by this Industry.

Many other Fine and Admirable Relations might be given of the Effects of these Mirrours, but they are too tedious: We shall therefore here put an end to this Chapter, and consequently the whole Book, desiring the Reader to receive all in good part, and excuse the lesser Faults of Impression and Phrase, since we can assure him the Doses are justly prescribed, and the Preparations exact which we have assigned.

The End of the Twelfth B O O K.

A N

1847

CLASSIFIED

The following is a list of the names of the persons who have been classified as follows:

Name	Classification
John Doe	Class A
Jane Smith	Class B
Robert Johnson	Class C
Mary White	Class D
William Brown	Class E
Elizabeth Green	Class F
Thomas Black	Class G
Sarah Grey	Class H
James Blue	Class I
Anna Red	Class J
George Yellow	Class K
Charlotte Purple	Class L
Richard Orange	Class M
Lucy Pink	Class N
Henry Silver	Class O
Isabella Gold	Class P
Samuel Bronze	Class Q
Victoria Iron	Class R
Benjamin Lead	Class S
Rebecca Tin	Class T
Samuel Copper	Class U
Elizabeth Zinc	Class V
George Nickel	Class W
Charlotte Cobalt	Class X
Richard Manganese	Class Y
Lucy Selenium	Class Z

A N
 APPENDIX

Shewing how to Make

GLASS-EYES

Very Natural.

THIS Secret is fine, and never was made publick before: The Eyes may be done so curiously, that the Nicest Examination can scarce discover them to be Artificial.

You must have a lighted Lamp, and a long hollow piece of Crystal, as thick as the middle of a Pipes Shank; the Bore must be pretty wide, and the Pipe about four Inches in length; let the Mouth-end be like that of a Trumpet, and the other widened and turned outwards like the Breech; this may be done by heating one end in the Flame of your Lamp, and whilst it is hot, turn it so with a pair of Nippers.

Hold this Pipe in your left hand (having before put a little Cotten into it, about an Inch or less from the Mouth, to hinder your Breath from being too

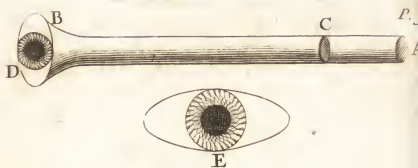
violently blown on the Work;) let it be between your two Fore-fingers and Thumb (as you'd make a Pen;) heat the Wide end in the Flame red hot, and so wind long Thread White Enamel about the grossness of a Bugle; your Threads must be red hot too, and solid, then they'll easily joyn the Crystal Pipe; make by this Serpentine Winding a Convex of such Diameter, as when blown out will answer that of the Eye you would imitate.

This done, keep the Work in the Flame till red hot, and so blow it out into an Orbicular Form, of a just largeness; then heating a-new the top, pinch with your Nippers a small Hole, and so turn it with the end of them round, of the bigness your Eye must be within the White; in this Hole wind pure Thread-Crystal as small as fine Packthread, till you fill it up, taking away the Superfluity (if any) with your Nippers; heat it in the Flame, blowing gently often; by this the Crystal will work Convexly, to give you the full shape of your Eye.

Upon this Crystal (heating it again) you must wind Crystal Thread small almost as Horse-hair, and coloured as the Eye you'd imitate; cover it once over, and as soon as the Center fills, cut off the Thread with your Nippers, that no Surplus remain: You must hold it often in the Flame, still gently blowing to keep it in a true order.

Afterwards with a piece of Black Enamel, about the thickness of a Duck-Quill, lay on the Black of the Eye; be very careful not to give any of these Threads or pieces of Enamel, too great a heat, nor apply too much of this Black, for it will spread; therefore you must proportion your Heats and Quantities very exactly, still continuing the Work in the Flame, and gently blowing as often as you'd restore it to its Shape: After this, cover the Crystalline part of the Eye with some Crystal of a solid
piece,





AB. is the Cristal Pipe

A. the Mouth

C. where the Cotten must be

B. the widened end of the Pipe

BD. the glass eye a making

*E. the forme of the Eye shewing
how the small coloured threads
must be laid on*

piece, about the thicknes of a Goose-Quill, and so heating and blowing as before, bring it to its due Form.

Then hold the Side thereof in the Flame, and with a Thread of White Enamel, not quite so hot, you may as it were cut out the Shape of your Eye, as you'd have it, Oblique, or otherwise; then border it with the said Thread, holding the Edges in the Flame, to become smooth and even.

Now if you find too much Enamel in any part of the Border, you may take it off with another Thread of the same Enamel, not altogether heated so much as that you'd diminish, which must be held in the Flame accordingly: Then proceed to Cutting or Filing; and last of all, Anneal it in a small Pan of Coals, and you have finished.

F I N I S.

THE
INDEX.

BOOK I.

- Chap. 1. **T**HE Rise, Antiquity, and Use of Glass. Pag. 1
Chap. 2. The manner of Building Furnaces for making Glass. p. 19
- Chap. 3. The way of making Glass, and the Privileges of Gentlemen who make it. p. 25
Instruments for the Work. p. 31
- Chap. 4. The Places where Polverine, Rochetta, and Soda are found. p. 33
The Vertues of Kali Salt in Curing the Stone, Ulcers, &c. p. 37
- Chap. 5. To Extract Salt of Polverine, Rochetta, and Soda. ibid.
To Calcine Tartar. 41
- Chap. 6. To make Frit for Crystal. 42
A pretty Dissolution of Glass by Cold. ibid.
- Chap. 7. To Extract Salt from Polver of the Levant. p. 46
- Chap. 8. Observations for a Gold Colour in Crystal. p. 48
- Chap. 9. To Extract Salt from Fern. ibid.
- Chap. 10. To make Salt of several Vegetables. p. 50
Salt for Manuring. p. 52
- Chap. 11. To make fine Crystal of Salt of Lime. p. 54
Chap.

The INDEX.

Chap. 12.	<i>To make ordinary Frit.</i>	p.55
Chap. 13.	<i>To make very fine Crystal.</i>	p.57
	<i>The Vertues of Sandever.</i>	p.58
Chap. 14.	<i>To make common Glass White & Crystalline.</i>	p.59
Chap. 15.	<i>To purifie Salt of Tartar.</i>	60
Chap. 16.	<i>General Remarks for all Colour s.</i>	p.61
Chap. 17.	<i>To prepare Zaffer.</i>	p.62
Chap. 18.	<i>To prepare Manganese.</i>	p.64
	<i>The Philosophers Magnesia.</i>	p.65
Chap. 19.	<i>Feretto of Spain the Mineral.</i>	p.67
Chap. 20.	<i>How to make Feretto of Spain.</i>	p.68
Chap. 21.	<i>Another extraordinary way to make Feretto of Spain.</i>	p.69
Chap. 22.	<i>Another way to make it of Copper only.</i>	p.70
Chap. 23.	<i>A Second way to make it of Copper only.</i>	p.71
Chap. 24.	<i>To make Crocus Martis.</i>	ibid.
Chap. 25.	<i>Another way to make it.</i>	p.73
Chap. 26.	<i>To make it with Aqua-fortis.</i>	p.74
Chap. 27.	<i>To make it with Aqua Regalis.</i>	ibid.
Chap. 28.	<i>Another way.</i>	p.75
Chap. 29.	<i>The best way to make Crocus Martis.</i>	p.76
Chap. 30.	<i>To Calcine small Copper Plates.</i>	ibid.
Chap. 31.	<i>Another way.</i>	p.78
Chap. 32.	<i>To Calcine it to a Red Powder.</i>	p.79
Chap. 33.	<i>To make thrice Calcined Copper.</i>	ibid.
Chap. 34.	<i>Another way.</i>	p.80
Chap. 35.	<i>To make Æs ustum.</i>	p.81
Chap. 36.	<i>Another better way.</i>	ibid.
Chap. 37.	<i>The way to make Crocus Martis.</i>	p.83
Chap. 38.	<i>Another way.</i>	p.84
Chap. 39.	<i>Another easie way.</i>	p.85
Chap. 40.	<i>The first Egmarine Colour for Glass.</i>	ibid.
Chap. 41.	<i>Another Bluer Sea-green.</i>	p.87
Chap. 42.	<i>Another with Crystal.</i>	ibid.
Chap. 43.	<i>A fine Egmarine.</i>	p.83
Chap. 44.	<i>Another.</i>	p.89
Chap. 45.	<i>Another finer than the rest.</i>	p.90

The I N D E X.

Chap.46.	<i>To make Emerald Colour in Glafs.</i>	ibid.
Chap.47.	<i>Another finer.</i>	p.91
Chap.48.	<i>Another wonderful Green.</i>	p.92
Chap.49.	<i>Another Oriental Emerald.</i>	p.93
Chap.50.	<i>To give Glafs a Turcoife-Blue.</i>	p.94

B O O K II.

Chap.51.	T <i>He Design and Contents of this Book.</i>	p.96
	Chap.52. <i>To make Aqua-fortis.</i>	p.98
	<i>To make strong Lute.</i>	p.101
	<i>A Furnace for feveral Ufes.</i>	p.112
Chap.53.	<i>To purifie Vitriol for making the Aqua-fortis stronger.</i>	p.104
Chap.54.	<i>To make Aqua Regalis.</i>	p.105
Chap.55.	<i>Another far stronger, called Water of the two Champions.</i>	p.106
Chap.56.	<i>Another more eafie way.</i>	p.108
	<i>Another with Spirit of Salt.</i>	ibid.
	<i>The Sovereign Menstruum of the Philofophers.</i>	p.109
Chap.57.	<i>To Calcine Tartar.</i>	ibid.
Chap.58.	<i>To make fair Chalcedony.</i>	p.110
Chap.59.	<i>A Second fort.</i>	p.113
Chap.60.	<i>A third and laſt way.</i>	p.116
	<i>Mercury purified,</i>	ibid.
	<i>Silver Calcined.</i>	ibid.
	<i>Common Salt purified.</i>	p.117
	<i>Sal-Armoniaçk purified,</i>	ibid.

B O O K III.

Chap.61.	T He Design and Contents of this Book.	p.121
	Chap.62. A Gold Yellow in Glafs.	p.122
Chap.63.	A Granat Colour.	p.123
Chap.64.	An Amethyst Colour.	p.124
Chap.65.	A Sapphire Colour.	p.125
Chap.66.	A finer.	ibid.
Chap.67.	A Velvet-Black Colour.	p.126
Chap.68.	Another fairer.	ibid.
Chap.69.	Another yet much fairer.	p.127
Chap.70.	A Milk-white colour.	ibid.
Chap.71.	Another fairer.	p.128
Chap.72.	The Colour of Lapis Lazuli in Glafs.	ibid.
Chap.73.	A Marble Colour.	p.129
Chap.74.	A Peach Colour.	p.130
Chap.75.	A deep Red.	ibid.
Chap.76.	Rock-Crystal calcined.	p.131
Chap.77.	To make Pearl Colour in Cryst al.	p.132
Chap.78.	To Tinge Natural Cryst al of a Viper Colour.	p.133
Chap.79.	To make in Natural Cryst al, the Colours of the Ruby, Topaz, Opal, Heliotrope, &c.	p.134

B O O K I V.

Chap.80.	T He Design and Contents of this Book.	p.136
	The Philosophers Lac Virginis.	p.137
Chap.81.	To calcine Lead.	p.138
Chap.82.	To make Glafs of Lead.	p.139
Chap.83.	To Work this Glafs.	p.140
Chap.84.	To give it a fine Emerald colour.	p.141
Chap.85.	To give it a fairer.	p.142
Chap.86.	To give it a Topaz colour.	ibid.
Chap.87.	To give it an Egmarine.	p.143
Chap.88.	To give it a Granat.	p.144
Chap.89.	To give it a Sapphire.	ibid.
Chap.90.	To give it a Gold colour.	p.145

B O O K V.

Chap.91.	T He Design and Contents of this Book.	p.147
	The Original of Precious Stones, and Metals.	p.148
Chap.92.	To prepare Rock Crystal.	p.150
Chap.93.	To make fine and pure Salt of Tartar.	p.152
	The Philosophers Salt of Tartar.	p.153
Chap.94.	Paste for Oriental Emerald.	ibid.
Chap.95.	Another deeper.	p.155
Chap.96.	Another fairer.	p.156
Chap.97.	Another fairer.	ibid.
	Chap.	

The I N D E X.

- Chap.98. *Another very fair.* p.157
- Chap.99. *Paste for Oriental Topaz.* ibid.
- Chap.100. *Another fine Topaz.* p.158
- Chap.101. *An Oriental Crysolite.* p.159
- Chap.102. *ASky-colour Paste for Beryl, called Aqua-
Marina.* ibid.
- Chap.103. *A Paste for Sapphire.* p.160
- Chap.104. *Another Oriental Sapphire.* p.161
- Chap.105. *Another deeper.* ibid.
- Chap.106. *Paste for Oriental Granat.* p.162
- Chap.107. *Another of a deeper colour.* p.163
- Chap.108. *Another fairer.* ibid.
- Chap.109. *Observations for Pastes and their colours.* p.164.
- To prepare the Crucibles.* p.165
- Chap.110. *To make Sulphur Saturni to be used in Paste
for Gems.* p.166
- Observations on the Sweetness of Sal Saturni.* p.169
- Chap.111. *To make very hard Pastes with Sulphur Sa-
turni, and to give them all the colour of Precious
Stones.* ibid.
- Chap.112. *Saturnus Glorificatus, how to make it.* p.171
- Chap.113. *To make Paste for Precious Stones of Satur-
nus Glorificatus.* p.172
- Chap.114. *To make a very fair Carbuncle.* p.173
- The Opinions of several Authors concerning the Car-
buncle.* ibid.
- The Sentiments of our Author.* p.174
- Chap.115. *Another more Noble, called Carbunculus
nocte Illuminans.* p.175
- The Author's Opinion thereof.* p.176
- A fine way to Calcine Gold.* p.177
- Chap.116. *To make Oriental Ruby.* p.178
- Very fine Rubies of Queen Elizabeth of Aultria,
and Mary de Medicis.* p.179
- Chap.117. *To make Balas Ruby.* p.180
- Chap.

The I N D E X.

Chap. 118. <i>To make Oriental Sapphire.</i>	ibid.
Chap. 119. <i>To make Oriental Emerald.</i>	p. 181
Chap. 120. <i>To make Turcoife.</i>	p. 182
Chap. 121. <i>To make Oriental Topaz.</i>	p. 183
Chap. 122. <i>To make Cryfolite.</i>	ibid.
Chap. 123. <i>Another way of making all sorts of Precious Stones much harder.</i>	p. 184
Chap. 124. <i>To make a fair Emerald.</i>	p. 185
Chap. 125. <i>To make a Violet Sapphire.</i>	p. 186
Chap. 126. <i>Another Violet Sapphire of a deeper colour.</i>	ibid.
Chap. 127. <i>Another very fine Blue Sapphire.</i>	p. 187
Chap. 128. <i>Another fine Sapphire.</i>	ibid.
Chap. 129. <i>Another admirable Blue.</i>	p. 188
Chap. 130. <i>To make Beryl, or Egmarine.</i>	ibid.
Chap. 131. <i>A deeper Egmarine.</i>	p. 189
Chap. 132. <i>To make a fair Jacynth.</i>	ibid.
Chap. 133. <i>Another fairer Jacynth.</i>	p. 190
Chap. 134. <i>Another Oriental Jacynth.</i>	ibid.
Chap. 135. <i>To make a very fine Powder.</i>	p. 191
Chap. 136. <i>Another Powder.</i>	ibid.
Chap. 137. <i>Fargons of Auvergne, how to make those Red, that are of a Gridelin colour.</i>	p. 192
Chap. 138. <i>To Extract the Tincture of the Fargons, and therewith to make a fine and very hard Diamond.</i>	p. 193
<i>How to prepare a Sulphurous Tripoly,</i>	p. 194
Chap. 139. <i>To make a Diamond.</i>	p. 195
Chap. 140. <i>To make Diamond of Alanfon.</i>	p. 196
Chap. 141. <i>To give the Natural Colour and Hardness of true Diamonds to Crystal, and Diamond of Alanfon.</i>	ib.
Chap. 142. <i>Another Way.</i>	p. 198
Chap. 143. <i>Another way to harden them, and make them sparkle as much as fine Natural Diamond.</i>	ibid.
Chap. 144. <i>To turn White Sapphire into a true Dia- mond.</i>	p. 199
Chap. 145. <i>Another way.</i>	p. 200
Chap. 146. <i>Another way.</i>	p. 201

B O O K VI.

Chap. 147.	T HE Design and Contents of this Book.	p. 203
Chap. 148.	To prepare the principal Stuff for Enamel.	p. 205
Chap. 149.	Milk-white Enamel.	p. 206
Chap. 150.	Turcoife colour Enamel.	p. 207
Chap. 151.	A very fine Blue Enamel.	p. 209
Chap. 152.	Another.	ibid.
Chap. 153.	A very fine Green Enamel.	p. 210
Chap. 154.	Another.	p. 211
Chap. 155.	Another.	ibid.
Chap. 156.	A Black Enamel.	p. 212
Chap. 157.	Another.	p. 213
Chap. 158.	Another.	ibid.
Chap. 159.	A Purple colour'd Enamel.	214
	Observations by the Author, on the Nobleness of this Colour.	ibid.
Chap. 160.	Another Purple Enamel.	p. 216
Chap. 161.	A Violet colour Enamel.	ibid.
Chap. 162.	A Yellow Enamel.	p. 217
Chap. 163.	To make Crystal-Ground for Red Enam.	p. 218
Chap. 164.	A fine Preparat. of fusible Manganese.	p. 219
Chap. 165.	To make a fixt Sulphur.	p. 220
Chap. 166.	Another fixt and incombustible Sulphur.	p. 221
Chap. 167.	To Extract Spirit of Saturn.	ibid.
Chap. 168.	A Blood-red Enamel.	p. 223
Chap. 169.	Another.	p. 224
Chap. 170.	A Sparkling Ruby-red Enamel.	p. 225
Chap. 171.	A Balafs-Ruby colour Enamel.	ibid.
Chap. 172.	A Rose colour Enamel.	p. 226
Chap. 173.	Another very fine Rose colour Enamel.	ibid.
	Chap.	

The INDEX.

Chap.174.	<i>Another Rose colour Enamel.</i>	p.227
Chap.175.	<i>A Splendid Carbuncle-colour Enamel.</i>	p.228
	<i>To Calcine Gold.</i>	p.229
Chap.176.	<i>To Calcine Copper for making Vitriol of Venus without Corrosives.</i>	p.230
	<i>The Author's Report of the Excellency and Vertues of this Vitriol and its Spirit.</i>	p.231
Chap.177.	<i>To make Vitriol of Venus without Corrosives.</i>	p.232
Chap.178.	<i>To Extract this fine Vitriol.</i>	p.234
Chap.179.	<i>To draw off the White Spirit from the Vitriol.</i>	p.236
	<i>To separate the Cap. Mort. for tinging of Glass.</i>	p.237
	<i>To restore it to a Blue colour, by the Air.</i>	p.238

B O O K VII.

Chap.180.	T <i>HE Design and Contents of this Book.</i>	p.240
Chap.181.	<i>The Furnace for Enameling and Pourtraying withal.</i>	p.242.
Chap.182.	<i>To Enamel on Gold.</i>	p.243
Chap.183.	<i>To Enamel on Silver.</i>	p.245
Chap.184.	<i>To Enamel on Copper.</i>	p.246
Chap.185.	<i>To prepare the Enamel for applying it on the Metals.</i>	p.247
Chap.186.	<i>To prepare the Colours for pourtraying on Enamel.</i>	p.248
Chap.187.	<i>The White.</i>	p.249
Chap.188.	<i>The Black.</i>	p.250
Chap.189.	<i>The Yellow.</i>	ibid.
Chap.190.	<i>The Blue.</i>	p.351
	<i>A very fine Preparation of the Blue.</i>	ibid.
Chap.191.	<i>The Red.</i>	p.252
	<i>Gold Calcin'd, and how.</i>	ibid.

The INDEX.

A Vermilion Red.	p.253
Chap.192. To Pourtray on Enamel.	p.254

B O O K VIII.

Chap.193. T He Design and Cont. of this Book.	p.357
Chap.194. The Furnace for baking and finishing the China-Ware in.	p.259
Chap.195. A fine Composition of Mold for China-Ware.	p.260
Pure Earth for China-Ware.	p.261
Chap.196. To Enamel China.	p.262
Chap.197. To Paint China.	p.263
Chap.198. To Gild China.	ibid.
Chap.199. Another finer Way.	p.264
Chap.200. To prepare Linseed-Oyl for Gilding on China.	p.265

B O O K IX.

Chap.201. T He Design and Cont. of this Book.	p.267
Chap.202. A Furnace for finishing the Painted Glafs.	p.270
Chap.203. A White for Painting on Glafs.	p.272
Chap.204. A Black.	p.373
Chap.205. A Yellow.	ibid.
Chap.206. A Blue.	p.174
To prepare the Crucibles.	ibid.
Chap.207. A Red.	p.175
Chap.208. A Purple.	p.176
Chap.209. A Green.	p.177
	Chap.

The I N D E X.

Chap.210. <i>Of other Colours in general.</i>	p.227
Chap.211. <i>To make Rocaille.</i>	p.278
Chap.212. <i>To Paint on Glafs.</i>	p.280
<i>The Privileges granted to such as Work therein, &c. ib.</i>	
Chap.213. <i>The Order of Baking the Glafs in the Furnace, after it is painted.</i>	p.283
Chap.214. <i>Another way to paint on Glafs.</i>	p.285
Chap.215. <i>To gild on Glafs.</i>	p.287
Chap.216. <i>Another way.</i>	ibid.
Chap.217. <i>To paint all sorts of Colours in Globes.</i>	p.288

B O O K X.

Chap.218. T <i>HE Design and Contents of this Book.</i>	p.290
Chap.219. <i>To Extract Yellow Lake from Broom-flowers.</i>	p.292
Chap.220. <i>To Extract the Essential Tincture of Poppy, Iris, Rose, Violet, and all manner of Green Herbs, to make Lakes of the same Colours.</i>	p.293
Chap.221. <i>Another Way to Extract the Tinctures from these and several other Flowers, Greens, &c.</i>	p.294
Chap.222. <i>The first process in making Scarlet Lake.</i>	p.295
Chap.223. <i>To Extract the Tincture of Kerm-Berries, for Scarlet Lake.</i>	p.296
Chap.224. <i>A readier way to Extract the Tincture of Kerm-Berries.</i>	p.299
Chap.225. <i>To make Lake, or Tincture of Brazile.</i>	p.300
Chap.226. <i>To Extract Tincture of Madder for Lake.</i>	301.
Chap.227. <i>How to make Ultra-marine, of Lapis-Lazuli.</i>	ibid.
Chap.228. <i>To make a Liquid for Moistning and Grinding the Powders withal.</i>	p.303
	Chap.

The I N D E X.

- Chap.229. *To prepare a mild and strong Lixivium for the Lapis-Lazuli.* p.305
- Chap.230. *The Form of the Vessel for settling the Liquors in, which are employed on the Lapis-Lazuli.* p.306
- Chap.231. *To make strong Cement to mix with Lapis-Lazuli, to separate the finer and better Stuff from the other.* p.307
- Chap.232. *To make a weaker Cement for separating the Colours of the Lapis-Lazuli.* p.308
- Chap.233. *To purifie Linseed-Oyl.* p.309
- Chap.234. *To incorporate the Powder of Lapis-Lazuli with the strong, or weaker Cement.* p.310
- Chap.235. *To Extract the Ultra-marine.* p.311
- Chap.236. *The Method of cleansing the Ultra-marine, when 'tis separated from the Cement.* p.314
- Chap.237. *To strain off the Ultra-marine already Washt and Purified.* p.315
- Chap.238. *To Correct the Colours just before prepared.* p.316
- Chap.239. *Another Way to make Ultra-marine, and draw off the Colours with more Expedition.* *ibid.*
- Chap.240. *Another Way to make Ultra-marine.* p.318
A Colour inclining to, or near the Ultra-marine; and that the Lapis-Laz. may be Artificially made. p.320
- Chap.241. *To make German Blue.* *ibid.*

B O O K XI.

- Chap.242. **T**HE Design and Contents of this Book. p.322
The Origine of Pearls, and how they are increased; with the like account of the Bezoar-Stone. p.324
- Chap.243. *To imitate fine Oriental Pearl.* p.326

The I N D E X.

- A further Description of Furnaces, &c.* ibid.
The Philosophick Pearl. p.329
Chap.244. *To make Mercury-Water for giving Transparency and Lustre to the Pearl.* ibid.
Chap.245. *Another Way to make those Pearls.* p.330
Chap.246. *Another Way.* p.332
Chap.247. *How to Blanch fine Pearl.* p.334
Chap.248. *Other Ways to Blanch and Cleanse fine Pearl.* p.335
Chap.249. *To make Counterfeit Pearl like Natural.* p.336
-

B O O K XII.

- Chap.250. **T**HE Design and Contents of this Book. p.338
The Original of Looking-Glafs, with an account when Metal, and Marble Mirrors were in use. p.339
Chap.251. *To make Looking-glafs.* p.340
The Privileges of the Royal Glafs Manufactures. ib.
Of Round Mirrors. p.342
Chap.252. *To Grind, Polish, and Diamond-Cut the Glasses.* p.343
Chap.253. *To File, or Silver them.* p.344
Chap.254. *To make Concave, and Convex Burning-Glasses.* p.345
Chap.255. *To make Metal, or Steel Burning Mirrors, whether Concaves, Sphericks, or Parabolicks,* p.347
Chap.256. *To Polish the Steel Mirrors.* p.349
The Invention and Effects of Burning Mirrors. p.350
An Appendix concerning Glafs-Eyes. p.353

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