Fleta minor. The laws of art and nature in knowing, judging, assaying, fining, refining and inlarging the bodies of confin'd metals. In two parts. The first contains essays of Lazarus Erckern ... in V books: originally written by him in the Teutonick language, and now translated into English. The second contains essays on metallick words, as a dictionary to many pleasing discourses by Sir John Pettus ... | Illustrated with 44 sculptures ... | [Sir John Pettus].

Contributors

Pettus, John, Sir, 1613-1690. Ercker, Lazarus, -1594.

Publication/Creation

London: Printed, for the author, by T. Dawks, 1683.

Persistent URL

https://wellcomecollection.org/works/pusd8x4h

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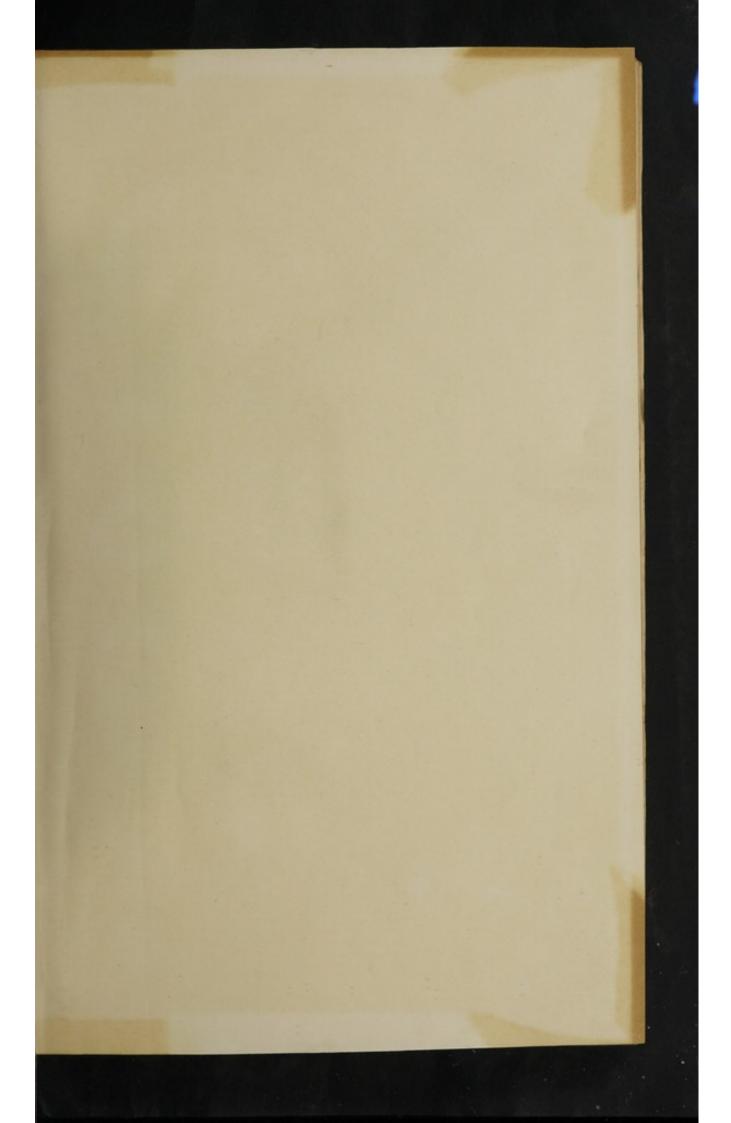
ERCKER LAWS OF ART AND NATURE 1683







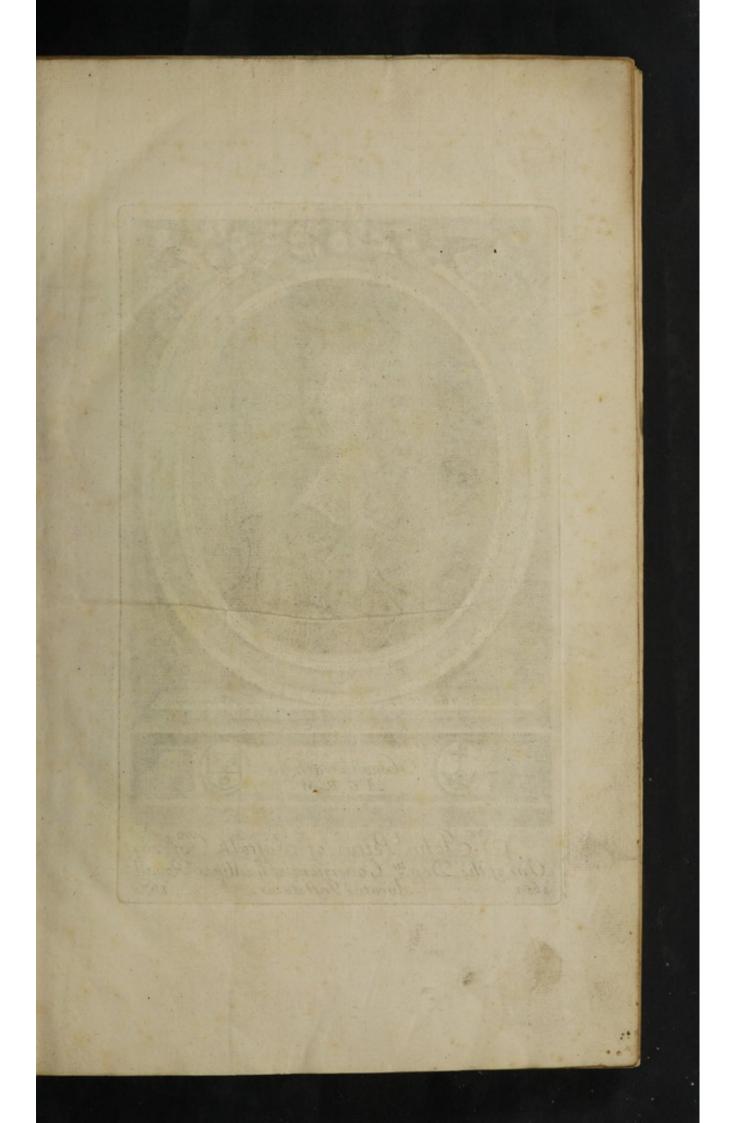
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S. John Pettus of Suffolk Knt. 1641.
One of the Depty Governors of y Mines Royall.
1651.
Auratus Infletatus. 1679.

FLETA MINOR.

THE

L A W S ART and NATURE.

IN

Knowing, Judging, Assaying, Fining, Refining and Inlarging the Bodies of confin'd

METALS.

In Two Parts.

The First contains ASSAYS of Lazarus Erckern, Chief Prover (or Assay-Master General of the Empire of Germany) in V. Books: originally written by him in the Teutonick Language, and now translated into English.

The Second contains ESSATS on Metallick Words, as a DICTIONARY to many pleasing DISCOURSES.

By Sir John Pettus, of Suffolk, Kt. Of the Society for the MINES ROTAL.

Illustrated with 44 Sculptures.

Mal.3.3. Numb.31.31.
Jehovah Chimifta Supremus.
Carolus D. G. Secundus.

LONDON,

Printed, for the Author, by Thomas Dawks, his Majesty's British Printer, at the West-end of Thames-street. 1683.

FLETA MINOR.

THE

ART and NATURE.

MI

Knowing, Judging, Micying, Fining, Refining

METAIS

In Two Pasts.

The Fish contains to 1.5 5 of Lagury Erelengthief Prove (on Alighed Late South Street of the Empire of Garming) in V. Booker Landy with early him in the Tempire Language was not an elected into English.

The Second contains has been reported by and and DICTIONARY Comment wheelfor DISCOLINSES

By Sir John Penns, of Sayling No. of the Society for the



Jehovsh Chemida Second

TO SUDDEN

Printed for the Author by Thomas Darke, his Maishy's British Printer at he Western Los Thomas three at he

Kings most Excellent MAJESTY.

SIR,

THE Materials of this Book are derived from your Majesties undoubted Prerogative to the Mines (in your Dominions,) of which Metals are made; Of them Moneys: And then honoured with your Majesties Superscription. And so by a Christian Circulation, the Possession, or ought to render to Casar the things which are Casars.

Thus Your Majesty hath a double Right to the Mines, and to the Products of the Chimical Art, by which Metals are sitted for their Journey to Publick

Commerce.

Herein I humbly offer my Endeavours to affift their motions, and onely to refresh your Majesties Memory, not to inform Your Knowledg: for (as 'tis hinted in the Title Page) Your Majesty is (in the Science of Chimistry, as in all Sciences of Humanity) Nulli Secundus.

These Perfections are evident in Your Majesties publick and private Elaboratories, from which pure fufice, and pleasing Arts and Sciences are communica-

ted to Your Subjects.

The Epistle Dedicatory.

In these I have observed Your Majesties particular respects to Chimistry (of an Universal Extent,) and thereupon I resolved to transplant this German Twig of L. Erckern (on that Subject) into Your Majesties Nursery; and Humbly Dedicate it to Your Majesty, (withmy Additionals) and also Humbly crave your Acceptance, as an encouragement to my surther Progress in serving Your Majesty with more Fruits; but at present it is to shew, That I am intent in promoting the Services I owe Your Majesty, as well with my sedentary Passive Pen, as before with my personal Active Duty, having (upon some significant occasions) had the Honour to be known to Your Majesty near Forty Years.

Now, Great Sir, Wherein I am incapacitated to express my Duty, for want of Ability of Mind or Body, or secular Fortunes; they shall be supplied by my constant Prayers for Your Majesties Health, Happiness, and Serenity in Your Government, being

Herein I humbly offer my Endowsen's to affel their

These Terferious are evalue in Your Maj sliks publick and private Exchangerories, short which pure Ju-slice, and pleasing essists and behaves are communica-

Tide Page) Your Alajelty is (in the Streng of

Your Majesties most Obedient

Feb. 26. 8;

and Humble Subject,

FOHN PETTUS.

red to Y dut Subjects

To the Right Honourable, George Marquess, Earl, Viscount Hallisax, and Baron of Eland, Lord Privy Seal, and one of His Majesties most Honourable Privy Councel; and Governour of the Society of the Mines Royal, and Battery Works.

My Lord,

Our Lordsbips free acceptance of the Government of the Mines Royal, bath encouraged me to add it to your Titles, and I hope without the least disparagement to your other Honours, deservedly conferred upon your Lordship by

His Majesty.

It is a Trust of great Concern (and I doubt not but it will be so managed by your Lordship) and of Honour too, (as it bath been always esteemed) for (not to trouble your Lordsbip with very Antient Records,)I find that King Edward the Fourth did make Richard Earl of Warwick (who foon after was made one of the Governors of this Kingdom, during its Troubles) and John Earl of Northumberland, bis Guardians and Governors jointly of all bis Mines in England; and King Henry the Seventh made Jasper Duke of Bedford, and other Earls and Lords, bis Guardians also of all the Mines in England (adding Wales.) And Queen Elisabeth, in the 10th. of her Reign, did form the Government thereof into Societies, by the Names of Governors, Deputy-Governors, and Affiftants for the Mines Royal and Battery-Works, and then made Sir Nicholas Bacon, Lord Keeper, and other eminent persons, her Governors for England and Wales, (adding those within the English Pale in Ireland,) which Government did continue Successively to the Earl of Pembrook, and others for some Years:

and

and after, bis late Highness Prince Rupert was made a Governour; and your Lordship to our contentment, doth succeed bim.

Now, my Lord, As for my felf, I have been one of the Deputy. Governors for above 30 Years, and do think my self obliged in point of Gratitude to the late Governours; and present Members (who were pleased unanimously to order a Contribution to the Charge of this Book, and for some former Favours,) to endeavour the advancing of their Concerns (especially now me bave the Honour to be under your Lordships Regiment,) and therefore as an Introduction to my real Intents. I not only publish this, but by some Additionals, I shall study to make the Government more advantagious to the Society, and much more to His Majesty; and even to other Proprietors of Mines, wherein I have sat still some Years, because I found that I should, be obstructed by some who studied the advance of themselves more than His Majesties Revenues, which I do not aim to do by any Oppressing Method, or projecting Humour (for I bate it) but by an bonest just may, and I hope not displeasing to any, but such as nothing will please.

And these I shall in due time communicate to your Lordship; being so consident of your Lordships great Abilities. (join'd with your perfect Loyalty to your King, and Love to your Country) that your Lordship will not approve of any thing that I shall offer, if it agrees not with your Lordships sound Judgment and deep Wisdom, for which all who knows your Lordship have an

English Pale in Ireland,) which Esquenment did continue Successively to the Earl of Fembrook, and others for fome Tents:

bigh value, and particularly

Your Lordships most humble

did form the Occomment shereof into Societies, by the Names of the American the American the Mantes for the Mines Covernor, and American for the Mines Covernor and Dates y-World, and then made Sir Mines Covernor and the Mines Covernor and the made Sir Mines Covernor and the Mines Coverno

Sovernors for England and Wake (withing roofe mithin the

To the Noble and Honoured Subscribers and Contributers to this BOOK.

My Lords and Gentlemen,

Did defign to have publish't your Names in a way that should have more fully manifested your Favours, and my Acknowledgments; but this Book extending to above 50 sheets more than I design'd, or at first proposed, took up my limited time, so as I must respit that intention, for I have not done with this Subject; intending not to trouble you or my felf with Subscriptions, but such as have Subscribed to this, shall have notice when the next is ready; and if they approve of this so well as to take the next from me, it will be an additional Obligation to me, for I am prepared to go through the Body of this ART, upon thefe Reasons; First, That it contains the Grounds and Maxims of most admirable Speculations; and next, That I may divulge their chiefest and most curious Experiments and Practicks: Now, that which incited me to this, was occasioned from hence, That having caused Erckern's Books to be Translated about Ten years fince; some eminent persons did perswade me (like the Story in Bocalino,) not to publish it, lest the Common fort of People should make an ill use of its impartments, alledging, That it was not well Translated: whereupon I betook my felf to the German Language, and in a short time I was so much Master of it, That with the help of a German here, I did indeed find many Errors, and Corrected them, which anfwers one Objection; and I have Printed fuch a convenient Number as may answer the other; And yet I am not altogether satisfied therein; for, what hath made Arts and Sciences

Sciences flourish more in the time of King Charles the First, and now in His Majesties Reign, than their Majesties encouragements to the free communication of such things as had many Ages before lain secret? so that we hope that all Pancerollus his lost things may in a short time be found again.

We punish our selves by fixing and disputing on the Theorems of antient Writers, and thereby making things to be Diabolical, which are only Divine Favours thewn us by Natural Agents, so as for want of knowing the true Practicks & Experiments, they are divulged either by umbraging Sophistications, or concealed under the Name of Philosophical Secrets, which, no doubt, but GOD intends for a publick and common Good: and this ill Fortune befell the Unguentum Armarium, as a piece of Witchcraft, 'till our Eyes were inlightned; and in many other things (which were they clearly communicated) fuch Superstructures would be raised from them, as might arive us to a kind of Angelical Knowledg in this World, and make us more apprehensive of our Happiness in the next: and therefore it shall be my study to unfold the Metaphysical Notions of this SCIENCE: by Practicks especially about the Philosophers Stone, which Study I value only for its fine Pursuits and Products of Experiments, but more, because the Laborers for it are, by their own Affirmations, obliged to a strict and religious Life:

I shall trouble you no further at this time, but with my

humble and hearty Thanks: and so subscribe my self

My Lords and Gentlemen

Your most bumble servant

JOHN PETTUS.

To my Worthy Friend, Richard Manlove, Esq; Warden of the Fleet.

SIR

Am here, a confined Person, for my being too kind to others, and too unjust to my self, and for not doing what was not in my Power to persorm, by wanting the Justice of my Debtors, whereby I am rather a Prisoner to them

than to my (reditors.

Yet I can dispense with all these, because they have occasioned my happiness, in your Acquaintance, and my contenting Retirement in this place, which was once a Palace, after, a staple of Comerce, and long since and still, a Repository of our Laws: And now, like Homers Iliads in a Nut-shell, here are all sorts of Degrees, from Prince to Peasant, all sorts of Professions, from the Doctor to the Novice; all sorts of Trades and Manusactures, and all sorts of Virtues; but your Prudence doth still suppress the Vices.

And I ingeniously confess, that by yours, & your Ladies constant Kindness & Indulgence to my declining years, I have made it a colledge of Learning, and so may other Gentlemen do (if they please) it being so qualified, that in an hours time there is no Art or Science wherein one may not be punctually instructed.

Now, Those that think themselves Prisoners to you are much mistaken, for they are Prisoners to the LAWS, and may make themseves students of All-souls in Le Fleet, of which

you are Warden.

A Guardian-ship very needful for the People, as a Completion of FUSTICE, in point of Restraints: For, (besides many other wise Considerations) they are good for Cooling the Animosities between Creditors and Debtors, and between the LAWS and Contemners of them, (and thereby prevents the Effusion of Blood, which hath often happed) and for Curing the Sullen and contemptuous Disposition of others to their Superiours.

C

For

For, I can truly say, That, by my patient Submission to them and my Missfortunes (being prepared with my 14 months Imprisonment in Windsor Castle, under the late usurped Power) I do now with more Satisfaction to my self, undergo this under a Legal Power, and thereby I affirm, That no Gentleman hath received greater Respects from you than my self, and therefore I take this Occasion to make my publick Acknowledgments, that it may be a Guid to other mens Contentments, for, as I have observed, That as you never were out-Hector'd by Affronts or Resistances, so you were never out-done by Civilities or Compliableness to your Methods.

As to the first, I never gave Occasion, and as to the other, my studious temper complying with your Love to Learning have so won on your good Disposition, that I must acknowledg to my honored Subscribers, and others, that had it not been for your Incouragement and particular Assistance with your purse; (though with some Inconveniencies to your own Occasions) I could not have finished this Book, as now I have done, and therefore as one Memorial of your kindness, I have given it the name of FLETA, and in my Picture minted the word

infletarus from this Place.

I could with delight to my self and others, spend more time on this Subject; but I must end with this request, That as you have given House-room here to the whole Impression of my Books, so you will please (in respect my person is restrain'd in Execution of the Laws,) to encourage it in its Travels abroad; and so not doubting of your Favour, I shall conclude with Ovid. (then, in my present Condition, but I will not punish my self with his Tristibus's,)

Parve nec invideo sine me Liber ibis in Urbem

Which I have thus Englisht,
Go little Book, leave me, but make report,
Who treats thee best, the City or the Court.

However you shall have the continuing thanks of

Tour Obliged Friend and Servant JOHN PETTUS.

To the Courteous READER.

Think fit before you read this Book, to instruct you in the Method of it, so as you may read the whole, or part, as your leisure serves.

1. It is divided into two parts (as the Title mentions,)

viz. Erckern's V. Books, and my Dictionary.

2. Whereas the Original of Erckern's 5 Books had no Numeral distinction of Chapters and Sections, I have divided them into Chapters and Sections, and Printed them before the Five Books, with numeral references to their chapters where they are contain'd.

3. Whereas the Sculptures had only Literal, and no Numeral Directions of their Contents, I have in the second part of the Contents before the Five Books, Printed the Contents of the Sculptures, with references to the Pages where they may be

feen and read.

4.Whereas the Original of Erckern's 5 Books hath no Coma's, Colons, Periods, Parenthesis, or Interrogatory Points, pertinent to the distinction of Words or Sentences (which are also wanting in many German Books) I have comply'd them to our way of Orthography, (which was no little trouble,) and therefore if the Reader sind some sew Omissions, they may upon that account be the more kindly dispens't with.

5. I do retain many antient and Saxon Words, upon the account of their affinity to the like Words which are still used

among us, and these are binted in the Dictionary.

6. In the Dictionary or second part, the first Words which I thought sit to explain, are in Capital Letters, and next, the Teutonick and Latine Words for those Capitals; (and other Languages,

Languages, as occasion requires,) and these I collected from G. Agricola, Alstidius, Cowel, Minshaw, and Skinners Di-Elionarys for the Teutonick, from Cooper and Holiock for the Latine; from Florio for the Italian, from Cotgrave for the French; and from Waltons Lexicon for the Oriental Tongues, which, with a German was all the belp I had for the use of above 600 Words; but the two chief Languages, of which I make the greatest use, are the Teutonick and Latine, this from the old Romans, (who continued among us above 500 years) the other from the Saxons (who were mixt with us as long,) from both of which Nations we gain'd a particular knowledg of Mines and Metals, as may be evident from many Roman and Saxon Works which remain bere under their Names to this day; and many of our Monarchs particularly Queen Elizabeth did think fit to defire the affifting SKILL of the Germans, to improve OURS; to prevent which trouble, I here publish part of their Art, and intend more.

Lastly, I have given it the Title of FLETA, which is borrowed from an eminent Lawyer, who whilst he was Prisoner in the FLEET, writ his Learned Book of the Common Laws of England, and thereupon (as 'tis said,) he call'd his Book FLETA (Cowel) to which I add MINOR, in submission to his great Learning, and for its assimity to the word MINER, viz. one who Labours in the Mines, as I do in

Learning the Metallick Art.

To conclude, I have writ some things from Authentick Authors (too many to recite here,) and some from my own Conceptions and Observations; now as they pleased me in writing, so I hope they will not displease others in reading.

JOHN PETTUS.

THE

PREFACE

OF

Lazarus Erckern,

To his five following BOOKS.

O learn and understand the way of Assaying, Of the Art of Assaying, Proving and Refining of Metalls, is an Excellent, Noble Science, and an Antient and profitable Art, long since found out by the Art of Alchimy and Chimistry, as also all other Works of the Fire, by which not only the nature of Oars and Mines, and what Metalls contained in them are known; but also how much there is in a Centner, or in greater or lesser Weights, and not only so, but this Art also teacheth bow to Examine each Metal by it self, as whether there be any Adulterated or mixt Metal with it; what, and how much the same is, and then which way those Metals may be separated from such mixtures or adulterations, as also by several mays to cleanse and separate other incorporated Metals, so that they may be judged to be fine, clean and free from mixtures, therefore this Art is very profita. ble to Minerists and such as work in Mines and intend to have benefit by them, and such Artists must endeavour

The PREFACE.

by all means to! earn and exercise themselves in the same, that they may thereby reap a Profit to themselves and others, and preserve themselves from Inconveniencies and

Dangers by their want of knowledge therein.

By this Art of Refining and the Profit that acrews by it, many good and rich Mines have been discovered, which otherwise would have lain concealed: and by the Advantage of these Discoveries many Cities and Villages have been built, Lands have been improved in their Values, and People thereby increased and plentifully maintained: As also great and mighty Trades and dealings with Gold, Silver, Copper and other Metals here, and in other Countreys exercised, and the Coiners of Coin and Minting Works bave been multiplyed by their Guardians and Masters; for from Gold and Silver, Money is made and much improved, so that the true Infight, Tryal and Examination of this Art, cannot be in any wife omitted or neglected, as that which is highly necessary to be known.

And such Artists as have exercised themselves in the by Princes. Knowledge of Assaying, and fundamentally and diligently practised the same, are by Princes, Lords and Com. munities thought worthy not only of great Thanks, but

been also promoted and recompenced by them.

For this ART of Affaying is the very Inlet and Mother of many other honorable and profitable Sciences as Mother of ARTS. Experience teaches us, and the more a man finds out, the more he is stir'd up to the contemplating and doing things of an higher Nature.

ceilary.

So that the Knowledg of Metallick Oars and Minerals Metals ne- are first to be inquir'd into, namely, How each one according to their Nature, Figure, Form and Colour are distinguishable from each other: Which without great diligence and daily Practice cannot be known, because God the Almighty Creator, in the beginning of the Creation of the World

The PREFACE.

World, bath placed Metals and Minerals in the Mountains, Valleys and Veins of the Earth, and canseth them to grow there: He bath also given to all and each of them an outward Form and Colour by which the one from the

other may be distinctly known.

Secondly, The Knowledg of the Fire is a principal How to use part of this Science, and very necessary to be inquired in- Fire in Meto, that he may the better know how to govern the same, so that he may give no Metal more Fire than its due, but to every one its proportion of Heat and Cold, as necessity requires to add or take from it, in its Operation.

After the Knowledg of Governing the Fire, the Ar- To make Inftrutists must have the Knowledg also of making all the In- ments. struments and Furnaces for this, either by his own han- Farnaces. dy work, skillfully to prepare them, or at least to direct that they may be well made, whereby he may not be hindred in his working, but by his own diligence accomplish

them.

In like manner be must be careful in procuring good and Weightsand just Scales and Weights, and to know also how to make them (in case such Artificers should be wanting) and sit them to all Metals, and he must have great Care in preserving them from Dust, and that they be alwayes pure and clean so that (as occasion serves) he may rely on the cer-

tainty of Proofs by them.

Next to the former Directions be must be well skill'd Tobeskill'd experienced and exercised in the Art of Arithmetick, for metick. the numbring and casting up Accounts (which to Asfaying Coins and Refining Works are very necessary, and is one of the Master pieces in this Metallick ART) And every Assayer must not only diligently learn this numeral Science (necessary to be known for the Proving of Metals or what belongs thereto) but also all such Arts and Sciences as may accomplish bis full Designs there-171.

The PREFACE.

Now, though it would not have been unserviceable to have writ of all such things more largely in this Preface and Entrance to what follows, as also of the Rise and Springs of metallick Oars, and how they grow in the Mountains, Veins and Chanels of the Earth, and bow generated (of which the old and later Philosophers have bad many different Opinions) as also of the Streams, Chanels and their Entervals (and other Accidents which do discover and produce Oars, whereby the Miners do guid themselves in their Proceedings and Works.) Tet because it would have been too long and endless to recite the Opinions of Philosophers, and the various Operations of Miner: (in respect they do not agree in all things, and miss very much of their Aims, and have written many Books to little purpose)therefore, for brevity sake, I have omitted them, and proposed only my own Practice, for the better advancing this Metallick ART.

THE

The first PART,

The CONTACN

Confifting of V. B O O K S.

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C H A P. II. How Silver Oars are distinctly kno n.

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Lazarus Erskerus

CAP.I.

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Erckern.

BOOK I.

CHAP, I.

Of Silver Oars.

Sculpture I.

Section 1.



Deciphered.

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- 1. The form of an Athanor or great Furnace.
- 2: The Forceps or Tongs and Fork.
- 3. The Coppel or Test, with Philosophers Bellows.
- 4. The Digestive Pot with its Cover and Fire about it.
- 5. A cover'd Crucible.
- 6. The long Bell, or Matras-Glass on a Sand Furnace.
- 7. The Wind Furnace with a Blow-pipe.
- 8. A Furnace with a Copper head, and its Receiver.
- 9. A Furnace with a naked and open Fire.
- 10. The Pestel and Mortar, with one beating the Metals.
- 11. The Owl's Head, or another form of a Cover to the Figure 8.
- 12. A Retort. THIS

HIS first Book speaks of Silver Oars, CAP.I. how they may be diffinguished by Section. 3. their feveral Sorts, and afterwards by pose of the Assay-Scales and Assay-Tests; Muffles, Coppels, and of Clar for Lead, of Lead-Glass, of Fusion -Pouder, of Ballances and Weights, and

how a Lead Grainer may be made, and then how every particular fort may be certainly affay'd or tried, as also of Slake and Slake-stone, Flakes and Hard-Work, See the of Laech-Speize, Black Copper, Pagment, and of Granula-Dictionary. tions; as also of Planches or Plates of Silver and burnt Silver, with a fundamental Information how to burn Silver in the common way, and under the Muffle: as also the preparing and making Tests: and how to cast Silver which is Tuff or bard, as well as that which is not tuff or more ductile: also how to assay Tin, Iron or Steel for Silver, and to know what any Silver or coined Mony is worth: and to make stroking or touching Needles, or Ingots of Silver for diftinguishing the fine from the less fine Silver.

Now, because I have in this Treatise first begun why Silver with the Description of Silver Oar and its Tryals, some first treated may wonder why I did not rather begin with Gold, (which is treated of in the Second Book) and why I did not give Gold the Preheminence, it being the higheft and chiefest Metal of the Earth, and so by right it should have been first treated of.

Therefore I think fit to inform the READER that I have not done this without good Reason; For, from Silver Tryals, all other Affays and Preparations of Instruments do flow, as out of a Fountain, and have their Rife from thence; for which cause I have judg'd it necessary, in the first place, to give information of the tame, and to place it in this first Book, because it is

CAP.I. to the Honour of the Crown of Bobemia, and bordering Countrys in Germany, viz. Miechfin, Sachsen, Shes. ren, Manbren, and other Countrys where there are many Mines containing good Quantities of Silver, and many Miners, Gardians of Mines, Refiners, Provers, Smelters and Melters, who exercise themselves in proving of Silver Oars, and of fuch Metals as contain Silver in them, and yet because there are many in these parts who have not gained the true Knowledge thereof, or have not in all things pertinent to this Science, obtained a fundamental Information, I have proposed to my self to be serviceable to such, and therefore I have more largely treated of silver, and its Tryals than of any other Metals, and am not willing to leave this unmentioned in this entrance of what I am to write.

CHAP. II.

How silver Oars are distintly known.

Section

Ilver Oars are found to be of many forts and Colours, yet if they be not very fine, they are not to be judged by their Looks (how rich foever they are in silver) and therefore 'tis proved by Artifts (who have diligently fearch'd in-

to this Science, and by them found out many years past, as also by others who have since improved this Art) that the worth of every Oar may be certainly found out, so that the very smelting, melting, resining and account thereof, may be demonstrated both as to its worth and the Charges.

Now

Now it is here necessary to be known, that so many Chap. as there are Sorts of Silver Oars, so many are their Natures and ways of melting and resining them; and therefore the Tryals of Silver Oars must be ordered according to the Nature of the Oars, because the hard, harsh, gross and crude Oars, cannot be proved like those of an easier Fusion; or of a more mild, subtil and dustile nature, because, as an Oar proves either harsh or hard of susjon, so it must be help'd (in the proving) by the Government of the sire, or by other wayes; as, by much Experience in proving such Oars have been and may be discerned according as they melt in the sire: so that if there be not a knowledge of the Nature of an Oar before melting, and how it will do in the sire, such an Oar, cannot be melted to prosit.

Now for the better attaining the knowledg of the Difference of Oars; as, which are of an easy, and which of an barsh and erude Fusion; the most excellent and experienced Miners do give every Mine (and Oar from thence) Names, according to their Natures: all which according to the Terms used by them are hereaster named.

First, there are reckoned to the Easy flowing Silver-Glass Oars, these Nominall distinctions, viz. Glass-Oars (as the cheifest of the leaden Coloured Oars) almost to be compared to the best digested Silver, for it doth not loose above a fixth part in the fire, and the rest is pure and good Silver, and this dig dOar is a counted the best Silver Oar.

Also there is found white Goldish Oar, not that it white gold contains Gold, but because it is good in Silver, it hath this name in respect of its Goodness.

Also the Horny Oar, (which is called so from its Horn Oars transparency or rather lucidation like Horn) and is very rich in Silver next to the three last mentioned Oars.

Section

There

There is a Silver-oar which is Brown-red (almost CHAP. 11. like Cinabar, but not so light) and this they call Red-gol-Section. dish Oar, and this doth yield above balf Silver, and it Red goldisto is found that these oars do break like one another, and

the difference not eafily discern'd.

As for all Oars which are gray and black in breaking Black Oar. and withall heavy, they are often rich in Silver, but fuch as break black and light, or brown and yellow are not allwayes rich, and it happens often that there is little or no Silver in them.

All Ironish brown and yellowish streamy Oars are Troniflo Our from decaying Mines, pierc'd by cold winterly Winds, and these contain some, but are not rich in Silver.

Also the leadish, or Oar that looks like mud (and there fore call'd muddy Oar) is fomtimes rich and fomtimes very poor in Silver, and indeed all leaden, borny, stony Oars, if they be yellow, white, gray, black, brown, red or green do not contain in themselves (if no other oar be mingled with them) much Silver, and for the most part none at all.

Also there is reckoned among the Easy-flowing Oars, Glittering all fuch Lead-Oars as are of a bright, glittering, shining Nature, or of a gray, brown or white Colour, yet these of themselves alone have little Silver, but the small flaky glittering or Wismet Oars, from the Mines in Bobemia, as also the much flaky, shining oars from the Mynes of Eryburgh in Milnia, do contain from 6 to 10 ounces in a centner.

Also all float or Easy-flowing oars that are Yellow, many Sorts. white, brown, blew, green, or gray, do contain near

that proportion.

Also Copper-grass Oar or Copper of a Mountain green, or Copper glass-Colour do hold some Silver, but the Course Oars of an Azure, Mountain-Green Colour, are comonly poor.

Fleat Oars

11.

ATureor

blew Our.

In

In fine, all Silver oars in all forts of Mynes free from Flint, Blent, Cobolt, Mispickle, Glimmer, Wolferan, course See the Die spelter and Wismet (or be spizy and Copery) are Gionary.

called, laft flowing mild oars.

On the contrary, all flinty Oars are reckoned among Flinty Oars the barsh, gross and bard flowing oars, and of thele many Sorte. oars there are also several forts, namely the gross Flinty-Oar, the water flinty-Oar, and the square flinty-Oar, these contain little Silver (and the most part of them none) or not above half an ounce in a Centner: allo Copper flinty Oars that are yellow like Brass, alfo the Brown and Blew-staind-Flinty Oars, they do contain much good Copper (as may be Seen in the third Book) but luch Oars contain little Silver, yet one fort more than another.

There are also rich-copper-Flinty Oars which have Cobolightent no silver but the Blent, Cobolt or mispickle Oars (as in mispickle Section 11.) if they be speckled or spotted with round black or gray spots, they are sometimes rich in Silver and

iometimes poor.

Also all common white Glimmer or wolferan (as in Section 11.) or glimmering or sparkling Oars, or Talk or Welferan, Cat-filver are very poor in filver, yet the black Glimmers Take Catare fometimes rich; but for the most part all such glim- parkling mery Oars are commonly poor, to as I account these but as Paterns to other metalick Oars.

Also all course-spelter, spizy or coppery-spizy Ours Spelter and (as in Section 11.) or the like kind, they are common- [12] Ours.

ly poor in Silver and contain none at all.

Also all spady Oars (or such as may be dig'd with a Spady Oars. Spade (if they be red, green, yellow or white (if there be no other mixt filver-Oars with them) for the most part do contain little or no Silver in them.

Also there is reckoned among the barsh, or bard-flow- slack and ing oars, the raw flack-stone, and copper-stone, spelter, be. Copper flone

CHAP.

CHAP. ing alike in cleaving and splitting of Furnaces which II. proceeds from the stirring of the slinty parts, as also from

the fcummy part in melting them.

Section. 18. The Ways of affaying them.

But how the Proofs of the above named foft-flowing, as also of the bard-flowing filver Oars are to be wrought, I shall by the following Discourse distinctly and ex-

actly inform the READER.

Now, because that in many places there are no Workmen who can well make Instruments, belonging to the proving of these oars, I will for the better Information, shew first what is chiefly necessary to be done in such proofs, both in the whole, and in parts; as also what matter or stuff is to be used about them; as also what Instruments are to be made and prepared for them.

CHAP. III.

How the Assay-Ovens to prove Silver and other Metals are to be prepared.

Section.

Special
Ovens.

Aderning

them.

HERE must be special Furnaces (for Assaying) made of good Potters Clay, and bound with strong Iron were or Hoops, that they may not fall assunder by reason of the strong heat which they must endure. But some diligent Ass.

do form and adorn their Furnaces fairly and comely, so as they may be pleasing to the Sight: This indeed do's give them an adornment, but there is no more done with it, than with a Common Furnace (that is made well, though plain.)

Now there are many forts of Assay-Ovens which Assayers

fayers made use of according to their several wayes of CHAP. working, but this is to be noted, That in one Oven, III. the Fire is to be better governed than in another, either by heat or cold, as the difference may be feen in the following Sculpture: But I intend to mention first, how the Ancients have made their Furnaces.

The Common Affay-Ovens, in which the Ancients Section have made small Tryals, they have caused to be made ovens of the square, of strong iron Plates about fifteen Inches wide Ancients. below, and fixteen Inches high, and floping from below to the top, to that the fquare was about ten Inches at the top, and this Square had no Bottom, but in the Fire part it had a Mouth-hole (of four Inches and a half wide) and the other three fides had each of them at the Bottom a wind hole, four Inches long, and one and an half high: there was also every where about the plate, holes cut into it, so that it was ruffe and sharp for the Loam to flick the better to the luting of their Furnaces.

Now to make such a special good Loam, (as will To make a hold well in the fire) take good and well - wrought good Learns, Loam, beat among it Flocks of Wooll, or Horse.dung, Blood of Oxen, scales of Iron and common Salt, with which lute the Furnace two inches and a half thick, let it dry, then take small ground Venice glass, Bonealbes, and a small quantity of Loam, mingle it well together, and plaster it all over the inside of the Furnace. let it dry well, then make a gentle fire in it, that it may be neald, and when the Furnace is to be used, there must first be a smooth fire-place, and upon that Copell-Ashes are to be laid the breadth or thickness of a finger, and this on the Furnace must be placed; and in the Oven upon the Fire-place a Muffle (which is formed as the following Sculpture doth shew:) and thus the Affay-Oven is made ready: and when there is any Tryal

CHAP. Tryal to be made of the Furnace, after it is well glaz'd within by the last plastering over of the Furnace with the Venice-glass and Asbes, it will last the longer.

> And when the Furnace in length of time is quite burnt out, then the old Loam is only to be knock'd out, and fresh put in the room thereof, and proceed

as before.

In such a Furnace, he that knows well the Government of the Fire, and is an experienc'd Affayer, may make all manner of Tryals, only the Registers are sooner stopped with the Ashes than the Furnace with the two mouth-holes, of which there will be information hereafter.

Section. 3. Norinberg Aff govens Potters Loam.

Some Assayers do use in their tryal of Furnaces (which are made of Potters Clay, and formed like the above-named Furnace) and tye them with wyre, and let them upon a foot which is broad and hollow, and hath in each of the four fides wind-holes (as the following Sculpture will shew.) And in this Furnace it is more ealy to govern the Fire, than in the above named Fur. nace, because the wind-holes in that Furnace (which are in the foot) do stop themselves easily; and such Assay-Ovens are called Proof-Ovens of Noringberg, and the Muffles appertaining to them, are also seen in the Scul. pture:

But it a man should be in a place where no Assay-Affay oven Ovens are to be had, and yet would affay a few tryals in hafte; in fuch case, Take only a few Tyles, place them together in a square, and leave in the sides Wind. holes, and in the fore-part leave also a Mouth-hole, and with a Pipkin cut in two, make a Muffle in it, and in

fuch Furnaces Affays and tryals may be well performed.

But in such Affay Ovens, in which most commodi. oully Allayes may be made, and in which the Fire may be right and duely govern'd, also as such as are not easily ftopid

A Tay Ovens best gover-

A Right

of liles.

ftop'd with ashes, and in which all the Tryals (that may CHAP. be made in any Furnace) may be tryed, they are to be III. made thus, viz. eleven Inches wide, and fixteen inches high, which is the full hight of the Affay-Oven, when you have measured eight inches high, then work it a little in, also that the Oven at the top may remain seven inches wide, and the thickness must be one inch and a half, and the lowermost Bottom three quarters of an inch thick, then measure from the bottom three inches high, and four inches and a half wide, which is for the lower Ovens mouth, then measure two inches above the lower Mouth bole (which is for leparating of the upper and lower Ovens mouth:) in like manner measure the height, three inches and a half, and four inches wide, then after a feparation of an inch thick, make the uppermost month-bole about the bigness of a little finger, so that from the middle of the hole to the top of the Oven there may remain yet fix inches and an half, then on both fides of the Ovens-mouth, towards the corner, measure three quarters of an Inch: and make there two holes a pretty-big Fingers widness, which must go strait through the Oven, as also the like behind: when all this is done, you must then also make a declination, from whence the Ashes may fall; which must stand two inches and a half from the bottom, and two inches and a half from the fides of the Furnace, and the declination must stretch hollow upward from the bottom, fix inches and an half: Only observe this, That if you intend to make any thing of Clay, then you must add so much as the Clay useth to shrink, because one fort of Clay doth shrink more than another, but most commonly Clay doth shrink the tenth part: When this Aflay-oven is also finished, and is yet lost, then there must be edges cut in it, in which the Iron bonds or wyer may lay, after that, let it dry well in the Sun, and then let it

of strong Armour-

plate.

CHAP. be hard baked in a Potter's Furnace or Brick-kiln.

There are also in like manner Affay Ovens made, which outwardly are of a square form, like the above-As govern named Furnace, and are made very neat and clean, of strong Armor-plate, and writhen with Ironpins, on which the Lute may stick well, and artificially brought together, also that such a Furnace may be taken asunder into five pieces, which Furnace, like to that of Iron-plate, must be neatly luted with a good and firm Lute, and to the strong plate of Iron at the outside of the oven, there must be little plates to put forward and backward in small Crevices, and so according to necessity the Tryal may be well made: Of fuch Affay Ovens there is much Estimation made, but there can no more be accompliflied with it, than in one of the other mentioned Furnaces, if only an Assayer have well the knowledge of the Fire, after which all Proofs are to be governed, then can he, without question, do well in all these Ovens.

> In this following Sculpture is to be feen how this and the afore-named Ovens are to be formed, which is thus

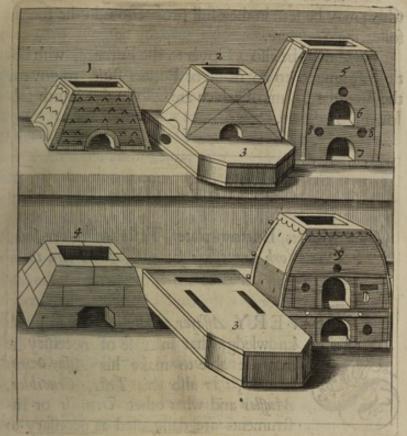
Deciphered.

- 1. An Assay-Oven used by the Antient Refiners, joyned with Iron Plates.
- 2. An Essay Oven used by the Norinburgers (in Germany.)
- 3. The Foot of it.
- 4. An Assay Oven made of Tiles joyned together, which may quickly be done.
- 5. An Assay-Oven made of Potters-Loam, and fastned with Iron Bonds.
- 6. The upper mouth-hole of it.
- 7. The lower mouth hole of it.
- 8. The holes for Iron-barrs to be put in. 9. An Astay Oven made of Armour-plates.

Sculpture

Sculpture III.





When any one of these Assay-Ovens is thus prepared, then cause two Iron-bars to be made of an equal length, which must go through the holes that are between the upper and lower Mouth-holes (Figure 6 and 7) and stand out about three Inches, on the out-side of the Oven, on which the plate must rest before the upper Mouth-hole, and cause a bottom-plate to be made no bigger than from the Bars to the lower part of the upper Mouth-hole, and so broad that it may reach a little above the Iron-Bars, and from the bottom-plate towards the sides, so as there may remain near an inch of room on the Back part of the Furnace, whereby the Wind may pass through it into the Oven, so that the fire may do its work.

IV. Which may be seen in their full proportions, in the fourth

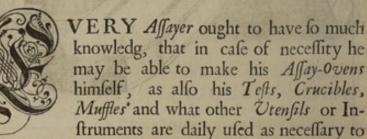
following Sculpture.

There must be also a Cover to the Furnace, with little Instruments to be made of Potters stuff, to govern the fire, the Forms of which are also in the fourth following Sculpture.

CHAP. IV.

How Muffles, Bottom-plates, Tests, and other small Potters-Work (necessary for Assayers) are to be made.

Section.



Assaying, because there are not in every place Masters of this ART to be found who know how to make the same, and although much pains may be taken to instruct a Potter (in case of Necessity) how to make some Instruments belonging to this ART, yet it often happens that they do not make them well, nor in good shapes; whereby an Assayer may perform his Work: and therefore I (as well as others, when we could not have good Instruments made sitting for us) have been forc'd to make them our selves, which are done thus.

Take good Potters-Loam (as good as may be had) but the Loam or Clay that is blew and becomes white in the fire, is found to be the best for use; Let such

of preparing Loam for Instruments.

Loam

Loamdry in the Sun till it be hard, and when you do CHAP. intend to make Instruments of it, let it be well pulveri- IV. ged, then moisten it with Water till it become fost, and let it be well troden or broken with an Iron, then put among it the Washings of Pibble-stones or very fine fand, as much as the Clay can well bear, but that you may not add too much or too little, be fure to make out of fuch stuff some Affay. Tests or Crucibles, and put into them some bard-flowing Oar and place them in the fire, which will offer thee a Tryal, whereby thou maift fee, if the stuff will hold, well, found and firm; fome do mingle among it some Chalk-stone, or the subtile red Talk or Glimmer in fuch place where there is much of it, but which is most necessary, Experience will teach: some take in stead of it the broken Pots or Crucibles, beaten small and sifted through a fine Seeve, and put so much among the Clay that they may vvork it vvell, because of its britleness, such Crucibles and Tests as are made of it hold vvell, (but vvhen Pibble-stones, as hath been faid before, are mingled with it, that it doth bind together in the fire, and the bigger the heat is, the more doth it bind) and this Proof-Test may be taken vvhole out of the Frame.

When the Loam is prepared you must then have section. a Frame, in which you may beat the Proof-Test and How the Crucibles: the Frames are best made of Brass, but Cases and they that cannot have such may cause them to be made Astay. To sit of good Wood of Pear-tree, and an Iron-ring may be put upon it, very closely, that the Frame, by reason of much use may not split or break then anoint the Frame with a little Bacon, and put in it a little Ball of the prepared stuff, as much as may be enough, and greafe also the upper part of the Frame, vvhich is called the Monk, and beat the upper part with a vvooden Mallet into the Case or Frame, then is the Test for-

med.

CHAP. med; pressit out vvith your Fingers, but have a care that the Clay be not too moift, otherwise you can not press the Assay-Test whole out: Some do put the Case with the Test upon a suddain and quick heat, and so the Test will come out whole, this is a very good way to make the small Crucibles, but with the great Affay-

Tests, it would be too long and tedious.

Section. To make Muffles of Clay over Sticksor

How the

bettom of

them are to be fram'd.

6.

To make Muffles you must have wooden sticks cut in form of that bigness the Muffles must be, greafe them with Bacon, and frame a Lump of Lute or Clay, of a convenient bigness, that it may be cut with a copper wyer, into a thin leaf or piece, and put it over the sticks or frame, and cut out of it luch another leaf, as may make it a half round piece, that you may close it behind, all this must be done upon the form, and must with a moist hand be stuck close to it: then let it stand, nigh three hours, that the Clay may be a little hardned, then cut the Muffle out, so as you will have it cut upon the fides and behind; and let it ftand yet a little longer, that it may go eafily from the flicks: Some do strew a little fine fand or asbes upon the Frame after it is greafed with Bacon, that the Muffle may come easily from the Frame: But that many Muffles may be prepared together, therefore cause more than one of these Frames to be made, that in the mean time while one doth dry feveral more may be made.

But, to the bottom Leafs or pieces you must have Frames of Wood, in Widness as the bottom leafs are. thick and broad; they must be prest full with the prepared Loam, then they will dry quickly, and come out eafily; or cut out of a piece of Clay, a leaf with a small wyer, so thick as you would have it, and shape it fur-

ther as is necessary.

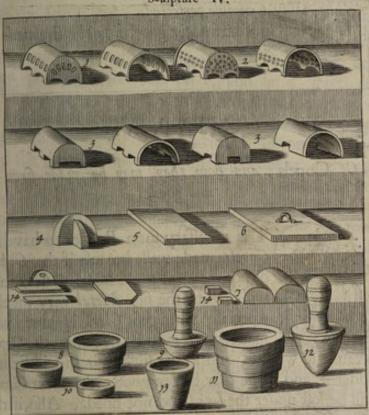
Of drying and calcining the Loam for Affaring.

Thele Tests, Muffles, Bottoms, Leafs and Crucibles thus prepared, must be very well dryed, and then in a

Kiln

Kiln or Potters-Oven well calcined, although the Muf-CHAP. fles and bottom Leaves are also used raw and uncalcined in the Assay-Oven, but there must be a very gentle fire, and the fire in the Assay-Oven, must first be kindled from above, downwards, and so they will remain whole, otherwise they will all fly in pieces; and thus you are fully instructed how the Potters-Clay is to be made into Instruments, and if they be not good and firm they are a great hindrance to the Assayer: the Forms of vyhich are truly to be seen in the following Sculpture.

Sculpture IV.



Deciphered.

1. The Muffles which the ancient Assayers did use, and the common Assayers do still.

2. The Muffle to the Noringberg Affay-Oven.

3. The

The first Book.

CHAP: 3. The Muffle to the Affay-Oven with the two month d IV. boles.

4. Stopples.

5. Bottom. Plates.

6. Covers.

7. Wooden Frames or Moulds for Muffles.

8. The lower part of an Assay-Test. 9. The upper part of an Affay Test.

10. The Frames or Moulds for Affay Tests. 11. The lower part of the Assay-Crucible.

12. The upper part to it.

12. The Assay-Crucible perfected.

14. The small Instruments for governing the fire made of Potters - Clay.

CHAP. V.

Of Copels, and bow they may be made firm and good.

Scalion. Copels of good staff.

made.

T is necessary for a Refiner to have his Copels made well, because if the Copels be not made of good Loam or Clay they will devour the fine Metal very much, especially when the Clar is not well made which is to be put upon the Copel, because it will rise, and so the silver Grain will be hid under it, and if the Clar be not good, the filver Grain will be lost under the Lead and not fined. Also, if the Asbes be not good, or something fat or oyly, then will the Copels melt in the fire, which will prove of ill Confequence, because with such there can be no Tryall

But

But, that you may have good Copels, that your Try- CHAP. als may be the better perform'd, make them in this fol-

Section.z.

lowing Manner. I nommon of the did to sent A risul Take Ashes burnt from any light Wood, (as Sal- for Copile, lows, &c. for such are best for this use) and put them into a Seeve, and pour Water on them that the Asbes may be wash'd through the Seeve into a Tub, so the Coals and groffer parts may remain in the Seeve, then pour into the Tub so much water more, that the Ashes may be covered-over, then stirr it about, and let it stand an hour or two: whereby the water will draw out the fatness and oilyness out of the Ashes, then pour the remaining water very gently off, that the thick troubled water may not go along with the clear water; and then pour another water on it, and let it stand also till the upper water grow clear; then pour it again gently off, and this do till the water hath no fatuefsor sbarpness: then the third time pour clear water on the Ashes and stir them about with a stick, as before, and pour that water, whilst it is thick and muddy, into another Tub, that the gross part of the Ashes in the first may remain till the water in the other Tub be clear and well fetled; then let the water run clear from it again, this is the first clearing: then pour another water upon the wash'd settled Ashes, and stir them again with a stick, then pour the thick again into another Tub or Boul, that is to try if there remains any Fatness or gross Asbes, that it may all be cleanly separated, and let the muddy water fettle very well because it is the last washing: and when the Ashes are thus far prepared, then make Balls thereof, let them dry well in the Sun, or in a Bakers. Oven, and keep them clean for use.

There are some Refiners that in stead of Albes of vine-(burnt off light Wood) do take Ashes of Vine-wood, and com-(but men After, CHAP. (but they are not every-where to be had) and they do wash and prepare them as abovesaid, some do use only fuch Ashes of which the common Lixivium or Lye is made, but the two former are better, which you will also finde by use and Experience, only there must be a

care that the Ashes be clear and well prepared.

Section. of Boneafhes, and which Bones are most Serviceable.

Secondly, You must have to your Copels good and clean Bone-Asbes, for which take Bones that have no Marrow or Gravy, and burn them white, pulverize, and pass them through a hair Seeve, then grinde them upon a stone, like Meal, and so you have Bone-Asbes prepared: then take two parts of the wash'd Athes which have first past through the hair Seeve, that they may not remain in Lumps; and with one part of the ground Bone-Ashes, and mingle these two well together, and moisten them with strong-Beer (but first let the Beer boil away one third) or, with a Glew-water: But, if you will bestow sonthing more upon it, then beat the whites of Eggs in water, and moisten the Afhes therewith, but not too much, that when you press a handful together, the Ash ball may well remain intire: then let the Copel-case be well fill'd with Ashes and put in, but be fure to scrape the superfluous Ashes off it, and give the Monk three or four blows with a wooden Mallet upon the Copel-frame, wipe the Monk clean off, and strew (with a little wooden shovel) good Clar upon the Copel, vvhile 'tis yet in the Case, and part the Clar vvith your finger, and fet the Monk strait upon it a. gain, and give two or three Blovvs to fasten the Clar upon the Copel (as necessity doth require) that the Clar may be fixed upon it, then take the Monk off, press upon other Ashes the Copel out of the Case, so is the Copel ready; in such a manner may you make Copels great and small, then let them dry till you have need of them, so will they be firm and good. Some

Munich.

Some do use a special Instrument made of Latten CHAP. which is full of little holes at the bottom, in which they put the Clar, and with a wyer that hath underneath a Section 5: little cross-Plate, they cause it to run through, but I do ment to strem the not like it so well, as if it were parted with the finger.

Some do take also among the Copel-Ashes the tenth of glew part of good Potters-Loam (which must also be wash'd for Copels, like unto the Copel-Asbes) and dry it in the Sun, and this is necessary to be used with it, and when the Clay is good and holds well in the fire: otherwise it may do more hurt than good in the Copels, and I conclude, when a man hath good Ashes that are well mashed (as I have hinted before) good Copels may be made that need no mixture, and those Ashes may well be moistned with fair water, but the Copels are more brickle by it, and not fo firm, as with the strong Beer or glew-water.

How good Copels may be made, wherein the Tryals will not leap nor sparkle.

UCH Copels as I have hitherto thought Section. fit to mention, are good to be used, by vvhich the true quantity and proof may be found in them, when the Governance of the Fire is vvell observed, but if this be not minded, and the Copel be cool and hot, then some part of the Silver is soon loft, but if an Assayer is uncertain in the Silver and Money-proofs, and hath not a full knovvledg of the Fire, it is better for him to cause the following Copels be made for Tryals.

Let Knuckle-Bones, or other Bones be burnt very Bones for Coppels.

VI. white (the Calves or Sheeps-bones are best) among com-VI. mon Bones) stamp them fine, and grind them upon a Grind stone fine as flower, then mosten such subtile boneashes (like other Copel-Ashes) with strong Beer, and of this make Copels, and strew Clar on them, as hath been done with the other before named Copels, and let them dry; so are they prepared.

Section. But

But good and clean Bones of Fishes may be had, (which of all Bone-Ashes are the best to be used for Copels.) When you would affay upon these Copels, set them in the Proof-Oven, and when they are only glowing hot, then put what you do intend to try in then, and although they are only thus, the Proofs will not leap, but be purely finished: only this is to be noted, that the Assayes upon these Copels are much colder, longer and go more fubtilly than upon the other Copels, therefore there cannot eafily any thing of Silver be loft; and when the proof is finished than may the Grain be taken off very pure and clean, and nothing stick to it, although it had been a Coppery-Silver that vvas refined in it, which Grains do commonly enter into the Clar, and they cannot always be taken off cleanly from other Copels.

ICH (opels as I have hitherto thought fit to mention, are good to be used, by vyhich the true quantity and proof may be found in them, when the Governance of the Fire is vvell observed, but it mis be not minded and the Copel be cool and hot, then some part of the Silver is soon lost, but it as and that not a full knowledg of the Fire it is better for him to cause the following Copels be made for Tryals, Let Knuckle-Bours, or other Bones be burnt very Let Knuckle-Bours, or other Bones be burnt very

AND nels must be fult (oparated from it. by boyling and bur-

only he must be called CHAP, VII.

How good Clar is to be made.

T is necessary that good Clar must be season, had for the making of Copells, because if the fame be not good, then there can be no good Copels made, although the Ashes be prepared as vvell as can be. Novv (as for my part) I have with Diligence try'd many Bones, and have found that Calve's head Bones or the Scales that come from their Forehead are the best: Take them and wash them from a boiling hot water, or let them boil well in the water, that the fatness and foulness may be separated from the other, then dry them and burn them untill they be fair and white, then stamp and grind them on a stone, still moistning them with a little water, and put them in a glaz'd Pot with a Cover luted on it, and set them once more in a fire or Potters-Oven, and let them burn well for four hours, then let them cool; this done, take these burnt Ashes out of the Pot, and grind them once more very fine upon a fmooth (or Marble) stone, that they may be very clear (of which clear preparation, the (lar hath its Appellation or name) keep it from Dust, and it will serve for your use at any time.

Some also do use *Harts-born* to make *Clar*, and they clar of burn it and order it as the other abovesaid, and this doth Harts born yield good *Clar*, but those of the *Scales* of *Calves-beads* I like better.

There is also of Fish-bones (as Pike and other Fisbes Bones) very good Clar to be made, but the Fatbone.

ness

CHAP. ness must be first separated from it, by boyling and bur-VII. ning them (as before) but this according to ones pleafure, and which Clar any one likes best, he may use, only he must be careful to see that they be finely ground to Ponder.

Section. How to be

When the Clar is ground to ponder, then some do wash it in fair water, and make four-square Pieces of it, or Balls (like Chalk-stone) as I my self did some years fince, but I find that if it be finely ground, and dryed only, it is the better, because by washing and drying it, and making them into pieces or Balls, they will grow hard, and cannot be fo well scraped from the Lumps, as with that which is in Pouder.

Now, how the Copel-Case and the Copel is to be ordered and performed the following Sculpture will shew.

Sculpture V.



Of Silver Oars.

25

Deciphered.

CHAP.

1. 3. The Copel-cases.

2. 4. The Copels that are made in them.

5. The Copels as they are set upon one another.

6. The Wash'd Ashes (or Clar) made into Balls.

7. He that works the Ashes.

8. He that strikes the Copels into their Frames or Cases.

But that the Forms and Proportions of the Copels may Section. the better be seen, the following Sulpture doth demon- Forms of Copels.

Sculpture VI.



Deciphered.

1. The Copel-Cafe.

2. The Copel for the Copper-Oars and common Proof of Common Oars.

3. The Copels for Oars that are poor in Silver, and also for common Oar Tryals.

H

4. The

4. The Copel for common Siver-Tryals, which are af-CHAP. Sayed according to Weight. VIII.

5. The Copel to Starling-filver Proof.

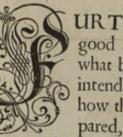
6. How the Copels are set one upon the other in the Ovens.

CHAP, VIII.

How Glass of Lead, or Lead-Glass is to be made.

Scetion.

Load-gloss to what Oars it is to be ufed.



URTHER, that every one may have good and fundamental Information of what belongs to Assayes, therefore I do intend, before I further proceed, to shew how the Fluss, or lead Glass must be prepared, which lead Glass is a Fluss, and

is used to the very hardest and unflowing Oars, to the end that they may as eafily be boiled up as the foft Oars: of which boyling, hereafter shall follow more full Direction.

Prepare this Fluss or Lead-glass, thus, Take fair and Flus or lead white pibble-stones, burn them in a Potters-Oven, stamp them small, and pass it through an hair Seeve, pour clean water on it, and wash the Mud from it, that the pouder of the pibble-stones may be clean and pure : of these pibble stones take one part, and half a part of red Littorage or Littarge, mingle it dry together, put it into a Crucible, but not above two thirds full, and put common Salt on the top of it, or Salt-peter (if fuch can be had) about three Fingers height above the matter, and lute it well; and let it flow together with a strong heat in a Wind-Oven or Tyle-oven; let the Crucible cool of it felf, then open ir, and all will be mingled in a yellow Glass; only a little Regulus of Lead at the Bottom, which is to be

lepa-

separated, but preserve the Glass, which is the Fluss. CHAP You may also melt the Littarge first by it self, and IX. of the flakes that come from it, take ten parts to one section. 3. part of prepared pibble-stones, and cover it with Salt, (as may. above) cause them to flow, and so a good Lead glass will come of it.

Or take instead of the wash'd Pibbles, good wash'd Another Loam, which is dry and firmly pulverized, one part, and way. three parts of good red Littarge, cover it with Salt, let it flow in a strong heat, this doth yield a fair Lead glass.

When the Lead-glass is made, and again melted in a Tocheanse Crucible, put a little Niter in it, and cause it to flow the Leada while after, so the Lead-glass will become cleaner or glass. more flowing: or one may use among it a fourth part of Caput Mort, and cause them to flow together, this also causes the Fluss to become finer and more flowing.

CHAP. IX.

Of the Weights which belong to the proving of Silver-Oars.

> HE Centner-weight by which all Oars, section. Slicks or wash'd slake-stones and what else of this nature are prov'd) is by the old Assayers proportioned thus: That the Centner is orderd to be just an

Hundred pound weight: for this Reafon, because in many places the Oars or slake-stones, and the silvery unwashed black Copper is bought by weight, and the fine Silver in it according to the Proof (before it is melted out of it) is paid for this end, that the Buyer may not be a Looser (because of the waste in melt-

IX. pounds as the Common Centner of the Mine yields (or where it doth weigh more or above) which Centner of the Mynt doth commonly weigh an Hundred and ten pounds, so that he may have the ten Pounds that is above, with the Silver in it, to help to bear the loss) therefore in a well ordered melting of poor oars they do hold most commonly 3, 4, or 5 loth of Silver, for the loss of the Silver in Melting should not be above the Silver contained in the ten Pounds of the Oar, that was over, comparing it with the proof-Centner: but in rich work and rich Oars, or concerning very rich Copper, the ten pounds which are above are also justly taken along with it.

Section.

Of dividing 15 Dram.

Preof CentNet.

1
2
4
Loth or twoOunces.

8
16
A Pound.
25
A quarter of a Centner.
Half a Centner.
100
A whole Centner.

The Peny-weights are of two forts, the one is with us in High Germany, the other is as 'tis used in Holland, after which the Silver or Grains may be tryed, upon a just

just proportion how much a Mark hath in it of fine CHAP. Silver. IX.

Heller, or Half-penny.	Section
Pence. Pence point of an interior of the point of the poi	Of dividing the Penny- weight in High Get-
1 Drams.	many.
1)	
Loth, or, 4 half ounces.	
16 Loth is a Mark, or 256 pence.	
	Of dividing
The single Grains.	Dutch Peny Weight.
3 de la composição de l	
Grains is a Half penny.	
Pence.	
Pence is a Mark, or 288 Grains.	
There are so much as 256 pence.	

The Mark in the Grain-weight, is parted into Loths and Grains, like as the Low Dutch Peny-weight is parted into Loths, Pence and Grains, and this Weight is most commonly used for Tryals in the Crucible for Coyn'd Mony, to which it doth best serve: for this Reason, because the

CHAP, the Grains here are reduced into greater Numbers, and the Contents more exactly found out, because in the Peny-weight it is only parted into Pence, and Half-Pence, and although the fourth part of a Grain (as to its Contents) is not usually reckoned, yet it is necessary for an Assayer to have such a fourth part in his parting or sharing for Information and Exactness sake,

```
3 Single Grains.
2
36
   Grains is half a Loth.
47
85Loth, or two Ounces.
16 Loth is a Mark, or 288 Grains.
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CHAP. X.

How all Silver. Oars are to be tryed.

Section. Affaying of Jife flowing Ours.



HAVE mentioned before, That a difference is to be made among oars, because some are harsh, hard-stowing and raw; as also that some are soft-flowing and mild: The soft-flowing oars are thus to be tryed for Silver: Take the Oar, grind it with an Hammer upon a broad Iron, (fit-

(fitted to that purpose) as small as pouder, weigh of it a CHAP. Centner (with thy Affay-weight) put it on a well-made Test, and mingle eight times as much of Lead in Grains among it, and fet in a warm Affay oven, and prefently make it hot, and let Coles before the ovens mouth, fo the Lead will begin to drive and turn quickly to Slacke or Drofs, and when it hath stood so long in the Proofoven, that the Lead upon the Test is all covered over with dross, then it hath dross enough; (this is called Boy. ling up or Up-boyling) then take an Iron book , lay it that it may be a little red hot, and stir the Oar with it cleanly about, which is done for this Reason, that if there should stick any of the Oar on the sides of the Test, it may be made loofe, and that the Lead also may work on it, and confume it: After the stirring, let it stand a while, and then take it out of the Assay-oven, and pour the Lead and dross upon an Iron-plate, in one of the little holes that are to be made upon the Plate, and let it cool, and then separate the drofs clean from the Lead, so is the proof of the Upboyling ready, which is done in the space of about half an hour, afterwards set Coppels in the Assay Oven, and let them glow well for half an hour, (and this is called Nealing) and upon these well neal d Coppels put your Lead so wrought, which hath been boiled up, and make it warm that the same may first begin to work, and when it begins to drive, then keep the fire not too high, that the Lead or work may drive well, and go off upon the Coppel in a convenient heat, and fo the Lead will all be drawn into the Coppel, and the grain of Silver will remain alone, (provided that the oar hath Silver in it) upon the Coppel, although it be very small, then take the Coppel out of the Assay-Oven, and take with your Pincers the Grain from it, to is the proof finished: Now, how this Grain is to be weighed, with the Assay-Scales, it doth require a special diligence;

CHAP. gence; and of this you shall be more exactly instructed X. afterwards.

Section.

2.

Tryals of barsh Oars.

You shall Assay these barsh and bard slowing Oars in this manner, Take the Oar ground small, and weigh of it a Centner with your Assay-weight, put it on a good Test, and add to it its due weight of Lead, to wit, Fourteen Centners: fet it in an Affay-Oven, and give it prefently heat, that the Lead in the Assay-Test may begin to drive, as you have done with the foft-flowing oars, and when the Lead begins to drive, then let it be cold again, which will be, when you do thut the lower mouthhole, and do open the upper, then will the Oar rife, and come to be roasted upon the Lead; when it is roasted enough upon the Lead (that is when it is feen to leave smoaking much and begins to slacke) then maist thou give it heat again, as much as can be. This happens when you do lay Coals before the upper Month-hole of the Affay-oven, so the great heat will force it, that the Oar will turn to flackes, but it doth flacke small and not eafily, and when the oar is almost boyled up, and hath flacked finely, then stir it cleanly with an Iron-book, let it stand again a pretty while in the oven, and when all is turn'd to fine slakes, then pour it as before upon a Plate hollowed, or let it cool in the Test, and beat the flackes from it, so is the proof of up-boyling ready.

In such manner, almost, may all Pibbles or raw oar be boyled up, and this is a right and good way to do it, but the up-boyling is hardly done in an hour, yet it may be done sooner in this manner; when you have weighed your oar, and set it on the Test without Lead in the Assay-oven, give first some heat until the oar upon the Test is roasted, and smoak no more: then set the Lead, (as much as belongs to the Tryal) upon the Test; give it a great heat, so will the Oar boyl up something easier, and in less time than if it should have been roasted upon the Lead.

Al-

Silver Oars

Although there are some that believe such a Tryal in CHAP. which the Oar also is roafted without Lead) is false and not right, yet I do give this Information, That I have Section. oftentimes, (with one fort or other) tryed both wayes, and I do truly affirm, That I have found no difference: But there must be a Care taken, that when the Oar is set alone upon the Test, that it may not be put into a violent suddain heat, because such an heat doth raise the small Oar, and doth cause it to dust away, especially when the Oars are stony, for it makes the Tryal false (this excepted) I know no fault, but be carefull and you will find it true.

Some have also another way to try raw mild Oar; Another as thus, They set first the Test in the Oven, that it may may to try glow, and then put the Lead in it, and let it by it felf flack pretty well, after that put upon the flack'd Lead, the weighed Oar in small Papers, so the hot Lead, and hot Slack will draw the Oar quickly to it felf, and will not let it rife much, or boil up very well: this way I also like, only that in drawing the Oar upon the bot Lead, (especially the mild Oars) it will dust, and when there are many Proofs to be made together, there will fomething be neglected, and the Proofs may become false.

If one doth know the Nature and Property of fuch Oars as will not eafily boil or flack, but remain upon the Lead (for so will the Chalk-stones) the gross and ran blind or Cobolt, the mispeckle, as also the mild and fresh Pibbles and water-pibbles which must (assoonas they are weighed) be mingled with Flus or Lead-glass (as hath been before mentioned) which will hold the raw Oar, and doth not suffer it to rise high, because it hath help by the Lead-glass, so that it will become soft Slacks and flacks yvell, and boyls up clean, as may be feen in melting: barsh Oars (which in Up-boyling each one by his proper addition may be helped) that they will be well iepara-

CHAP. separated, or else there will remain some Silver in the

flacks, and so there yould be some Dammage.

X. Section. 6. Of Affay-ing the Cop-per flacky Oar.

In S. Joakims Valley (so called) there are Oars broken, vvhich are called Coppery-Oars or flaky Oars, vvhen they are once boyled up, the Work or lead will not go off upon the Coppel, but casts up a Ring or border, and eats much in, and makes the Proof false: and vvhen this is knovvn by an Oar, then must the vvork or Lead which hath been boyled up (and from which the drofs is separated) be again set upon the Test, and be slack'd again, and then the Lead vvill come off clean and white; This is called, the Lead cleansed of its Foulness, then it must go off upon the Coppel, as before.

It happens also often, that the gross Sulphury oars do also make the Lead black and barsh, also that upon a the groß ful**phuryFlints** well neal'd Coppel it doth not drive, but leap off, which

makes the Tryals oftentimes come false, because of its Foulness, such Lead you must once more set upon a new Test or upon the same, and let it slacke again, so will it

be white and clean and go well off upon the Coppel, and

loofe nothing.

bolt Oars.

after Up-boyling.

Concerning the Cobolt oars, there are many forts of them, some fresh and some milde, black and gray, some in trying do go eafily into the Lead, but such Lead that comes by Up-boyling from it, is black and red, and it afterwards doth work upon the Coppel, and diffolves, therefore it must after the first Up-boyling, be cleansed again of its Wildness and must be slackd once more, so it will become white, and go clean off from the Coppel: One may also fet the weightiest Cobolt Oar in a Test in the Oven, and let the smoak pass away, some of which fort do leave gray Ashes, and some a black grain upon the Test, and the rest will burn all away, but put a little Lead to it, and it will easily go in it, and also go clean off from the Coppel, and is found alike with the CHAP. other Tryals.

But some do take it as above-mentioned, That when section. the raw oar upon the Test is roasted without Lead, the Reasting roasting doth take away some of the Silver, and that oveni. the gross Sulpbur doth carry it away, and they will demonstrate it by some volatile raw Flints, and the raw flackestone, which comes from it; which after they are roafted do not yield so much Silver as if they were melted raw through the Furnace, to which I do yield, and have found the same true: But because the roasting generally in the great W ork with quantities of oars is done in the naked fire, in which it also must lye several hours, contrariwise in the Assay oven and small Proofs there is but little oar put in, and that in a close Fire is roafted in a short time, I judg for certain, that through such roasting of the Oars in the Assay oven, nothing can be lost of the Silver.

Some may ask, If this way of using trying and boyling Probation up of Oars in the Test (and to let them so go off in the by which the Test) be the right way, or no, by which the true full worth worth, and how much Silver the Oar contains in it may found. be known? To which I answer, That this is the right proving, after which the melting Works may be ordered, and let up: But the true worth, how much Silver

the Oar hath in it, is not found there.

But to know this, Set a great Coppel (as is used to Copper Assayes for Silver) in the Assay-oven, and neal it well, and put fixteen Centners of Lead in it, let it begin to drive, then put one Centner of the ground-oar, which must be parted into many parts, and put it in small Papers, one after another, when the one part doth come first on it, it will seem stubborn upon the Lead, and vvill cover it all over, but let not this hinder thee; Do it first a little cool, and then hot, so it will soon flack in the Coppel;

Section. IO.

CHAP. Coppel, and the flacks will pass away, then set an other part of the Oar on the Lead, and that will do like the first, which slackes will soon pass away, then put in like manner the Oar all fingly upon the Lead, and it will all pass clean avvay in the Coppel, so that it will hardly be discerned, but seem like any other yvork

upon the Coppel.

In this manner may all other Works (if they be flowing or barfb, as also melted flack stone and Copper stone) be tryed through; in vvhich you will finde a great difference, if you try the other usual Way of Refining, but this vvay cannot be used generally, except of all Oars that are melted, to flacks vyhich are not altogether without Silver; therefore the common way of Affaying (with the Up-boyling upon Tests, of which all flacks do come, which cannot be wholly without Silver) is the best way: Ihave only mentioned these Assayes, to demonstrate, That with the same (out of every Oar) the right and full worth of Silver may be found in it, as fully as in the other Common Assayes: For several years, some vvorthy Assayers have weighed the Oars with the Cent-To try with ner-weight, which they intended to try upon filver Proofs mingled with Lead-glass, and covered with Salt in a Crucible, and placed it before the Bellows, and did melt it into a Regulus, after which when the Crucible vvas cold, then have they beaten out the Regulus, and together with the flackes have fet it again upon a Test in an Assay-Oven, and caused it to slack fully, which way is nothing vvorth, especially vvhen many Oar-Proofs are to be made: then Refiners have foon feen it, and have thereupon ordered their Tryals according to our vvay.

12/ When many Oars are-to betryed.

Lead glaß.

Here I must mention also, That vvhen an Assayer hath dayly much to try (to vvhose hands vvithout Question barsh and bard-flowing Oars come often) and if he be then vvell skill'd he knoweth by much and dai-

ly Experience and Practice) how each Oar is in the CHAP. Tryal; therefore when he hath prepared the Oar for Affaying (and so he must because of the many forts) use a bigger Assay.oven, that he may set several Proofs together at Work, whereby his Tryals may be made the fooner, and must keep this Order, when he will fet his Assays in the Oven, if they be 8, 9, or more, he must place them accordingly upon the Assayes, which are prepared in this manner; vig. That always the bardflowing Oars may be hindmost in the Oven, and that the foft-flowing may stand before: for they are soonest boiled up, and so may be taken out of the Oven without hindrance to those that must be longest in the fire, and then be cast upon an Iron-plate, vvhich Plate must be made thus, It must have as many Holes and Vents as there are Tests to be let in the oven at once: fo that each Oar may be poured out from its oven hole, that you may not miftake: But if it should happen that (because of thy many Tryals) you must have above one Furnace, then put all the bard-flowing Oars into one Furnace, and the foft-flowing into the other; otherwise you must stay one Tryal for the other, which would be an hinderance. This vvay of Assaying is at Kuttingburgh (because of the great Oar-Trade in commonuse there) to that in some places every Week 200 Tryals of Oars are made, and the Contents are delivered to a Dram.

Take Notice, That it is with this, as with other To aff ay to Tryals, (as was before mentioned) only have a Care a Dram. that you make use of an Assay-weight which may not be too little, and to have good and quick Scales upon which you may know the weight to a dram, or the fourth part of an Ounce, to then if you do well with the Proof in the Fire, then may you fafely and furely give in the true Contents of as many Loths and Drams as you

do find, after that one is weighed.

Further

CHAP. X. How to weigh the trydgrain.

Further, take Notice, That when thy Tryal is made and that you will draw up or weigh your small proof-Section, 14 grains, let your Scales be kept in a Case of Glass (that the same may be preserved from the Wind and Dust) then put into the one Scale the small grain of Silver, and into the other the grain of Lead (as small as it is) and put as much of the Assay-weight to it, that it may stand even with the grain in the other Scale, when this is done, then change the Scales that are in the Proof-scales, and see if the Scales stand even as before, if then the Proof be found alike on the one fide as on the other, and just with the weight, then may the fame be judged true, and be given in.

To bostrich Oar with Flug.

Such fibrer Oars as are very rich may also with the Fluss (made of Salt-petar and Argol asshall follow hereafter) be mingled and put into a Crucible and covered over with Salt, and may be melted like unto the Copper Oars before the Bellows, and there will be a filver Regulus, in the bottom of the Crucible (which is not very tuff nor pure, because of other incorporated Metals) the which you may make fully tuff upon a Test, and in this manner the filver is very eafily to be had out, but it is not the true Contents, because the Slacks do yet contain part of the Silver in them, the grain also doth not come very fine from the Test except it be done upon the Coppel.

CHARD may remain a firme or fettlement, weigh this, and d

CHAP. XI. contains it contains

How poor Oars of Silver are to be Assayed.

S for poor and unclean filver Oars which section, are mingled with stones (and yet may be wash'd off with water) Assay them thus; stamp and grind them in an Iron Morter very fine (like flower) mingle all well together; and weigh 28 Centners of it with the Assay weights, then put it into a smooth Tub, wash it with water till it remain like a fine flick or Clay, then weigh this wet flick and you will find how much those Oars do weigh and afford of clean flick, in one Center (because the flicks that are made clean by washing are also weiged vvet) try it upon silver (as you have been taught above) after fuch a Proof you may make your Accounts: and if by preparing and vvorking thus you can subsist: such a Proof hath preserved many an Assayer from danger of loss.

CHAP. XII.

To try Muddy-vvater springs of Silver.



OMETIMES it comes to pass that section. from mild silver Veins, there springs out of the Mountain a blackish or yellowish muddy mater, which doth often contain Silver: this you must try thus, Take a Potfull of this Water, boil it that there

CHAP. may remain a slime or settlement, weigh this, and do XIII. with it as with other Silver Oar, so will you finde what it contains.

CHAP. XIII.

How a true Lead-Grain which is usually drawn off in the Proof, is to be made.

Section.



VERY Assayer hath need to have great Care of the Lead-grain which he may make of the Lead that he uses dayly more than one grain, that he may be certain, because all Lead, almost, doth contain Silver, and although the Lead of Villach is counted the best for to affay

withall, yet there is but little to be found of it that is

quite without Silver.

So then there is no grounding upon this, because The Lead of unexpert Assayers that do run off upon the Copel four Villach not Centners of Lead, and vvhen they find no Silver therein, do therefore conclude that there is no Silver in the Lead, but there is need to run off so much Lead upon the Coppel, as much as is required to every Assay, and to try it more than once, and if then there is found no. thing in all this, then may it be concluded, That the Lead holds no Silver, and yet one is not to rely altogether upon it, but an Assayer is to prove his Lead several times over and over, again: that if a piece or lump should differ one from another (because the Pieces of Lead are not all cast at once in the smelting House where it is made) that he may be certain of his Lead, which is of much concernment: and fo you will finde that also the Vil-

Villach-Lead doth leave a grain of Silver when the full CHAP. weight of Lead is affayed, which filver-grain is to be laid XIV: upon the Scales with the Assay-weight, that it may be abated from the other Grain of Silver which came from

the Proof-Oar.

Further some Assayers are of the mind, That if there is a little Copper added that holds no silver at all, and The Leaddoth cause it to go off on the Coppel, that then the Lead- the Addition grain is found the better: this is well, if one defires to per. try Copper upon Silver, and so to make the Lead-grain; but to Oar-proofs, and to other things which are not Cop-

pery fuch a Lead-grain must not be used.

Because all Oar. Tryals do flack in the proving such as To make are very rich of Lead, and yet do afford some Silver: Leadgrains the Opinion of some is, to take the weight of Lead, and a Centner of Earth of the Mine or common Oar which hath little or no filver, and boyl them up together, that they may turn to flacks, as is done with the Oar-Tryals; then the flacks will draw in part of the Lead grain, which is to be counted for a true Lead-grain for use. But I judge because the Lead grain is otherwise poor, that the Difference herein is not great, yet it is left to every ones pleasure to make use of his own way.

CHAP, XIV.

How a Slackstone or Copper-stone is to be made, and to be tryed for Silver, and what the Slackstone is.



LACKSTONES (as the Philosophers do judg) are Sulphur and Arsnick min- Hone is. gled vvith a fubtil Earth, and doth separate in fusion from the Dross, and doth draw the Copper and Silver to it felf, demonstrated thus; The Brimstone in the

CHAP. beginning doth roast away, and the Arsnick doth sub-XIV. lime it felf with a strong heat, but the Earth in which the Silver is and the Copper doth remain, which is afterwards eafily brought to flacks, that the Metal may be separated, which otherwise could not be if the Arsnick had been with it, from hence may be known how to draw the Silver and Copper out of the Slackstone, to can it be no otherwise than to separate the Sulpbur and Arfnick first from it, which is done by roasting, as may be feen in the great works of Smelting; thus, that the slackstone in the beginning may have but small heat (and not a strong fire) so that the To separate cold Air may easily fall upon it, and cause the venomous Sulphur to rife, (which doth fly from cold, and loves the heat) and fo doth eafily separate, which other-险 wife doth stay in a violent heat, and remains alwayes Slack stone, and is afterwards not so easily separated, yet a small heat only doth it not, therefore in roafting, the fire must be increased by degrees, and in the End, when the Sulpbur is almost roasted away from the Slack stone, then with a strong fire the remaining Sulphur and Arsnick must be driven away, although the roaft should flow with it, yet it is no hurt to it: I do write this, That it may be feen, that the Searchers of Nature, have also with Diligence searched into

which way the Cakes

thence.

When the Red Slacks or Copper-stones are prepared and the Cakes let upon one another, and you are wildre to be hucked out. ling to try them for Silver, then beat out of every Cake a piece, not quite in the middle nor quite at the end, which is the best for proof (because the Silver runs toward the Cold) to that the stone-Cakes are found richer at the end than in the midft:) Take all the pieces that are cut out, mingle them together, and make a proof

these things, and that Roasting hath had its rise from

proof of it (this is called Younger proof) which you CHAP. may grind very small, and weigh of it a Centner with XV. thy Assay-weight, and assay such a Stone (as you have been taught above) and as hath been done with the barsh oars, put presently its due of Lead to it, and let it first roast off upon the same. In the end give it good heat, that the proof may be boyled up; But because this Proof is of much Concernment, therefore take fixteen weight of Lead, that the Tryal may have enough, because for a Tryal it is better to have the weights of Lead too much than too little.

GHAP.

To try Hard Work and Copper - Laech upon Silver.

RY and fat hard Work or Copper Laech Section: fome Founders (especially them of Cut-Two Sorts tenberg) do use for an Addition to work work the filvery Oars into flacks, that fuch Addition may be rich in Copper, and that fresh Cakes may be cast, and the Silver separated, to which in Comparison to common Refining, there belongs a particular Account and Understanding, for such dry and fat Hard Work must be tryed for silver, like unto a Leadish black Copper (which is almost one thing) and of which there will soon follow Direction.

CHAP. XVI.

CHAP. XVI.

To Affay melted Speiz, and what it is:

Section.
I:
What Speiz

HE Spiez Oar is in many places (especially in foakim's Valley) and is found out in melting: the Philosophers do think that it consists of Arsnick and Brimstone mingled with a subtil Earth, which doth separate it self from the

flacks, like unto the Copper flack stones, only in the Spiez Oar and the flack stone there is this Difference: For, as the Brimstone doth surpals (as abovelaid) the Arsnick, to in the Spiegy Oar the Arsnick surpasseth the Brimstone: therefore the Speig is vvhiter than the Slackstone, and doth loose but little either in the strong, or small fire, nor by roasting; nor can it be overcome by Lead, but is always found again, and doth loofe but little; only this is necessary to be known, that when the Speize is melted in the flintish-Lead Oar gently, and not over-heated, and doth then mingle with the flacks of Iron and (according to the manner of the City of Goslar) doth melt among the light Dust, so comes the Speiz to be loft, and none of it is found again, and the Silver enters into the Lead, which is caused by the Antimony in the Lead-oar, and the red Sulpbur in the Flints: which are both again in the Arsnick. But when there is a defire to Affay the Speiz for Silver, you must grind it small, and weigh it, and with so much Lead (as a flackstone hath need of) set it on a Test in an Assay oven, and in the beginning a great Grain of speiz vvill be found fyvimming upon the Lead, vvhich cannot be confumed by

To take the Silver out of Speize.

by it, some Refiners do take this Grain with Pincers CHAP. out of the Lead, and although the silver of the speix XVII doth enter into the Lead, yet without question such Grain doth contain some filver: But that the full Contents thereof may be found out, Leave the Grain on the Test, and add to the speig on the Test, some filings of Iron, that hath no filver, and then the speiz will be quite confumed, and become drofs or flacks.

CHAP. XVII.

How Black Copper is to be melted and cast into Ingots.

HERE are many forts of Black Copper, settion. one part is very good, but others un- Difference clean and harsh, as Iron - slacky, leadish, coppers. speigy, and also sometimes tinny, according as a Copper Oar doth break by another metallick Oar, or, if any of them hath veins through the Copper Oars, fuch a Metal comes to be mingled with the Copper, and is the worle for it.

So then, if you will cut out fuch black Copper and will cast an Ingot of it, Take of the Cakes which have been How black made upon the roast at once into Copper, cut a small piece Copper is to of every Cake above and under, and not quite in the middle, nor at the end, according to proportion and bignels of the Cake; and here you must be careful that you do not cut a small piece out of a great Cake, nor a great piece out of a small Cake, because one Cake contains more filver than the other, and so a Proof may be ioon made falle.

When the Cakes are all cut out, then put all the pie- How the Proof Ingot

CHAP. ces into a fracible, melt them before the Bellows toge-XVII ther, and when the Copper begins to flow and drive, then ftir it about with a dry splinter or stick, and let it stand a little longer, then take a clean Ingot rub'd with a little tallow, and cast the Copper into it, all at once, that nothing remain in the Crucible, but fet the Ingot smooth, that the Copper may be no thicker at one end than the other, because where the Ingot doth hang, the Copper runs that way, and is richer there in filver, especially in rich Copper. You must also quench in water the cast Ingot, if the Copper hath not been leady or tinny, and with a hard Charcoal the tallow may be scoured off, and the Ingot cleanled, but the Lead and Coppery cast Ingot must be left cooling in the Ingot, that the Lead may not rise up, so is the Ingot finished, which is to be cut halfthrough the Ingot, and beat it cross vvay, then with a Hammer and Chilel Strike it into two, to in the breadth the goodness of the Copper may be feen, and how the Ingot hath been together: and one half is to be given to the Buyer, and the other to the Seller, that if there should be an Error in the Proof then the Ingot might be affayed again.

Section. Difference of the Proof

It is also necessary to know, that if the Copper doth drive too long in the Crucible, it doth waste and become richer in the Contents, which is eafily to be feen, befides, if the Ingot be cast too hot, it will be in some places full of little holes, also if it is not all over smooth, but wrinkly and with knots, then it is cast too cold, so it is not found alike in Contents: if any of this happens in Casting by negligence, then such an Ingot is to be done away, and the Copper Cakes again cut out, to cast another Ingot, and thereby you will fine the right proof, and contents; because if the first should be melted and cast again, then it must drive again in the Crucible, and hen the Cakes are all out out, then put all the

the Copper would waste more, so the Contents would be CHAP. richer, and the Tryal talle.

If you intend to affay fuch, Cast Copper Ingots for Section. filver: Cut (with a Chiffel) at the end of the Ingot a Againg little piece, put that away and cut another, beat it flat upon a clean Anvil, or, if tis brittle, then to small bits, which you may weigh and affay thus: weigh of fuch pieces equally two Centners, put each in a small paper by it felf, make it fo that it may lye flat in the papers, and not in heaps, put also two great well-made and well neal'd Coppels in the Affay.oven, in the middle under the Muffle, and in each fixteen Centners of good clean Lead: but before all this, make a flame in the Oven with a Copper pipe, and the Oven and Coppel must be clean that no Ashes may remain in it, make it at the beginning warm, and when it begins to glow, and when the Lead doth go upon the Coppel, and doth not leap; then put the weighed Copper upon it; make it hot again untill it begins to melt or to go fresh. After this open the upper Mouth-bole, and shut the lower, cover the 0ven with a Cover, yet not quite close, but that it may remain open about an inch wide, or as necessity doth require; Afterwards fet behind (and upon the fides of the Muffle) the little Instruments, so the Copper will foon begin to go, then let it have a requisite Coldnels (because the Copper among other Metals (try d for filver) can endure the most cold. And after it hath gone a while cold, then lay before the upper Monthbole a few live coals that do not sparkle, or, if you do make your tryal in the Furnace made of Armour-plate, as in Sculpture III. Figure 9. then put before the upper Ovens-mouth the little plate full of holes, and govern the fire with fuch live Coals on the plate with holes, or by moving the Cover above, that the tryal may be hotter and hotter untill the end, then take the Cover quite

The Regiment of the

CHAP. quite from the Oven, and cause the Grain of Silver to XVII be all over bright and clean from spots, because the Copper Affay and government of the fire is of much concernment, and is accounted fo, because it is necessary to know how to give heat and cold (as it requires) if the same be duly perform'd) but if it is not so, and that the tryal be too hot, then there will be an ounce of Silver less in a Centner of rich Copper, and the Contents will be found so much poorer, but because such a Knowledg and Government of the fire cannot be described, but is learned only out of much Experience, therefore do I rest here: But yet know thus much, that if the Proof on the Coppel doth grow high and clear, then it is hot, but if it doth go flat and darkish, then doth it go cold; There must in the Copper Assay in all Tryals, the middle way is to be observ'd, and the true contents will be found: although young Assayers do much esteem their own Works, and do flight knowledg of the fire, yet it is certain, as the Copper for filver by fuch means is right af-Sayed, so must it be done with all other Copper Tryals, and he that is well acquainted with fuch Copper proof in the fire, he will want nothing in other Tryals, as hath

Grain produced from the Affay. been faid.

Thus, when the Grains of fuch two tryals have twinkled, fresh and clean, then take the Coppel out of the Oven, and take the Grains off, while the Coppel is yet hot, so they will part clean from the clear, and the Coppels which bring the yellow subtil Littarge alwayes with it. Provided it hath had its due Heats and Colds (as hath been said before) but if it hath had too great heats then there will be no Littarge and it is not good to trust to fuch Tryals, but vvhen the two Assay Grains in the drawing up of the Scales are of a like vveight, then is it a fign that the proof hath been well made, but if they differ, although the Tryals have been diligently per-

performed, yet there is no certainty to ground upon it, CHAP. and it is better that such be made anew; but forget not XVII when you do intend to draw up the Proof with thy vveight, to put it in the scales with thy weight lead grain of the Assay lead, and to beat it off from thy proof

grains, although it be very small.

One may as vvell lay the vveigh'd copper first upon the coppel, and let it glove veight copper and afterwards the was to try due veight of Lead, which is as well; only the cop- Salver. pel must first be yvell vyarmed, othervvise the Lead will leap upon it, and the proof become false, which cannot be by the former way, because if the Lead which is fet first alone upon the Coppel should leap, it may then quickly be made still again, if a live Coal be laid a little while on the top of it, and afterwards put the Cop-

per upon it, fo it will not hinder the Tryal.

Further, every Assayer ought to know when the Cop- Proof Inpels are not made of good Ashes and well prepared, for to have hereby they become tender, and will rob the proof of great care of fome Silver; likewise, when he doth use a new Assay-Oven, to which he is not used, and doth not know well the Degrees of fire in it, so it is better that he may learn first to know well the nature of his Coppel and Oven, that he may trust to it, and this may be done in the following manner: Take a Copper Ingot, of which a Centner contains about forty Loth, or twenty Ounces of Silver (which in many Tryals hath been found of a certain Content) and of this make one or two Tryals one after another, as often as you do intend to change your Instruments; then, if you finde the first contents, you are certain of your Instruments, and there is no fault in them.

Concerning the black-iron-streamy-slacky and ram Copper they are not to be affay'd like the abovenamed good Proving of Copper upon the Coppel, therefore when you do intend the behack of the black of the copper upon the Copper

CHAP. to try such, beat them small and weigh of them two XVII equal Centners, put each of them in a particular clean Test, place them in an Assay-Oven, and when they are glowing through, put to every Tryal its due proportion of Lead, to wit, fixteen Centners (like them before) and make them warm, and so they will begin to flacke, but you must not let them flacke too much, for then the Lead will enter into the flacks, and there vvill remain too little Lead with the Copper, and so cannot go clean off, but if the proofs be right boyld up, then take them out, and let them cool in the Tests; afterwards separate the drofs from it, and cause the Lead or work to go off upon the Coppel, as cold as can be, yet to as that the proofs (as hath been taught before) may not congeal too foon, but appear pure and bright, and hereby you will have the true Contents, because such unclean coppers when they are not boyled up at first, but enter raw upon the Coppel into the Lead, then they do flacke upon the Coppel and fret on it, and the proofs must be hotter, so that the true contents cannot be exactly found

The weight of the Coppels.

Further also, I cannot leave unmentioned, That the Cop- Coppels after the proving of Copper do alwayes come heavyer out of the fire, than they were set in at first, which thing although it brings little profit to a Resiner to knovy; yet it is to be vvondred, what the cause of it might be.

CHAP.

GHAP. XVIII.

To try Bell-metal for Silver.

ELL-metal, of old broken-Bells (vyhich section; is sometimes rich in Silver) must be try- Bell Metal, ed like unto the black raw Copper; but because of the Tin that is in it, it must be boyled up stronger, therefore there must be to such Tryals, four parts more of Lead than to Copper, by which also the Lead doth loose more: Or, weigh of such Bell-metal only half a Centner, and allow to it so much Lead, as to a Centner of Gopper, so it will flack clean, and there will remain enough of Lead with it, (after it is boyled up) to drive off in the Coppel.

CHAP. XIX.

How old Silver-plate or Coyn is to be made into Grains.

RAINING of Silver is done for the most For what part when bad, broken or other forbid- the Graining den Money (coyned in Hand) that the profitable. same may be all melted together and afterwards to Assay it, and to fit it for better coining, that also the bad Money may be rooted out of it : this is to be done thus; When there is much of it to be granulated, then must there first be a furnishing of necessary Instruments, viz. Crucibles

Crucible for easily breaks

CHAP, and Wind-Ovens, that one may easily granulate a great XIX. quantity of Silver in Plate or coin, and when you have all Necessaries, then let the crucible empty into the windoven, a good hand-breadth higher than the grate, and cover it with an Iron, cover, cover the crucible all over

with coals and ashes, and upon them live coals, let the fire kindle from above downwards, then you need not

fear, that it will be crack'd (as it happens fometimes when it is let in a luddain heat) and when the crucible Section. Why the

hath been fet thus in the fire, and that the fire hath yvell kindled downwards, so that the crucible is red hot all

over, then uncover it, and fee if it is yet vyhole, and hath no crack, vyhich is foon feen in the glovving heat, then

put in the Silver that hath been first vyeighed in the crucible, and cover it, put coals over it, and give it a strong

heat, that the Silver may fink, then may you put more Silver, if you have it into the crucible, and give it fire

again, that it may fink, and also follow it with the Silver, until the crucible be full, when that is done, then

give it fire enough, so long till the Silver in the cruci-

ble begins to drive, and when thou feeft it drive then throw upon the Silver (in the Crucible) coal-dust, or

Ashes that the Silver may be covered with it all over; ftirr it well about with a glowing hot iron book, and af-

terwards with a small warm Crucible take the Silver out

of the greater Crucible, and pour it in cold vvater.

If you will have round Grains, then pour the Silver through a vvet Broom, but if you will have your Sillate the Silvet round.

ver bollow and thin for separation then stir the yvater with a stick well about and pour the filver into the boyling vvater, so vvill it become hollovy and thin, or

granulate it over a *Role, (vyhich being half in and half out, the water vvill run about, so will it be bollow, after

it is granulated; then pour the water off from the Grains, and dry them in a Copper balon over the fire.

But

To granu-

* Walezon

But if there be many to be melted and granulated; CHAP. the (rucible is to be fet likewise into the mind Oven, and XIX. first kindle the fire by degrees, that it grow warm, that Section. you may fee if the Crucible doth remain whole, because How to goif the same in the first kindling doth remain whole it will fire. hold well in melting, provided the first be well tended, fo that the (rucible may not stand naked, but that it may have a like heat, because the place that is left naked the cold doth work upon it, and in that part doth eafily break, therefore it is necessary to put the coals sometimes down about the Crucible with an iron Instrument, that the (rucible may be preferv'd, and when the Crucible is glowing warm and whole, then put with an iron Instrument (which is made purposely for it) the old Silver therein, that the Crucible may be heap'd full, and put the cover upon it, and afterwards coals, and give it convenient heat, and the Silver will eafily fink down, and still go on in putting in Money so long till the Crucible be full with the melted stuff, and then give it a strong fire or two, that it may be fully hot in the Crucible, and when you see that it doth cast a black Scum upon the Crucible (which fcum you must take off with a Scummer full of holes, and let it be cold) then fift it through a fine bair seeve, that the grains of Silver which have been taken (with the scummer) out of the Crucible may be put to the other Grains; keeping the black dust that falls through the bair Seeve, because there is yet filver in it, which afterwards you may make to profit; when you have taken all the scum from the Crucible, then cast again some clean coal-dust upon it, give it fire once more, that it may be very warm, and drive it, if it be not so, then the contents of the grains comes not alike, and it happens fometimes, that that which is not alike must be granulated again, which can not be done without loss, therefore be carefull at the first, and do

CHAP. do not hasten too much with it, so when it is sull hot in XX. the Crucible, then may it in the same manner (as hath been taught above) be taken out of the Crucible, and be cast through a met Broom (which hath not many small twigs) into the water, or, if there be much to be cast, then have two Brooms to cast through, that the one after the other may be dipt into the water, this is the common way of granulating, and it is the best vvay to do it, by vvhich the grains have an equal content, and near finely round.

CHAP. XX.

To granulate out of a Kiln.

Section.

1.
Themanner
of performang it.

urther, there is another way to granulate (novv used) called Granulating out of the Kiln, and is thus: Cause a Kiln to be made of Potters earth (alittle above a Span diameter within) which must have Iron. hoops, and the middle ring or hoop

must have a long Iron-bandle, and at the end of the handle a ring; likewise the Kiln is to be cut out on that side towards the Bellows, and when there is an Intention to granulate in the Kiln, then it must be set before the mouth of strong Bellows, and coals put in it, and after let the Bellows blow into it, that it may glow well; and then the old Silver (with an Iron-ladle) must be put on the top of the Coals, and the Bellows must blow always, so will it melt easily; and put still more silver, and let it stow: do this so long till as much Silver is in the Kiln as it can hold: stir it well about, after that, Take the Kiln vvith the coals in it, from the Bellows, and take it vvith the handle upon thy arm, and the ring which is at the end of the handle in thy hand, by which

you may govern the Kiln, and so granulate it out of CHAP. the Kiln; through Brooms as hath been faid before.

This is a quick way to granulate, but the Contents of the old Silver is sometimes not found alike, and it doth also waste more than by other grainings or granudoth allo walte more than by other granings of granulatings: Now as often as there is need to melt in such any of grana Kiln, it is necessary to do it alwayes well over with "mlating. a good Clay, that may hold well in the fire, otherwise, when the Metal is warm, it may flow through it.

It happens also often, that if a (rucible doth leak or or run out; and in that case sweep all clean together, put it in a Vessel and pour vvater on it, and that which when the doth swim at top, take off, and throw away, and pour doth break, other water on it, this do so long untill the water doth go clear off, then out of the Residue pick out the course sand and stones, and stamp the rest in a Morter and fearse it through a hair seeve, that which doth not pals keep it, because it is good, but that which goeth through, vvash that again in a long Tub made of Firr, that the refidue of the good may be got out : because where much is to be granulated there will be sometimes some Mischance, so that a Crucible may run out, and cannot be rectified again without loss and dammage. The following Sculpture is thus

Deciphered.

1. The Grain or granulating Kill or Kiln.

2.2. The Wind-Oven of Potters-stuff upon a Trevet or tbree-fot Frame.

3. Another Wind-Oven of Potters-Loam with Iron-Hoops, on a three-foot Iron-trevet or frame.

4. The Crucible in which the Silver is to be melted.

5. The crucible in which the melted Metal (that is taken out of the fire) is to be put.

6. The copper Bason in which the granulating is per-6. The form d.

56

CHAP. 7. An iron-roaster on which the Silver is heated and XX. roasted.

8. He that tends the Grain-Kiln.

9. The Broom-holder for Granulation.

10. The granulating Veffel.

11. The Bellovvs to the Grain-Kiln.

12. The Instrument used by bim that tends the Grain-Kiln or Furnace.

Sculpture VII.



CHAP, XXI.

How the grain'd or granulated Silver is to be affayed for fine Silver.

> Ranulated Silver hath different Con? Section. tents, therefore according to its con- The differ tents the Addition of Lead must be : rent Conbut that there may be a true Under-Graind Silver. standing of the difference, so the Addition of Lead (according to the Con-

tents) must be taken thus, viz. to that vvhich contains fifteen Loth of fine Silver, the Lead must be 5 or 6 times the quantity, and to that wwhich is burnt silver, (and is 15 Loth and three drams in the Contents) to fuch there needs but four times the quantity. But if the Grains are from 12 to 14 Lotb, then take to one Mark, ten Marks of Lead, and upon 14 Loth Contents, take The differ nine quantities, from 9 unto 12 Loth Contents, take 16 rent Quantities of quantities; and from one to eight Loth-Contents, take Lead. 18 quantities: and although upon some Contents there might well be one or two quantities more, than one too little: so that the Proof may have its due of Lead, and if the proof is right governed there vvill be no vvant.

When you are ready to affay fuch Grains or old filver, then fet first the Coppels into the Oven, and not Grand above two filver Tryals at a time: Let them be well nealed and heated, and then put the vveight of the filver or grains, to two equal marks of thy penny weight, place each of them into a small Test or put first the prepared Lead for the proof upon the Coppel, and let it begin to vvork, and after it, also the weighed grains; govern the fire by covering the Furnace, as also by put-

rich Grains.

When the

Proofs bave too little

CHAP. ting the Instruments under the Muffle, that the proof XXI may go off alike, and pretty cool; cause afterwards the Grains to shine bright, yet not over hot, that they may not bolt or fly out, else the proof will be false.

> Further, know also, that the Grains which are rich in Copper (and can endure much cold in trying) must be kept coldeft, and afterwards let it shine clear (if the Contents be truly to be found and that which is not rich in Copper, with less coolness will leave its subtil Littarge on the Coppel (as hath been faid above.) But the Burnt filver and the very rich Grains cannot endure the cold because it hath no streamy Copper with it, and the proof would eafily congeal, and if this should happen there would be no Remedy afterward, but it must be done again, therefore such proofs must go off a little hotter.

> But if it should happen (by not minding it) that to one poof, there should be one or two quantityes of Lead too little, then the Proof will not shine clearly at all; which is eafily to be feen by the Grains, when there are little Spots upon them: as also black and wrinkly, and not very clean, such Tryals are falle, and must be begun

anew.

Also it is to be noted, That if the proof do go too When the Proofs dogo hot, then the Lead will carry more than ordinary, of 100 hot. Silver with it into the Coppel: and what one hath in the beginning of the proof, that he vvill finde; only have a Care that the Grains (in the end) may be clean and

clear, so you will finde the true Contents.

When the Grains are gone off clean, then they must be struck off from the Coppels while they are yvarm, so do they go off clean from the Clar, but if there should yet stick something about it, then press the Grains with clean flat tongs, and the unclean will fly ayvay: Further, Bruth it yvith an hard Brufb, clean off, and vyhen they are very clean, then yveigh them one against ano.

To make

affay grains

ther, if they be alike and do stand even at the Globe of CHAP. the Ballance, then is the proof right: weigh then one XXII grain by it self, and see hovy many Loths, Drams and Pence, it hath by thy Affay-weight, that you may find by it, the true Contents, and fee that the Lead-grain be alwayes abated, though it be never fo little.

CHAP. XXII.

How coin'd Money in great or small Sorts may be Affayed.

> HAT concerns good and Gross Money, Section; as Dollers and new Rix Gilders, try them of Dollers thus, Take the piece you do intend and rix Gilto try, beat it flat at one end, upon a smooth clean Anvil, that it may be cut with small Sheers used for Silver, and so cut it into little pieces, and weigh them

according to your Grain weight, two, alike Marks, put this into a small Test, and make a Tryal; if it be Dollers: put nine quantities of pure Lead, and to the new Gilders, put eight quantities, cause them to glow off in a reasonable heat) and cold (as you have been before inftructed) and fuch proofs (when they are govern'd well in the fire) do yield a pretty deal of fine and fubtil Litarge on the Coppel, which the unexpert Affayer knows not.

It is also necessary to know, That neither these nor other proofs do leave any Littarge on the Copper, if they To affay be not done in Coverd Ovens, of which Tryals many Re- Affay ovens finers do know nothing (as hath been faid) therefore they do feldom bring a Proof to its true contents, for they know not how they must order their Coppels according to the quantities of Lead, which is of no small Concern,

CHAP. that they may not have too many nor too few Ashes, XXII because, if there be too few Ashes, then the Coppel will become soft, because of the much Lead which they suck in, which easily doth draw the filver with it into the Coppel, so the Contents is lessened, and if there be too many Ashes then the Coppel will be too big, and take too much room in the Furnace, and are not so convenient for use.

Section.

To affay fingle and donble Stivers. Concerning fingle and double Stivers, they must be Assay'd in the following manner, Take two or three and cut them with Sheers into little pieces, and weigh two equal Marks, or pieces or parcels according to the Grain-weight, and take great care that you have some of the out-side for the Tryal to both alike, because the proof that hath most of the out-side will be found richer in the Contents than the other that hath not so much of the outside.

The Lead quantity.

Put to each Mark or Proof eighteen Quantities of pure Lead, cause them to go off pretty cool, and at last to shine clear, which then also doth leave subtil Littarge upon the Coppel, yet not so much as of the Dollers; then if the Grains are of an equal weight, the Proof is right, draw one of the two up, with the Grain-weight, and as many Loths and Grains as you do find, so much is there Content in a Mark of sine silver.

To Assay

Upon white Pence, Keinish and other Pence the proof is thus; Take twelve of them, and cut of each of them a bit or two for a Tryal, only take notice that you do take of such Pence, some bit where it is thick, and of some where they are thin, that to each Tryal there may be some of the thin and some of the thick Bits: add to each Tryal eighteen Qantities of pure Lead, and cause them to go at first sine and cool; and lastly, to shine bright, so will the Grains be alike; but, if in the one Proof there be much of the thin, and in the other much of the thick

thick Pence should come, then the Grains would not CHAP. be alike, but oft times the proof in which much of the XXII thin Penny did come, that fine Grain will be almost two Grains more; and the other so much less in which most of the thick did come.

This is not much minded by fome Refiners, but when their Grains do differ, then they do take the middle of it, but it is better the proof be right and that by diligence, the proofs may come out alike, because the section. small Money by boiling white doth differ in the Con- To finde the tents, fo is the proof now adays better to be found than true Proof to melt a Mark of the Money in a Crucible, and to foon Money. as it begins to drive, to cast it into an Ingot, and then to make a tryal of it fo (without question) the true Contents will be found, and agree with the other proof made of the thin and thick Bits.

I must mention also, that some Refiners and Assayers are about to prove Coyn'd Money with the Low Dutch Penny weight (which is not amiss) because the Con. tents do agree with the Grain-weight; as for Example, Suppose you have assayed new Gilders, according to the Grain-weight, and have found that the Mark doth contain fourteen Loth and fixteen Grains, but according to the Low Duch Penny weight, twelve pence and four grains, these twelve pence and four grains make just so much as 14 Loth, and 16 Grains, and so both of these are of one Content, yet of two Denominations.

If it should happen that an Assayer should be in 70 assays fuch a place where he hath no more then one Cent- the Silver, ner - meight, nor could have any more, and there the Comshould come before him Grains of coyn'd Money, or a mon Cent-ner weight. Lump of Silver to try, how much a Mark of the same doth contain (of Loths, Drams and Pence, or of Loths A loth is and Grains) of fine Silver, he must take out of the Half an Centuer-weight fixteen pound, and let them be a

CHAP. Mark or fixteen Loths, the eight Pound, eight Loths; XXII the four Pound, four Loths; the two Pound, two Loths, and one Pound, one Loths; after that, the fixteen Loths two drams; the eight Loth one dram, the four Loths, two Peny-weight: the two Loths, one Peny: and one

Loth, a Heller or Half-penny.

If he hath then affayed a piece of Silver according to fuch weights, then may he find the Contents eafily upon Loths, Drams or Pence, but concerning new Gilders, which commonly do hold fourteen Loths fixteen Grains, they will hold in such a peny-weight fourteen pound, and 28 Loths, or a little more (which would be according to the above-named Directions) also fourteen Loths, three Drams, two Pence, and almost half an Heller or balfpenny, do carry 14 Loths and 16 grains.

In like manner one may for Gold take to 24 Carats

16 pounds of the Centner-weight, and assay the Gold

To assay the according to it, but it is better if an Assayer hath by hand

Centuars

Mpon Grains. the Assay-weight, already parted to make use of the

same, because to mind this doth require an expert Assay-

er, for an unexpert one will eafily err.

CHAP. XXIII.

How Burnt filver Pieces and Plates are to be cut out.

Bornt filver

F you will cut-out a piece of burnt Silver, then first cut a piece out at the top, with a small half-round Chissel, not quite in the middle, nor quite at the end, then turn that piece of Silver, and cut in like manner a piece out of the bottom, or he all from one side, but opposite to the

that it may not be all from one fide, but opposite to the piece that was cut at the top of the other side, that is to be cut on the back side.

But

But concerning Plates, cut them out at one fide above, CHAP. and the other below, and weigh of each half a Mark for XXIV a proof, put them together in the Proof-Scales, that is into one Scale, and into the other put the whole Mark, opposite into the other Scale, if it be not just alike, as it should be, then make it so, that the scales may stand equal (and affay as you have been taught).

Clear Silver may also be cut out also above and be- Blink Silver low in like manner for to be affay'd; and so the Contents will alwayes be found just when the Proofs have been

well made.

CHAP. XXIV.

How Silver Touch-Needes are to be made.

HE filver Touch-Needles (which are al-To called Proof-Needles) they are generally made and used by all Refiners and Guardians, and they that deal in Silver: by which Touch all Silver-Contents may very nearly be known: Now to make fuch it is very necessary to have weights that are a pret- To make

ty deal bigger than common Affay-Weights: And then them. take good fine Silver, and of it make the first Needle, (and make a Mark on it) viz. 16 Lotb of fine: And to the Second Needle, take 15 Loth of fine Silver, and one Loth of fine Copper: and

C	H	A	P.	
X	X	r	V.	

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In lor	Fourth	13	Statem wol	3	
31.7.13	Fifth	12	m radicate in	4	
	Sixth	II	ad it o the o	5	
	Seventh	10	some Sails,	6	oppolite
	Eighth	9	ol ni odnig us	7	blued it
Tr. d	Ninth	8	Loth of fine	8	Loths of
To the	Tenth	107	Silver and	9	Copper.
* Sun Buo	Eleventh	6	le sd of roll ter	10	lewin II.
mend av	Twelyeth	5	found infew!	II	mill along
-	Thirtenth	4		12	well-made
	Fourteenth	3		13	20.40
	Fifteenth	2		14	Bes and
	Sixteenth	1		15.	- COTON

Scction.

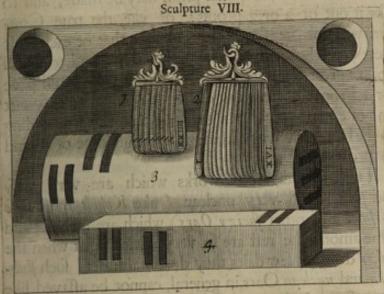
When you have weighed all thefe, then put every To try them Needle's proportion into a Crucible, and do not let it drive much, for thereby the Needles may prove falle: but fo foon as the Silver and Copper in the Crucible begins to drive then stir it with a dry Splinter (or stick) and cast each proportion into a small (Ingot, out of which the Needles are to be made, which you may shape as you please, and put a mark or distinction on each Needle, according to the Contents of each, thereby to fee how many loths of fine Silver a Mark doth contain, that you may not be deceived by the Touch, but thereby make a right Judgment.

Needles bulf Loth.

Some do part and divide the Needles into two balfloths, which is left to every ones Freedom, and there is enough in it, where the Touch may not be certainly known by the loth, Now when thou dost intend to use the Needles, then upon the Silver which thou hast made, scrape a fine shining stroak, and also make another stroak on the Needle by it, and fee which stroak on the Needle is most like the Silver-stroke, and so you will see by

them

them how much the Silver doth contain: and that the CHAP. form of the Touch - Needles may be feen, this following XXV. sculpture doth represent.



Deciphered.

1. 2. The Touch Needles.

3. 4. The Ingots to be compared with the Touch-needles!

CHAP. XXV.

How Mettals that are melted must be cut out, and affayed for Silver.

F wrought (lead which is Cast in melting of the filver Oars) some are clean and Clean work, pure, and others are foul and unclean; the Clean which come from the mild and good Oars, them, you may by them-felves prove like unto Lead, and take a Proof out of it, when 'tis going to melt, and weigh

CHAP. of it at least a Centner, or else when the work is cast XXV. forth, as much as it doth weigh is to be cut and assayed together: And keep this Order, that always of the whole that is cast, a special proof may be made, and to take it out of 2 or 3 proofs: or else the true Content will not be found, except it be that of each cast piece the whole quantity be weighed in, and to go off upon a great Coppel altogether; but if you would have for a Proof some cut out of the Cakes, you may cut out of each (especially if the Work be rich) according to the bigness above and below, to weigh some of all, and to prove it.

Section. 2. Unclean work.

There are also some works which are very milly and speigy and very unclean (like Kobolt and course Wilmet and other speigy Oars) which are melted; and fome among the rest are so very unclean that when the (akes do lye a few daies, they do fall afunder: fuch stubborn and unclean Oars, in general, cannot be affayed like unto the good; but when fuch Work hath been weighed, then cut or beat out of every Cake a piece, and weigh it to unclean as it is, vig. of every cut, and affay as fol-Take of the work as much as it is in weight, loweth: put it on the Test in the Affay-oven, cause it to flack, that the Fury and wildness may be consumed, let it cool and knock it off, and cause it to go clear off from the Coppel, but if it be not flacked at first, but set raw upon the Coppel, then it will work upon the Coppel, and will not go clean off, as is shewn.

Some Assayers do use to take the Content of such unclean work, and cause it to go together in a great Assay. Test or Iron-Kiln, and cast it forth, and then weigh of it for a Tryal, which is not right (although they do think they shall obtain the true Contents) because by this running together the Contents comes finer, and the proof is made richer, therefore the abovesaid way is much better, by which the true Contents is found.

But

Another Custom among As

But when an unclean Work is put upon the Coppel, CHAP. then to imagine (when a work of it felf will not go off XXVI. that to add some other clean Lead, and to help it that way, that it may go off pure) is vain. For this cannot when there be a certain way of their Proofs, nor are you to trust to ded to the work Tryal. the same: Because in the Work-bouses the Lead is not altogether without Silver, so the Silver is found in the lead that is added (as little as it is in the other Contents) which becomes so much richer.

Likewise as it hath been said, of casting and working, how they are to be tryed, fo it must be done with bearth Tryals, they which are overlaid with Silver and richwrought Lead, and taken from the Hearths, let it be good, or unclean, only that at least, the half of the whole weight may be weighed and tryed, fo will you finde the fine Silververy near, yet not altogether fully, because the unclean that was at first in the Work, and hath been weighed with it (before the Harth.proof was taken off the work) when it is in driving was dissolved and taken off; as also fometimes the Proof is taken off too hot, and fometimes too cold, by this may every Assayer understand the Contents: and which (although, as hath been faid, in comparison of the Silver that is brought forth) is not much out of the way:

CHAP. XXVI.

How Tin is to be affayed for Silver.

IN among the rest of Metals doth en- section. ter most freely into Lead, but the strength of the fire will not permit it to remain therewith, because as soon as there comes great heat to it, then doth it go again, and rife upon the Lead, and becomes altogether

The Lead-

CHAP. together stubborn, so that with no force of fire, besides other help, can it be brought to a true Up-boyling upon the Test, because the Tin doth oft times contain much Silver, and the Tryal of it is very necessary: Therefore was I the more willing to instruct young Affayers of the Tryal of it, which is done thus: Weigh two equal balf Centners of the Tin, and to each balf Centner, a Centner of good found Copper, and fixteen quantities of pure Lead, put each half Centner with its Copper and Lead upon a Test, each by themselves: Begin first with a flow beat, and when it begins to drive upon the Test, it will begin to rife, then let it go very cool, and take two Centners off the abovesaid Lead-glass put it also to it, upon the Test, and the Lead-glass will cover it all, and will not fuffer the Tin to rife fo much: and when you have let it go cool so long(till the risen Tin upon the Test doth no more look bright, but black and dark) then give it again as much Heat as you can, and boyl it up (as you do an unflowing barsh oar) and when it hath slack'd well, then stir it with an hot Iron-book, let it stand a while longer, untill it be boyl'd up very clean, then take it out of the Oven, suffer it to cool, beat the flacks off from the work or Lead, and let it go off upon a Coppel: if then the Tin doth hold Silver, there will remain a grain upon the Coppel, draw it up, and you will finde the Contents.

To fuch a Proof must you make a Lead - Grain on purpose, thus; Take a Centner of the Copper of which grain to this Tryal. you did add to the Proof, cause it diligently to go off upon the Coppels with the Lead quantity: and keep the Grain of Silver that comes from it which (in the drawing up of the Proof-Grain all times to the Weight) is to be laid and abated, else one cannot be certain of the Contents: and after this manner in Tin the right Con-

tents is to be found.

Some

Some Affayers are of another Opinion, to beat the CHAP. Tin thin, and weigh of it two balf Centners, and put XXVII. every one upon a Test by it self in the Assay-oven, give it a gentle heat that the Tin may be wasted into Ashes; and into the same Ashes (yet every one apart) they put the Tim. 16 Centners of Lead and two Centners of the Flus upon a Test, and boil it up like unto an Hard-flowing Oar, and let it go off upon the Coppel, this proof is also right, but it requires a little more time than the former, although the Tin doth also rise upon the Plate (yet it may easily (by governing of the fire, when it hath first cooled and afterwards very hot) be forc'd to flack cleanly.

CHAP, XXVII.

How to Separate Iron and Steel from Silver.

LSO there is found fometimes Iron very season. rich in Silver, the reason is, because the Hammer-smiths do not mind the small contents in it, also they do not know that it contains any Silver, and fo, that Silver in melting cometh among the I-

ron: to prove this, that the certain contents of the Silver may be given in: File the Iron very small (which you do intend to affay) weigh of it half a Centner, and add to it a Centner of yellow Brimstone, and let it go off mingled well together and fet it in a gentle heat, that With Brime only the Brimthone may flowered only the Brimstone may flow and penetrate the Iron. and that it may be brought out of its substance, and let the Iron cool again in the Test, grind it again upon a Stone or Iron, and mingle two Centners of Flus, or Lead-glass among it; and add to it twelve Centners of Lead, cause it to boyl up (as you are wont to do, with a hard flow-

ing

CHAP. ing OAR) and in the end the work that cometh off, let XXVII. it go off upon the Coppel, and you will find the Contents of the Silver.

with Anti-

Some Assayers do use to prove Iron for Silver another way, namely, they weigh the Iron (although it be not fyled small) viz. half a Centner and put it in a Crucible, and add to it a Centner of Antimony, let them go together, then let the Crucible cool, and put that which did drive in the Crucible upon an Affay-Teft, let it smoak away, and grind it again upon an Iron-plate or Stone very small; mingle it with Flus (with an addition of the Lead as hath been shewed in the proof before) then cause it to boyl up clean, and let it go off upon a Coppel, but if the Lead be black (because of the Antimony) then fet it upon the Test alone, cause it to slack (as other wild unclean Work) then it will go off upon the Coppel.

With gross-

Others take small fil'd or thin beaten Iron, cut of it half a Centner, as also a Contner of raw gross mater flints, which holdeth no Silver (with its due of Lead) mingle it together and affay it (as raw Flint is affayed upon Silver) to the Brimstone which is in the Flint will devour the Iron, that it will become Slacks, and will then go into the Lead, and although the Flint holdeth a little Silver, yet that may be abated instead of the Lead-grain, and this way of Assaying Iron for Silver; I have found to be most fit, and it is done with little trouble, and the con-

tents is also found right.

Copper and Iron, as also Silver and Iron love one ano? To separate ther well, and these three Metals cannot be so separated, the Copper, that a part may remain, to do any profit with: yet by a right understanding of their Nature this is possible; that from the two most constant among these three (as silver and Copper) the Iron may be separated (being as an unclean Metal to those two) also the Copper dross,

(which

(which is separated in the Melting and doth contain sil- CHAP. ver) may be separated; which parting is done in the XXVII.

following manner.

The Lead-Oar hath commonly Antimony with it, How the which (in melting as a foft flowing Metal) doth enter Coppery Ia ron which into it and devoureth it) for this end, and to prevent holds Salver is to be made it, a due proportion of Lead must be added to the Iron to profit. in melting (as there shall be further Instruction given in the Fourth Book) for the Lead Oar (by Reason of the Antimony that is in it)doth work upon the Iron, and taketh the Copper and Silver to it self, which is the Reason, that at fuch places where the Lead-Oar is melted, the iron rich Copper Dross (which doth contain some Silver) may be used with Lead-oar in stead of old Iron, which is to be put among it by degrees, and so the Iron will be consufumed, and the Silver and Copper will enter into the Lead, which to my mind could not be imploy'd better; but in the melting after the Gosflarish manner, the Lead doth mingle among the dust, whereby it doth partake of much of the uncleaness and wildish Nature which is in the Dust and slacks, and so is left with it : But how the Copper is to be separated from the Lead will follow hereafter.

And in this manner the Iron-stone (that contains Sil- Iron-stone ver may be made to enter into the Lead-Oar, that it may that it may that it may the soliver. take the Silver out of it, which cannot be done better: and this I was willing to impart for the better instruct. ing of them, that Affay Iron and fuch melting works.

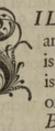
CHAP.

CHAP.

CHAP. XXVIII.

How Black or white Silver is to be burnt clean, and bow the Tests for it are to be made right.

Section.
I.
Deft or neat



ILV ER-burning is to burn Silver pure and clean and deft upon a Test, and this is to be done to the Blink Silver (which is not yet clean enough) by two ways; one way under the wood, before the Bellows) the other under the Musse.

and is only done with Coales.

e pare lifts. I

But I intend to write first of the Tests in which the Silver is to be burnt clean; they are to be made and prepared thus, Take Ashes from which Lees hath been made, which are not sharp or falt: wash them and let them be dry, and keep them for your use, and when you do intend to make a Test, first get an earthen unglazed test such as the Potters use to make in their frames, and fo large as thou wouldst have them, pour water in it, and make it wet all over, that the Alber may stick the better, then put some Ashes into it, which must first be moistned like unto the Copel-Ashes, put it two fingers high in the Test, press it together with a wooden Pestel, which hath about eight Angles: then put more Ashes after it, press them also down, do it so long till the Test be full, then stroke off the superfluous Ashes with an Iron made on purpose from the test, and turn it about the Brim (with a round wooden Ball) fo as the Ashes may lye smooth doon upon the test, afterwards cut it, with a round tharp bent Iron, according to the bigness of the Silver that is to be burnt upon it, and when the test is cut out, then must you have a small bair Seeve.

Seeve, and put ground Bone-Ashes in it, and swigle or CHAP. strew it over the test, that it may be white all over, and XXVIII. then turn the Ball over it, that it may lye Imooth upon

the test, so is the test ready.

When you intend to use such test, and to burn in it, The manner then first make a Small coal fire upon it, that it may be of this Burns dry, then let it before the Bellows very eyen, so that the Bellows may blow just into it, which is to be known thus, hold a shovel over the test, and if the blowing of the Bellows do go off from the shovel and blows off all the Ashes and dust out of the test, it doth stand right, and then beat the piece of Blink-filver into bits, but first put a little straw into the test, and the bits of silver upon it; Give it fire and coals that the test and the silver may be well covered, then begin to blow, so the filver will melt eafily, and begin to drive, then put away with an iron-book all the Coals from the filver, and stroak the filver also clean off, yet so that nothing may be lost, then lay split wood, or other wood for fire, and fit for the purpose, and cause the Bellows to blow under wood for the burning of the Wood upon the filver, so the filver will begin to silver. drive under the wood, and that lead which did remain among the filver will be drawn into the test: only confider when such split wood is burnt upon the test, then put more wood by or upon it, that still the filver may be burnt with a fresh flame, and so will it be sooner clean, while the filver doth yet go upon the test, and it must be stirred about with a round bowed Iron-book, and made glowing hot, whereby the filver may be clean, or elfe it will retain some lead underneath.

But that the Silver may not be Burnt so much, but The content may have a right and true content, namely, fifteen loth, of burnt Silver, and three drams, (which commonly the burnt Silver is to have) then you may in the mean time once or twice, with a well pointed Iron, (thrust a little into the Silver)

How the Silver doth

Silvers that

are not

burnt 100

CHAP. and take a proof out (which will hang eafily about it) then beat it off, and see if it hath much yellow Litharge, or beat it upon an Anvile, and if it be Deft, then the Silver is well burned, if not put the proof in again, and let the Silver drive longer upon the Test, until you do find the proof upon the Iron, white and dest, but the Silver upon the Test cannot be overdone, because the Test grows soft from superstuous heat, and take more Silver to it than it ought; all which is well to be observed, and diligent exercitation or use is needful, if one will burn blinck Silver upon a certain content.

And if by negligence, the Silver (before it is done) doth become cool, put again Coals upon it, begin it again and burn it that it may be right, for the hard burnt Silver do (in Coyning) hurt of which afterwards a great

dammage will follow. or nigod bus, will a tlem liw

Some of the Refiners in the burning of Silver do put upon every Mark of Silver a half Loth or Dram of good Copper that the Silver may not come too high, but upon their just content, not that it remaineth with the Silver, but because it goes together with the Lead in the Test, that the same burnt Silver (as we have heard) may not become of such a high content; this is a good intention in such places, where the Silver for Payment upon a certain content are given in, and, without proving, accepted, and there reasonable dilligence in burning may be so observed, that none of the parts may be wronged and hurt.

Coppery Blinck Silvers. Whole Coppery blinck Silvers, such as they make in the Resining Houses, may be burnt very Dest, but they will remain too light on the Content, to the same must be put a little Lead, (as much as it will permit) as sometimes likewise may be done to the Silvers which are melted of speizy and Cobolt Oars for their Wildness and uncleanness sake.

Now

Now when the Burning is finished, and the Silver ta- CHAP. ken out of the Test, then is it to be fully quenched, where- XXVIII. by the Albes will fall eafily away, which stick about when the it, and the rest of the Ashes must be taken away cleanly, Silver burwith a strong Brush, and let the Silver be dry, and when nished. the Thornels (if there be any) and the Silver hath taken hold on the Ashes, they must be beaten down with a Hammer, that the piece on all fides may be smooth.

But that the Reader may have a larger understanding of the Silver Burning, also how the Furnace, and Test, with all other things appertaining to them, are to be formed, is clearly to be seen by the following Sculpture, which is thus

Deciphered.

1. The Burning Furnace.

2. The Test which is put into it.

3. How the Silver is burnt on the Test.

4. The Bellows blowing.

5. The Iron-plates Luted over with Clay and used against the beat.

6. A Fork and Hook to stir the Melted stuff or Metals, as also for Iron-proofs.

7. An un-used or unwarmed Test.

8. A Test that is in warming.

9. A Roafter or Iron, on which the burnt Silver is made dry.

10. The Water-Tub over which the burnt Metals is brusht and cleansed.

11. The Ball and Pestle for making Tests.

12. The Block upon which Silver is beaten with an Hammer.

13. The split-wood for the Silver burning.

14. A Test that hath been used and Broken.

15. eA

The first Book

CHAP. 15. Athree footed stool for several uses.

XXVIII. 16. A Tankard to put Water, into Fig. 11.

Sculpture. IX.



CHAP. XXIX.

How to burn Silver under the Muffle.

URNING of Silver which principally is used in lower Saxony) requireth a fingular and better Diligence than the Common filver burning, and also particular Tests and Mussles: The Tests you must make thus: Let the prepared Tests to be Hoops be of Iron, of the bigness as you intend to made with Iron

burn a great or small piece of filver, they must be high rings. of a hand fquare, but at the top a little wider than at the Bottom, in one of them put in the prepared Test-Ashes, and fill it to the top, still beating down gently (with a broad Hammer) the Albes about the Brim; and so further and further till you have beaten down all the Asbes that are left, or are too much upon the Test, stroak them off with an Iron, and then overturn the Rings and test alike upon a little Ashes, which is to be laid under; then take them with your hand out of the telt, till it is half empty, and make the Asbes imall again with your hands, then press the test full again with a heap beating it down also with the Hammer, as is before directed, and the rest of the Albes also stroak off with an Iron, then turn the test again, and make the Ashes smooth with the Ball, then the test is prepared: Now the tests after this manner prepared are much better and stronger than they which are beaten into the tests.

Concerning the Muffles which pertain to this Silverburning, they are to be made over little round sticks af- The Muffles ter the bigness of the upper part of the test, and are to burning. be cut out in the like form with the tests; and other

CHAP. pertaining Instruments which the Sculpture following will XXIX. Thew.

> If now you will burn Silver, then put the Test with the Ring between four square burnt Stones in Sand or Ashes, as deep that the Sand may be even with the test above, in an Oven for it prepared, in which several tests may be put together, and fuch Wind-Ovens must have alwayes one Wind-hole, which may drive two Ovens, especially in such places wherein many pieces of silver come together, and once in one day are to be burnt.

> Afterwards put the Muffle on the test, which is made after its bigness, and a burnt stone on the top, that nothing may fall upon the Silver, put coals upon and under the Muffle, and about and upon the test, and when the test is grown warm then put in the beaten filver, and let it begin to work, but if you would have it foon melted, then you may blow it with Handbellows, through the Month-bole under the Muffle, and then it quickly goeth, and when it is melted take away the Coals again, and let it go also under the Muffle, stir it once or thrice with the Iron, as you have done in the other, then it will go upon the test, under the Muffle. all off: (just as the Silvers upon the Coppels.) With this burning of Silver both great and small pieces may be burnt, as with the Bellows, and without loss or any great damage upon the Content.

Section. A clean fil-

After this manner, I have feen at Goslar in the Workver burning house (when it was kept) upon one Test on one piece near one Hundred mark of silver burning: If now you will (while the Silver goeth) take out with an Iron one or two provings (as is done in the Silver-burning before) you may do it (and it is not to be despised) but who in this ART is conversant, the same needeth not to many provings, but he knoweth it upon fight, when

it hath enough.

Now

Now when the Silver under the Muffle is burnt clear CHAP. and begins to stay, one may let water run upon it in XXIX. a Copper Channel and cool it, then with strong Tongs section. take it out and purify it from the Ashes, (as is above-faid) then the Silver is burnt.

The Tests may be kept together, because they are not without Silver, the same in some Mine-works the kept. Work-men use to take to themselves, but in some they belong to the Republique: They may be made at any time to prosit, and the Silver that is in them may be melted out, as may be seen in the following sculpture, and is thus

Deciphered.

- I. The Oven in which the Silver is to be burnt.
- 2. The infide of that Oven.
- 3. The Wind-holes of that Oven which drives the fire upwards into the Work.
- 4. The Test that is set into it.
- 5. The Iron Mould or Ring into which the Tests are to be put.
- 6. The form of the Iron.ring.
- 7. The Ring fill'd with ashes for making a Test.
- 8. A round Muffle.
- 9. A Ball and Hammer for making of Tests.
 10. A person that breaketh the burnt Silver.
- 11. Another person standing on the back-side of the Oven who takes Care for the burning of the silver.
- 12. AV essel of water into which the burnt silver is to be cast.
- 13. Bellows and Instruments belonging to the Oven.

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The first Book.

Sculpture X.

CHAP. XXIX. Section.



CHAP.

CHAP.

CHAP. XXX.

How Copper is to be Assayed for fine Silver.

N respect it is of use to burn the light- section; content silver fine (for many times they How much be added; whereby they do too much, or too little) therefore to such light-silvers, if the

Mark containeth eight Loths of silver, then ten times the weight of Lead is to be added, and if the Silvers containeth from eight to twelve Loths, eight weights of Lead, and then from twelve to fifteen Loth, fix weights of Lead must be added, but if the burnt silvers centent should be fifteen Loth, then the Lead may be two weight less, but if it should be wholly cleansed, then tis better one weight too much then one too little, that the filver may be the cleaner: And when you have put it in the Test, let it be warm, and add two weights of Lead, and when it begins to go, then draw in the Silver gently, and let it go together, and when the Lead is almost gone, then add again two weights of Lead, do this as long till the Lead is all put in; and the Silver becomes clean, and when the Lead is done and fingly added) there needs not so much Lead, as when the Lead is added to the Silver all at once: you must not force it, but do it as cool as it will permit, else the Silver will go more into the Test than otherwise; when now the Silver is almost purifyed, then gently turn it with a glowing Hook, least it retain a leady lump, or much smoak of Lead, but by this way it may clear it felf and look pure.

But as to the Coppery Silvers, if they are to be burnt

CHAP. fine upon the Test it cannot be done more conveniently

XXXI. than under the Muffle.

The Silvers which are to be burnt pure and clean with To take the Lead, do retain with them a smoak of Lead, if now one fmosk of would bring it off, the fame must be set upon a plain plate, and blow it with the Bellows, then they may become very clean.

CHAP. XXXI.

How Silver is to be separated from Tin.

Section.

A Telt for

ANY times it happens that in burning silver Ware, Monys, Copper, and other Metals melted together (of which the most part oft times is TIN) that the fame cannot be made to profit, nor feparated by every common Gold-smith

and Prover, therefore let this following way be an instruction (as the most convenient) namely, Put a test in an Oven, and a Muffle upon it, let both first well glow, and if the burnt matter be ten pounds then add upon the test twenty pounds of pure Lead at once together, and when it begins to go, then put in it of filvery rich TIN half a pound, then the Lead will take it soon to it self, which will quickly (from the great heat) begin to ascend, and to raise it self up; let it stand a while upon it, then draw it with an Iron Hook clear off from the Lead, then add more TIN to it, let it stand its time also in it, then draw it off also, and this infunding the Lead and drawing away, do as long till the burnt matter do all come upon the test, and if the Lead in working becomes weak, then refresh it again with one or two pound of new Lead, that it may endure the longer in the heat; but if the burnt matter be Coppery, it is the better; if not, you must add

add somewhat of Copper, because it becomes more Deft CHAP. by it, and the Lead doth take the Silver and Gold easi- XXXI, er in than our of the stubborn Tin only.

In this work the Gold and Silver will go into the Lead. and the most of the Copper is drawn off with the TIN, then let the Lead go clean off, (as the Custom is) then

have you the filver separated from it.

But to bring the Copper and Tin (which is drawn off) to profit, it may be done thus ; let fuch ftuff dry, and How to make the fecause it to melt in a strong Fire, and so the Bell-caster, or parates Tin Founder may mingle it among their stuff and east it together (as in Anno 1567. the City of Slakenword, in the Bohemish Borders was burnt down, and within the Walls of the City there remained not one House) when I my felf did (after this manner) bring much burnt Metals to right, and separated the Silver from it, which no body

elle would take upon him to do.

The Philosophers do write of precipitating, by which to precipitate Silver in common tin may be put down, and formed ver from into a Regulus; thus, one must set the tin apart in a lit- Tin. tle Oven, make it very hot, and then precipitate it, and with luch a precipitation the Silver in the tin will be brought down a hand square, and the same in the same deepne's may be cut off, and the remaining Tin may be again and again and so often cut off until the Silver in the bottom may be brought to a Regulus, and then (though tin be with it) it will purify fully, and that which doth precipitate will not hurt the tin, but they do write nothing of it: I fignify this, for the take of fuch, who have a pleature to this Art, and are willing to Exercise themselves in it, and so take it into their further Meditation, that they may have hereby a way of doing it: I for my part Suppose, that because the Gold in the Silver, and the Silver in Copper; is to be precipitated, that likewise this precipitation is possible in the tin.

CHAP.

CHAP.

CHAP. XXXII.

How to drive out all forts of Silver, that it may be Deft, smooth and fine.

Section.

Silver in casting together from an evil fmoak (or when happily a little tin comes among it, or, that among the old Silver there hath been tinny, false and gross mixtures,) becomes hard: then is it, as

A little Lead Ball.

To Brickle

hard burnt Silver.

follows, to be made Deft, again: Put the Silver upon a plain Test (which is done over with clean and fine Clar, blow it till the Silver runs and goes well, then add two or three Balls of very clean Lead, according to the quantity of Silver, blow it again until the Silver doth bear the Bellows, and becomes Dest; but you must (in the blowing upon the Test) once or tyvice (with a glovving Iron-Hook) stir the Silver that it may be Dest throughout, then let it cool, and put it in a Pot together as it pleaseth you, and take notice, that if somewhat of the Copper be blovvn avvay, by vyhich the silver on the content becomes richer, then if it shall retain the Content, vyhich it had before, it must (in the casting again) be helpt by adding so much Copper.

But bard burnt filver, (or other good filver, which might become brickle from a leady Lump) that same Silver (if a little Lead be with it) may (in this manner upon a plain Test) be made Dest without any addition; except it hath too much Lead with it self, then it must

be

sprintren is polluble in the tim.

CHAP.

be made upon a plain little Test (as above is taught) by CHAP! the Silver, burning-pure and Dest.

Also there may a Flus be prepared to make the Silsection. ver dest, (which doth cleanse the Metals very much:) A flus to thus, Take sal Alkali, Nitre, Red Argol, and salt Petre, of brickle sil one so much as of the other, calcine, and dissolve it again in warm Water, and let it go through a filter and coagulate; so is the Flus prepared.

CHAP, XXXIII.

How to boyl Copper from the pagment or old Silver in Coined Money, or from thin beaten plates of Silver.

AKE fulphur and vitriol of both alike in quantity, grind them small, and make them a little wet with Vinegar that it become as a Pap, mingle the Coyn or old Silver among it, then take a long Linnen sack, put the Money with these ad-

ditions in it, fow the Sack on the sides from the top to the bottom, so that the Mony may not lye too thick in it, pour Water into a pot, and hang the Sack in it, that it may neither touch below, nor on the sides; boyl it well ten or twelve hours with the fire, and so much as the Water does wast by boyling, you must add to it again with warm Water, so that the Pot may be always full of Water, whereby the Copper will be boyled out of the Silver or Coyn, and the Silver will remain in the Sack, then wash it with warm Water and pour it together, but the Water will boyl and dry in, and the rest melt together (with the Flus yyhich is used to Copper Oar)

CHAP. thus you have the Copper which hath been boyled out of X XXIV. the Money, only the filver by this is not altogether fine but retaineth some small quantity of Copper in it.

Ked Argol, and Jak Tetre of THE TOTAL CHAP. XXXIV.

in warm Water, and let it go through a filter and coa-How good proof Ballances are to be made and fitted.

Scation. An Affayer able to make Ballances,

PROVER hath not only need that he have clean and just Ballances for proving, but he must know also when they do fail (or elle become changeable or uncertain) how to mend and help them again, so I judge it for a great piece of Ignorance (and it is also not well,) That

fome who profess themselves Provers of this ART, do often (when a little is amiss in the Ballance, or worn out, or for any other small matter) use to send to Neurembirg and other more remote places in Germamany, to mend their falle Proof-Ballances, whereas they themseves should have so much Knowledg as to make and fit them with their Proof-weights, and Proof Instruments, so as they may be certain and sure of their Proofs.

And bow to help their Defetts.

Therefore, That a fundamental Instruction may be given, I will instruct all who do love this Proof ART (especially the young Provers) because there are not alwayes Masters to be had, who know right well to mannage fuch things: and to teach how the Proof-Bal. lances and weights, and other Proof-Instruments are to be made, and also (if it be needful) to mend and rectify them: and first I shall begin with the Proof-Ballance, which is to be made as followeth.

The Bals lance of the Proof. Scales.

Cause a small Ballance to be forged out of the blade

of an old Sword, that it may have a little broad and CHAP. thin Tongue, and throughout be pure and well wrought, XXXIV. and nothing ruff or sbivery be on it; this formed Ballance make fast with a little Screw, and file the thickest part, and then fearch the middle on the fame place, and make a little hole with a drill through it, and fasten a round point in it, that it may stand out at both ends; fit it in, with thin bits of Brass, and soder it (with Silverfoder) fast into the Ballance, so the soder will easily flow

after the thin Brass.

Out of this sodered point are filed the little Irons on section. which the Ballance moves, and afterwards the little Tongue. Tongue beaten thin upon a smooth Anvil, and glow it often in a small Wood-fire, that it may not crack, then fearch the middle of the Tongue, from the Wartz or little Wartz Iron streight upward unto the end of the same (and its stionary. length is to be the same from the Wartz to the end) and mark it with a stroak, then cut upon the one side of the Tongue next to the stroak a bit of the Iron clean off, and on the other fide of the Tongue, cut some also close by the Wartz, that the Tongue may rowl over from one fide to the other, then may you also cut off the rest of the Iron on that fide, when this is done, then glow the Tongue and dress it again straight upwards, then file it (upon a foft piece of Wood, very smooth, according to your pleafure; you may also pierce (or make holes) neatly in the Tongue near the Ballance for curiofity fake) afterwards bend a little the two ends of the Ballance alike, before the Ballance be quite fitted, that the two ends may be of equal length, and then file the Ballance according to shape and form, as a well proportioned proof Ballance, and lo make an end; but how the filing and other Work is to be performed, that cannot be written, but it requireth a dilligent exercise.

The Fork in which the Ballance useth to hang, that CHAP. XXXIV. must also in like manner be subtilly Filed, also the holes (in which the little Wartz come to lye) may be thin, clean and strait through it, and must be pollisht with a smooth little Stone, that no shivers may remain, which Fork must be so long as the Tongue, that the Ballance may not ne in it, that it may hand o

flide out of it.

Section. ved.

When the Fork is prepared, then take the Fyled How the fi- Ballance, and hang it in the Fork with the Tongue downted Ballance wards, and fee if it be alike weight on both fides, if you find that one fide is heavier than the other, you must help it until it does hang even, then make it smooth and clean all over with a gentle Fyle or with a foft Whet-*Hemathin. Stone, and pollish it with the hard * Bloudstone, (which is

called Glasscup) when the Ballance is fully finished, then prove it again, that the Fork may hang even, and that it want nothing. But if there is no smith, which can forge the Ballance with the little Tongue (because all Smiths cannot make it so well of one piece) then take a clean steel Wyer, or a forged Iron in the form of a of a Ballance without the Tongue) and soder it with filver foder, and fix the little Tongue upon it, the Tongue may also be garnisht with Brass, afterwards Filea Ballance for it, (as hath bin faid above) but if you will not take the pains to Garnisbit with Brass, then may you

> upon the Iron vvithout any addition or increase, and if any thing doth break upon it, it may be neatly fodered with Gold soder, as experience vvill teach.

> take Gold-foder and foder all what is necessary about the Ballance very cleanly, because this soder vvill flovy

The proof scales are used to be made blew, (that they To cause the may not rust so easily) and is done thus, cause a pretty thick Iron to be warm in the fire, but do not fuffer it to be quite brown, lay the Ballance with one end upon it,

and draw it a long as it takes colour and becomes blew, which

which is foon done, only take notice the more a place CHAPL is thin, fo much fooner doth it heat and cool, therefore it XXXIV. is foon feen, that such places do turn white again in fair Weather, and clear shining, and these Ballances become of a fairer blew, then if they were done in dull Weather, as experience does manifest. Now how that forged Ballance, as also the Filed Scales are to be formed, is to be seen in the following Sculpture thus

Deciphered.

1. The forged Ballance.

2. The Fork of that Ballance forg'd.

3. The balf forg'd Fork.

4. Filed Scales with the balf Fork.

5. The Pearl and Pendula's, the one fastned on the top of the Fork, the other fastned to the bottom of the Tongue and Fork.

6. One end of the Beam, (and the like is to be suppos'd

at the other end of it.

7. How the Ballance the Pearch and Pendula are to hang, on the Wartz (or little Filed pieces of Iron,) on each side of the bottom of the Tongue.

8. The Holes in each end of the Fork.

9. The little Hole at the end of the Ballance, (and the like is to be supposed at the other end of it.)

10. The Scales like small dishes.

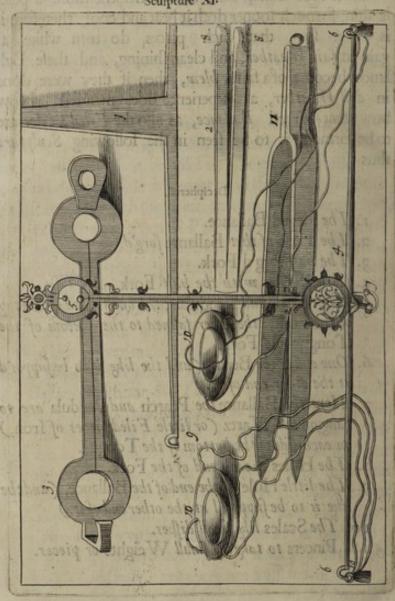
11. Pincers to take up small Weights or pieces.

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The first Book.

CHAP.

Sculpture XI-



CHAP.

CHAP. XXXV.

Of Filing or Joyning the proof Ballance or Scales.



ILING and foyning of proof Scales is a sections special Science, and is the true Master- To Si Scales. piece, which is not known to every one that can make them, and is done thus; when the proof Ballance is Filed out, (as hath been faid before) then make, of Sil-

ver, two flat clean and smooth scales, and also two very The weight thin small scales, the which are called inset scales, which of the Scales altogether are to be as heavy as the Ballance, or rather a lance. little heavier than lighter, and put fine filk Thred to them, in length of the whole Ballance, from one end to the other, fuch Threads are to have a neat Knot on the top, whereby the strings may hang to the ends of the Ballance, and when the strings are made fast to the scales, then weigh them one against the other, with another proof scales, and see if they do weigh alike, then hang them to the ends of the Ballance, put the infet scales therein, and hang the Affay-ballance in a Case made on purpose, and draw them up gently, if then the scales do turn on the one fide; that is, when you do press the scales down on the one lide, that the scales remain down, as also on the other fide, and will not go back but remain standing then the fault is in the Beam, that on the same places is fitted too high, from which the Ballance falleth on both fides, ballance fall and will not stand just; if you know this, then make the lesh. Beam on both fides somewhat lower, but so that it be not higher on one fide than on the other; to the rectifying of this, you should have a little smooth plate of Pear-

CHAP. tree, upon which make a Gross stroak, and in the midst of XXXV. the (ross must be a little Hole, and upon this lay the filed Beam of the Ballance, so that the little Wartz in the little Holes, and the Beam and little Tongue may come to lye upon the ftroak, then you may foon fee how the Beam, the little Tongue, and the Ends are fitted, that so

you may help and fit it.

So when the little Beam is thus prepared, that it may stand near the Ends, a little lower than the Line upon the little plate, then lay it in the Fork, in its place; give it the right quickness so that it draw well and distinctly the smallest of the Weights of the Proof-Weights (and not ftop in its lodge) nor have too much room (that is to fay) that the holes below of the Fork may not stand too far off from the little Wartg, but only that one may fee through to try it.

Section.

Now, when the Proof-Scales are thus made with To make the the greatest dilligence, see that it has its quickness, and does not stand; also that there be no fault neither in the Beam or little Wartz, it must stand right both with the scales and also without them, if it doth not this, but goes heavy on the one fide and light on the other, there is the greatest fault, which to mend many do not understand; but thus is it to be done, help the Ballance above on the one end, and on the other fide on the scale, (that is thus) bend the one end a little down, or a little narrower, then doth it give presently the Ballance on the other side, weight, for the length, and takes fo much from the other fide of the scale, that the Ballance may stand in again in the Fork, then try it again whether it do well either with a Burthen or without a burthen, and that it may have its right quickness; but if it does not so, but goes still a little at one fide, then have you done too much, then help it with bowing back of the end, and the scale; but if you have not bowed the end on the right fide, then the Bal-

lance

lance will go more false, therefore you may easily see on CHAP which fide it is to be helped with binding and fitting them, xxxv. and you may also use this dilligence, that when you have bent the end on the one fide, and that you also do the like on the other fide of the scale, but make it even with Weights, that the Ballance may stand right in the Fork, by which you may see how it doth stand in either with Weight, or without, and then it is eafily to be corrected.

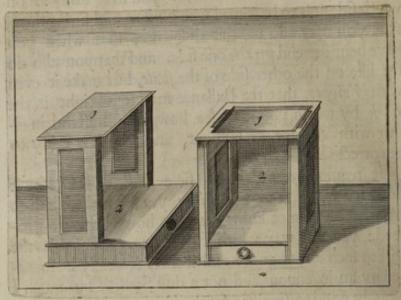
It requires great Pains to fit a Ballance thus, for it doth try many times a Master; yea, it maketh him fo err, that he cannot know oft times how further to proceed: yet this way which I have here proposed is the best to such a fittingness: and it must certainly be managed by an ingenuous, and not a dull Soul. Thus much I thought good to fignify, for the clearer Instruction, because tis very pertinent to our present Discourse of Pro-

ving, therefore I omitted it not.

And that the Proof Ballance may be preserved clean section, and pure from Dust, and also that in time of use the wind The Case may be no hindrance, but stand firm, therefore it is to Ballance. be put in a clean and well formed Proof-Case made of wood, which on both fides is to be fet with bright and clear Glass, that the Light may come into it, and that per, all things may well be feen (the Form is shewn in the following Sculpture: And, for conveniency of the Sight, it were best to colour the Inside of this Case green, because the Fire is hurtful to the Eyes, and by this colour they are again quickned and refreshed.

Sculpture. XII.

CHAP.



Deciphered.

1. The Out-fide of the Case for the Ballance.

2. The In-side of that Case wherein the whole Ballance is to hang, and he kept from Dust.

CHAP. XXXVI.

How Proof-Weights are to be made and divided, and first of the Grains Pence and Carrat weights.

Section

1.
To be made of Silver or Brafs.



of the Weights is no small thing, therefore I am obliged further to demonstrate
how, and of what such are best to be
made: First, it is better they be of good
Silver than of Brass, for the Silver
neither coloureth it so soon as Brass
doth

doth, but remaineth all times pure and clean, if CHAPA now the Silver be cast into an Ingot, then one may cut XXXVI. out four square pieces in the proportion and bignels (as every piece of Proof-weight shall weigh) heavy or light, and file all fuch pieces pure and clean, upon a Whet-Stone, draw them smooth: also every one in particular (in respect of the Division) is with diligence to be put upon the Proof-Balance, that if it be still too heavy, it may be made lighter, and true; and fo laftly, it may stand just. But some Provers think one should make and divide the Proof weights from above, that is from the greatest still to the smallest; again, some from the smallest to the greatest; but know that it is best to be done in the following manner.

If Proof-Weights are to be prepared anew, they must weights of A be divided from the greatest to the smallest, for this Marke Reason, Because one may better and more easily have the just and certain weight of a Mark, than of one from the smallest, as from the half-Grain or Heller, and should make a Weight out of it, there the Mark would be either much too heavy or much too light, in which an error is eafily committed, Therefore use, in such a dividing from above, a small Grain of seeved and mash'd Copper, by which may be feen how much must be taken away and filed off from a piece, which is yet too heavy; when now such Proof-weight is finished, then proofshall it be drawn up from below, from the smallest to weighte the greatest with diligence upon a quick and good Proof-Ballance, and if there is yet any want, which cannot be great, that it may be compleatly helped.

Now, how the Proof-meights, piece by piece are to be divided, may be feen in the IX Chapter of this

is up the wife with diff some from the firstletero

first Book.

CHAP.

CHAP.

CHAP. XXXVII.

For dividing the Weight of the Centner.

Section.

1.

Carrats.



S the Grain-Penny and Carrat Weights may certainly be divided from the higheft to the lowest, so it may be done with the Centner-weight, but because in the pounds there are unequal parts, understand it thus, The Centner hath a Hundred pound: the half, 50 pounds: and

Unequal parts.

the fourth part, twenty five pounds; and if one would out of it divide fixteen pounds, (which one that is not well skilled in Division may have great labour therein) then you should do thus, when you have made right the Division of the Centner to the fourth part, then weigh the fourth part of the Centner with a proof weight (it may be a Centner or penny-weight) and how much it weigheth, then you may make your account how much fixteen pounds shall weigh: (an example,) I put, the new divided twenty five pounds which do weigh on the penny-weight 13 loths, three drams; then I fay, the twenty five pounds will weigh one Mark, thirteen loths, and three drams, which may weigh fixteen pounds, which amounts to nineteen loth, no dram, no penny, one beller, and do prove a little more than a fourth part of a beller, fo much then must weigh fixteen pounds, after this weight or fixteen pounds: divide your weight with small grain'd Copper, (the smallest as you are informed before) and although the (entner had more pounds, nevertheless the unequal division of it may likewise be found.

Now when the proofweight is all perfected then draw it up likewise with dilligence from the smallest to the

greatest

greatest, as you have done with the other, if there CHAP. should be found an Errour, then mend it also, so there XXXVIII will be small Difference, and the Centner will remain in the desired Weight.

But that you may be sure whether the Proof-weights be right and just, set them aside, and make one Proof-weight more, as heavy as this, then put the made weights which pertain to a Proof-weight altogether in a quick weights are weights and if they stand even together, then you have made them right; if not, and that thou sindest them not alike, then look where the Error is, and mend it, for, whoever will be sure of his Weights, must not think much of this Labor.

Lastly, Number and Mark every piece of the Proof-Weight with a small iran or steel Punch, how much each piece doth weigh, by which it may be known: (but the marking must be done after its made smooth on a Whet-stone whereby the Shivers which it had from the Stamp may be made smooth again) and lay them into a little clean Box, made on purpose of wood (the form of which is to be seen in the following sculpture) in which there must be as many little round or square Holes, as there are weights, then shut the sides that it may be kept from Dust, and that the Weights may remain clean and pure. The Sculpture is thus

Deciphered.

1. The little Case for Weights opened.

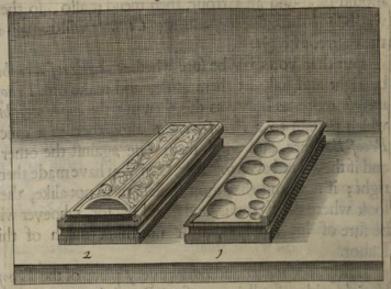
2. The same Case shut.

Sculpture

C

CHAP. Stell li terlio Sculpture XIII. XXXVII

5.



Thus much I was willing to fignify and write concerning the Proving of Silver Oars, and what appertaineth to them; and though it had seemed needful to Instruct, How such and every particular Oar according to their Natures and Properties, should be melted and made to more Advantage in the great Fires of Furnaces and Smelting works: yet because, in this Treatise, I have only purposed to write of Proofs in Small Fires, and leffer Oyens, and because these now mentioned works are almost common in the Smelting and great Mine-works: Therefore I am willing to let it rest here; yet some great Works and Meltings, I have mentioned (in this and other Following Books) because thy are not so common, and meerly for the Instruction of other Assayers.

The End of the first Book.

CAPI. parent and feet, how finall foever it be intermixed with them, and the lame Gold which is thus to be found

Golden OARS.

from the Culin .II . I Where the

a a siwa to C H A P. I.

Land a mid a ballaw bas banong a sinh and w bat CAP. I.

HIS Second BOOK describeth how Section. Gold oars are to be known, and how to Roaft Boil and Prove them; also of Washing, Purifying and Quickning the Gold Wash-works: and further, how Touch-Needles are to be made, and to Divide the Gold-weights; also to di-

still Aqua Fortis, and to rettify it: also how Silver and Gold are to be parted by Aqua Fortis and by Fufion; and to make the Gold deft to cement it, and give it an high Colour, and how it must be cast through Antimony, and be brought to its bight with the ovens, glaffes and Instruments which are used to all these. In band

The Knowledge of Silver-Oars having been now To know treated of; We proceed to the Gold Oars, (although gold Oars, they are not found in fo many Kinds and Colors) which must after their external Modes be known also, together with their proving and ordering of them. But they have this Condition attends them, (as Experience hath taught me') That no Oar hath Gold only of it self, without other incorporated Metals) unless it be ap- Novarly it

CAP.I. parent and feen, how fmall foever it be intermixed with them, and the same Gold, which is thus to be found in these Oars is not wholly pure and clean, but commonly Silvery, although one more than the other.

Gold in Horn Oar.

Now, the fair Gold that is found thus Intermixed or commonly standing in a whitish Flint, and sometime in a blew and yellow Horn-stone, and also in a Blew shiffer streamy and yellow iron, but very small and flaming with Gold, and this is found in the Mine at Knein, two miles from the Eal in Bohemia, towards the West, where there is also found a grenish Silvery Flint, in a firm Quarry; and when this is ground and wash'd, then a fair and high Duke Gold comes out of it, which otherwise is not feen in the Flint, at the present: I know no place in Germany, where, out of any Oar, any higher Gold can be made.

Gold in Woolfrain. Tin, and Iron Oars. * Shurl, ger.

Why the

with them.

Rivers

Further, all Goldish oars (which are commonly sandy) have good Duke gold, yet not all alike, some are gross and in grains, others are flaming and light Gold, and there is almost in all such works a heavy Temper (or wolfram wash) especially in Tin and Iron stone, which with the Gold have been driven far by the Deluge, and it is both wonderful and neat, and the work and colour and difference may eafily be difference, of these forts: and the Rivers and Channels which do flow over fuch works are so seeded with it, that Duke gold in many places is found in them, not only in remote Kingdoms and Coun. tryes, but also with us in Germany, it is brought to profit, yet in Germany for the most part it is poor, and cannot bear the charge of Washing.

Of the River Nile.

But some old Writers say, That (out of the River Nile in Ægypt, which did flow into the Sea in the time of the Deluge, in which all Sand was brought together) other Rivers and Channels have also been seeded with Duke gold; But, to this I cannot confent, for this

Reafon

Reason, Because this River is very great, and goeth CAP. I. through that part of Ethiopia, (which is called India) in which also is found much Gold, and it is faid to be the greatest of all other Rivers, and doth flow the furthest; yet I esteem it much too small to inrich so many Gold-Mines with Gold - fand and channels in fo

innumerable places of the World.

There is also with us in Germany all forts of Grains which are found in many Mountains and Channels, and Grains are are carried away by out-landish men; some of them carried aare flinted, in part brown yellow and black, and within reigners. likeGlass, and in form commonly round, and also square, of which, as 'tis faid, Gold is also made: for my part, I efteem fuch not at all, because I have assayed many times fuch Grains in the Fire, and other ways tryed, but could not find Gold in them. But thus much I have from very credible Persons, who have assured me, That fuch Grains have not Gold in them, nor none is made out of them, but by fuch persons brought far into Italy and other places, for an Addition, out of which fine Colours and Amel is to be made, which colours and Amel by them is thus esteemed and fold dear, as if it were Gold, which also is agreeable to reason and may be believed, especially because many forts of Mines, with us in Germany, are found which do yield gloffy and fine Colours.

Further, fometimes with the digg of Gold (which lies Gold in I. in flints, especially in the Gold-Mine at the Eal in the ron-man Kingdom of Bohemia) there breaks a finall grey spiffy Oar, which, after its colour, is called Iron-man, that fame also is not only rich in Gold, but it also filvery, therefore it is not to be compared with the other dig d Gold which Randeth in flints. Also there is found much Gold flints which have not only Gold but filver also, and common- Goldin flore; ly more of filver than gold, likewise flints which are ve-

CAP.II ry copery and filvery, the filver of it is also rich in gold; as also some white flints which have no Copper at all, and but a little filver, and are goldy, but the flints which are coppery, and whose Silver hath Gold are found common-

ly with small flints intermixed.

Section. 11. Gold Marcafite. Concerning the *Marcafite*, of which many make Fables, and do write as if it were a meer *flint*, is very rich in *Gold* (because it doth not loose the fourth part in the Fire) and in *roasting* and *glowing* becomes more and more fine: I have many times diligently enquired after it, but never received any good account concerning it, much less could I hear of one who had seen such a *flint*.

But, as far as I can comprehend, the Marcasite can and must be nothing else than a very good Gold-oar: Now whether this Name be given it, or any other, it matters not: But how these (one after another call'd Gold-oars and wash'd Works) are to be proved and try'd, shall plainly follow.

CHAP. II.

What Proofs and Washings the Gold-washers
use in Gold-works.

How much may be wash'd in a day.

OLD-Washers who go abroad in the Country for Gold-washing, and get their Livelihood by it, they have for the Gold-works a special proving, whereby they do observe how much Gold they wash in one day, and accordingly make

their Accounts, whether the VVork will bear the charge of Washing, and whether it be poor or rich, and to this Proof they use a particular Weight, which is divided by the weight of an Hungary-Gilder, after the worth

worth of so much as is used to pay for such mash- CAP.II

But because commonly 92 Creicers are given for section. an Hungary Gilder weight of wash Gold, therefore they of Creicers make forth the greatest weight as high as an Hungury Gilder and lign it with 92 Creicers, the second piece or half of the weight with 46 Creicers, and so of all the other pieces, one after another, with their Worth, till to the single penny, as followeth,

92 Creicers the weight of a Gilder.

46 Creicers the half Gilder.

23 Creicers the fourth part of a Gilder.

12 Creicers

6 Creicers

3 Greicers

2 Creicers

1 Creicers

2 Penny weight Bobemish Money.

By these Weights every one may be informed of a of \$\frac{g}{g}\$ old grain of \$Gold\$, how much it is worth when weighed, \$Grain. therefore commonly the \$Gold-washers\$ which go into the Lands for such Work carry with them such a Weight, with a black *SicherTray, and a little Box sull of \$Quick-*Sichertray such as fold a little \$Balk \text{cgcl}\$. SicherTray, and a little \$Balk \text{cgcl}\$. Sichertray and a soft \$Leather\$, a proof \$Test\$, and a little \$Balk \text{cgcl}\$. Sichertray is sichertray and a little \$Balk \text{cgcl}\$. Sichertray is sichertray and a little \$Balk \text{cgcl}\$, and a little \$Balk \text{cgcl}\$. Sichertray is sichertray and a little \$Balk \text{cgcl}\$, and a little \$Balk \text{cgcl}\$. Sichertray is sichertray and a little \$Balk \text{cgcl}\$, and worketh upon it: if he finds \$Gold\$ in it (how small soever it be) then doth he cleanse a little of it, and doth cause it to enter cleanly into the \$Quick silver\$, and doth afterwards press it through the \$Leather\$, from it, and that which doth remain in the \$Leather\$ he puts upon a \$Proof Test\$, into the fire, which he doth presently kindle, either in the \$Woods\$

CAP.II Woods or Mountains and causeth it to go off, and the Gold to be red-hot, and what it doth afterwards weigh according to his Creicer and penny weight, so doth he make his Reckoning, how much of such oar he can wash and make it return to an account in one day, and fo in a Week.

Section. To prepare

If upon Search he doth find by such proof that the Walb.work will recompence his labour pains and charges, Washing it. then each one, according as he is best instructed doth wash the same, and make his prosit thereby, among which there are some who do wash that which doth lye in the Fields under the moist earth, as also the Sand out of the flowing Rivers or Channels, and do wash it over a Board, in which are cut little Gutters and wrinkles, here and there, into which the heavy Gold will descend and remaineth; but part of it will wash over, especially if the work be rich and hath grain Gold; but if it doth go flow, it requires more pains.

works

Some years past, there was found upon such Work A special and sand, by the water-side, a special wash-Work by which,in one day near 300 weight of rubbish have been wash'd away, and the Gold faved : which is done thus, There must first be made of Brass Wire a Rattar or The Bignes Seeve as wide or narrow as the Work requireth, and it is to be tyed from above downward with Brass myer, and it must be stretch'd fast upon Iron stays, that it may not bend or rise, the bigness of the Rattar is to be seven spans long, and five wide, and in depth a good span, with a bottom that doth enter two thirds into the Rattar, and with one third part to be extended for carrying the matter out (which is to be done over with Tin) the Rattar must also have, on each side, little wooden pieces fastned to it, by which he may reach to the foremost Instruments, that the gross matter that doth not go through may eafily be emptyed.

As

As also the lower bottom under the Rattar must CAP, II have on each fide Boards fastned to it, that nothing may fall from the Rattar, for from that place the Work paffeth from the Rattar, upon the flat hearth (which is to be thirty spans in length, and four broad) and the Chanel through which the Water doth run-out must be wider than that above, and also covered-over with Tin: to this there is also Water used more or less, according as the Work is foul or fandy.

This Wash-work serveth only for Sandy-works, but not at all for the clean and deft : yet because this work is not common to this day, therefore (for them that have not feen it) I have delineated it in the follow-

ing Sculpture, thus

Deciphered.

1. The man that worketh with the Rattar.

2. The middle Floor whereon that which goeth through the Rattar doth fall.

3. The lower Floor whereon that which cometh from

the middle Floor doth fall.

4. The Plain Receiver of that which falls from both.

5. The person that stands on a Board, and out of a Wheel-barrow throws the Matter or Oar, into the Tunnel, which guides it into the Rattar.

6. The Channel in which Water doth run into the

Rattar.

CAP.II

Sculpture XIV.



Section:

Then some of the Gold-washers use upon their of seircing hearths the strong Timode black and russet moollen Cloth, over which they do drive their Works, because the woollen cloth is rough and hairy, fo that the small and round grains of Gold will remain, and not run forth (as it will from the Timode) whereby the Gold (upon the black Cloth may apparently be known, though it be fmall and little.

Others

Others use in stead of the Timode or black woolen CAP. II Cloaths Linsy-woolsy (half linnen and half woollen; Section. wrought in themanner as the Timode is) upon which the The sorts of Gold doth stick better, and such Cloths do last longer, med for because of the Linnen that is among the Woollen which seircing it. doth strengthen it, therefore it is better for this Work.

But there is another way of Washing (not much in use) which is called Driving and Washing through the the long long Rattar; but according to my mind, it is not so convenient a way for the small VV orks, which have great and small Gold, and are both sand and Clay together, yet I do not much decline from the before described Rattar-work: For, in this Labor or washing, because of the turning in the upper and lower falls, the running Gold is preserved better, and the Gold goeth with the small common Work over the plain hearth, upon which it is driven: and the manner of doing it is seen in the following Sculpture; thus

Deciphered

- 1. The Miner which caries the matter to be wash'd in the Rattar.
- 2. The Parts of the Rattar, more visible than in the former Sculpture.
- 3. The Washer that governs the Rattar.
- 4. The upper and lower Falls from the Rattar.
- 5. The plain Boards, or Hearth) on which they fall.
- 6. He that stirs about the muddy water from both Fallings.
- 7. The Tub wherein that which falleth from the hearth is to be wash'd.

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The Second Book.

Sculpture XV.



Section. Slicks.

Thus much I was willing in short to discourse about the Gold-Washing, as a Direction how the Work is to be done to Advantage. If now a Work be rich, then it is the better, and then may eafily be found and used a manner of Washing, that the loose Gold by it may be preferved : and when the Slick is brought into a nar. rowness, and the Gold drawn out with the great Instrument, or with the flender and long one (which is called a

Saxen)

Saxen) then may it be quickned and pressed through CAP.II the Leather; then glow out and cast all together, of which more shall be written in what followeth.

Thus far I have spoken of the Gold and *wash-works * Septen sich do need Boxes: Now I intend to write also of Souther. which do need Boxes: Now I intend to write also of the Gold Oars which are had in the Mines out of the Veins; and how that must be buckt or masht; in which of great grain'd the digg'd Gold is clearly to be feen, and fuch must have gold. a special way of preparing it) namely, those Oars in which the Gold Standeth in great Grains, and may be parted with the hand, or beaten in a great Iron Mortar, and, if there be much, then fet it over a Seeve, made on purpose, and so cleanse it, and it needeth no more pains, nor greater Art: and it is better than that the Oars (without difference) were brought under the Buck, or washing place (especially because one useth to observe fuch a hand parting in smaller Mettals, as Silver, Copper and Lead Oars.)

fmall Gold (and cannot be separated with the hand) goldin min-But the poor Gold Oars which are mingled with the same if they can be wrought without Roasting, may gled. be Buck'd and prepared two wayes, viz. by a wet and a dry Bucking or beating; by the wet Bucking is the Oar washed through Tin plates and Channels (and like unto filvery Oar, driven over a plain Hearth, and afterwards made clean) but in the dry beaten Work, the Floor is driven over the plain Hearth with Woollen or Lingy-Woolfy stuff (as above, where the Goldwork hath been taught) and fo wash'd and made clean

and quickned.

There are also Flinty and Horn-stony Gold Veins, in which the Gold is very fubtil and thin, and is mingled Horn flony with other Water-flowing Gold Oars, the best way of gold Oars preparing them is, That fuch Flints and Horn-Stones, wid. provided there may be had Wood enough in the place,

may

CAP.II may in a special Roast Oven, made on purpose, be burnt; first, very hard and well, and when it standeth in the greatest heat, pour water upon it, that it may cool suddenly, and so the subtil flaming Gold will be, as it were, frighted, at the incorporated Oar, and run together, and become a round Body, and is strengthned and remaineth the better in washing, also 'tis better preserv'd: likewife, the Flint by quenching doth become so brickle that afterwards in great quantity, it may eafily be buckt and separated, and is not so hurtful (after it is roafted) to the tender Gold, as before when it was raw) because the hard Flint among the Gold.Oar doth more hurt in Bucking in respect of its weight, and the muddiness carrieth away some of the Gold with it, in the mudy Water, but feing that it is very rare to find plenty of wood in fuch places where flinty, Horn-stone Gold Veins are; therefore every one is left to try the best way.

The Roaft Ovens in which those flinty Oars are roaft-Roaft ovens, ed, and afterwards quenched with water, make them thus: Give to each Oven two Ells in square, and fix Ells high, and cause it to be built up with stones, that the Oven before the lower part may remain, open so high that the roafted Oar may be drawn out of the hole (after the Oar which is to be roafted is put in) then it must be closed up with Clay, also there must be in the Oven, in stead of the roaft, Separations, made of Tiles an Ell high, upon which the wood is to be laid, that the Wind may go between the Tyles into the Oven, whereby the fire may burn clear.

> VV hen you intend to roaft in fuch an Oven, then lay into the Oven upon the Tile-Stones, short split wood, two Ells high; upon which put the ftony Oar, as gross as it doth come out of the Pit, but the small which are not in very great pieces let along the fides of the Oven, that the great pieces may be in the middle, to that the flame and

> > heat

heat of the fire may wind about it, and also the heat Cap. II of the fire remain together in the Oven, and force it self through it to the top of the Furnace, and such forand inclosed Heat doth much more than in an open Roast, and when the Roast in the oven burneth at the siercest, then must water be poured on it, and be quened suddenly, therefore such a Roast Oven for better Advantage is to be built in such a place where water may easily be poured into it, so the subtil Gold will run together in grains, and the stone will become brickle (as hath been said before) although the same do become brickle only with burning, yet it becommeth more brickle by quenching, and it is done more especially for the Gold sake.

The form of such Roast-Ovens, and how they must stand in its proportion and shape, will be seen in this following Sculpture, thus

Deciphered

- 1. The Form of the Roafting-ovens.
- 2. The Shutters to them.
- 3. The In-fide of them.
- 4. The Partitions in them, made of Tile, and a person atending at the mouth of them.
- 5. He that pours Water into the top of the Oven.
 6. The wood that is used in those Roasting-ovens.
- 7. The Instruments to close the Ovens.
- 8. The Ladder to go to the Top of the Oven.
- 9. The Pieces of Metal that are to be used.

Sculpture XVI.

CAP.II



Section.

If there be a great quantity of the Gold-stones, then there may be made more ovens, as also bigger, and according as necessity requireth, regulate them that the Fire may have its full force.

Thus much I was willing to mention concerning the Preparation of the Gold Oars: But because I have not from my youth, medled so much in it, as with other Oars, therefore have I shortned my Discourse: and others that know better Methods have their Liberty to inlarge. CHAP.

CHAP. III.

Of Gold Slicks.

URTHER, know also that when section. the Gold Oars and Gold Slicks are clean- of por fed for to quicken : and the Gold drawn Gold flicks. out, with the Quick filver, and hath been quickned, yet there will remain from the quickning a Slick, of which fome is poor in Gold, and some rich,

yet the rich Slicks may be made to posit and melted like as a rich Silver Oar: But the other common Gold Slicks, especially if they be of the Gold-Mine at the River Eal) are flinty, and that the Centner which hath but a dram of Gold, cannot better be melted than over the raw Slicks into Slackstones; but if the Slicks be not flinty of themselves, then there must be another flint, (which yields much Stone) added to the Slick in melting, and when the slackstone doth not come out rich in Gold, then add more of fuch Flints to it, to help the Flint, until a Centner of the Slack-stone doth contain 13 or 14 Drams in Gold, but it must not be wrought by adding more to it, because if it should become too rich in Gold (it is to be feared that) the Slakes would remain too rich: therefore, if there be enough of fuch flints to be had, let them be added to it, or if the slick it felf be flinty, and yield stones, then twere better that the Slackstone were brought no further in Contents, than to 10 drams of Gold in the Centner, and so the Slack will remain the poorer: thus the Iron flaky Oars (which have very fubtil flaming Gold, and commonly the Centner of

Section.

Ofrich

Ricks.

CHAP. it doth contain a dram or two in Gold) may return to

III. great Advantage.

But the rich Gold Ram or Slick (out of which Gold is quickned) which in part useth to be very rich in Gold that sometimes it doth contain a Centner from three to many Loths of silvery Gold, such can no better way be melted than with Lead; yet because that same Slack is very subtil, therefore the blast in melting doth raise it up very easily, so that it doth sty out, and is lost by it: to prevent this, Let the Slick be mingled with strong Yest, and let it dry, then break it into Bits, or before it is quite dry, cut it to small Bits, and put it into the Oven, and so it will remain better in the fire.

To bring both to Pro-

·Tis necessary I further direct, That when one hath a Gold Slick, and would melt it, and that a Centuer thereof doth hold from two to five drams of Gold, and is not stony in it self, there must be other flints added so that the flint and flick may not be throughly mingled together, nor run upon the flick, for by this there will be danger, because the flint doth spread it self, and gives a little rough stone, whereby there will remain much of the Gold behind, but weigh the flint and the flick, each by themselves, and if any of it be melted, so much (according to the quantity, partly flint and partly flick and flacks) must be set into the melting oven, and it will fine it felf well enough together, and by this means (as Experience teacheth) more row frones and more Gold will be wrought out, than if fuch flick, flint and flacks had been mingled together, because the work remaineth close together and is not spread.

CHAP.

CHAP. IV.

How Gold-Slicks with Gold from digg'd Oar are to be prepared.

HEN the Gold flicks which do contain Gold are made clean, and there is a defire to make more profit of it, by quickning and getting the Gold out of them, then the flicks must first be prepar'd in the following manner: viz. Take good strong Wine Vinegar, put into every

gallon half a pound of Allum, cause it to boyl up a little, and then let it cool, then put the Gold-flicks in a clean prepared Vessel, and pour the prepared Vinegar upon it, that it may cover the flicks, let it stand two or three nights in it, and work well upon it, so the Vinegar will make a fresh ground to the flamy Gold, that it will not eafily enter into the Quickfilver, and that which is yet among it of deft oar will become slimy, and the Gold is made less, and when the Vinegar hath stood the mentioned dayes over it, then separate the Vinegar clear from it, and wash the flicks clean and fair with warm water, and let it dry, then put it in the grinding Tub or wooden Vessel, and so much Quick-silver to it as the quantity of the Gold in the flicks doth require, and rub it well together with the hands, afterwards with a wooden Pestel, fitted for it, grind it well and so long, till the Quick filver hath taken up all the Gold; when this is done, then pour warm water upon it, and wash the flicks and Quick filver clean, and pour out the muddy matter, and the Quick filver will run together again! which

Sections

CHAP. which must be separated very clean from the slicks, that nothing remain behind, because it is more Goldisb: when this is done, dry it with a spunge; and put it in a double strong Timode or into a fine leather (which is better) and force it with a strong Coard so as the Quickfilver being so prest will pass through such Timodes or leather, and the Gold with almost as much Quick-silver will remain in the Leather; put this on a flat Test upon a coal fire, and the remaining Quick filver will cooperate and the Gold will remain alone; then glow it well and

Scation. To pref the Quickfilver through Leather.

till it doth hold the wind, then pour it into an Ingoto:

The prepared Vinegar (as hath been faid) with Allom, is for the most part used by all Refiners, but they quicken Gold only simply with flick, but 'tis better that such Vinegar be prepared and used.

melt it together before the Bellows with Borax, fo long

When the Gold bolds Silver.

But if the Gold be a little filvery (as commonly walk Gold is, which do not come out of an higher Content than they are in the Oar) beat it thin, put it in Cement, as hereafter shall be discoursed, then it will be clean and have a high Colour.

To pick out the digg'd Gold.

What Gold hath been pick'd out and is wholly dig'd (or else separated by the hand) such Gold may be melted with Borax and cast, and if there is yet any uncleanness then set it first upon a flat Test, let it drive with a little Ball of pure Lead until it doth hold the Blast, and afterwards again with Borax melted into an Ingot, and fo it will be deft.

This manner of quickning doth serve upon all slicks, (which have digg'd Gold) because as the same is washed in Sand, and pick'd out of the Oars; in the same manner it will come out in quickning, and doth not hurt the Quick - filver at all, and when it is forced out, then may it be used again.

There have been also some Gold-mashers which have had

had a fingular manner in the Gold-washing and quick_ CHAPE ning; namely, they have first ground in a Mill the Gold IV. Oars (or Slicks) very small (as small as Meal) after- Scetion wards they have moistned it with strong, hot Salt-water, and have mingled it very well like unto Copel Ashes, that the Salt may every where touch the Slicks upon the Oar; and while the Salt mater is yet warm and hot they have upon five pound of the Oar poured twenty pound of Quick filver, and have mingled the Slick or Oar several times with it, and stirred it well, so long untill the Quick filver could hardly be discerned in it, and they have afterwards put the Oar into feveral Vefsels full of Water, made on purpose, and have stirred it, but one Vessel did always stand lower than the other, that that which did fall out of the upper veffel, (and so to the second or third) might be received and settle in the fourth.

And thereby washed the most of the Muddiness away; then they have taken the Oar and mingled it with the Quick silver, and put it upon the Mill (which hath an hollow stone) and have ground it with water, that it might flow through it, untill no more Muddiness did go from it, till all that which is come through the Mills be settled in the Vessels and preserv'd, so that nothing was lost: Lastly, the Quick silver was taken out of the Mill, and with diligence kept together, and dryed, and pressed through Leather. This Work I like well upon great Quantities of poor Oars, in which the digg'd Gold is very subtil and not slinty, and yieldeth no stone, which cannot be melted otherwise to Advantage

This is a neat work, and is worthy of Deliberation;
But I for my part have this further Confideration in it,
That poor Gold flicks, cannot be much Charge; because,
first, the Slick must be ground, and the Charge of the
H h Salt

V. the other grindings, and the waste of the Quick silver; but lastly, to make the Gold compleatly clean (besides the charges of the building up of the Gold-Mill) tis necessary to be careful herein, for, some Gold-Oar may have so much subtil Gold, as will pay richly for all the Charges.

CHAP. V.

How Clean Gold-flicks are to be made to profit without Quickfilver.

Section.

I.

By Leadglass, &c.

N want of Quick filver one may melt the clean and rich Gold flicks with grained Lead, Litharge and Lead-glass in a Crucible with a little of Caput Mort. and Sandover, and cover it over with Salt, and so cause it to flow well in a Wind-

Oven, and afterwards cause the Regulus to go upon a flat Test, because of the Black-stoney Veins there will be also much fine slick thrust out among the Iron, therefore the Iron is first to be drawn out with a good Loadstone, otherwise it will be much hindred in the upboyling, but if the Gold slick be flinty or the like, then it must first be roasted, so all the Gold which is not loose in the slick will enter into the Regulus of Lead, and be made to prosit.

The Test to such work must be prepared with wash'd Ashes, among which must be mingled half the quantity of small Bone. Ashes, and a little Potters-clay, and the upper part must be done over with good Clar, that nothing of the Gold be drawn into it, and when it is all thus prepared, then water must be poured into it, and let it suck it in, whereby the Test will be made firm and good,

To make firm Test for Gold.

and when the Gold is gone off upon the Test, then take CHAP. the appearing Gold, which is yet unclean, put it upon a VI. flat Test, done over with a little Clar, and let the Bellows blow upon it, so long until the Gold doth endure the blaft, and so it will be deft, and then you may (if it have yet a little smoak of Lead) cause it to melt in a Crucible with a little Borax, and cast it into an Ingot, or presently let it go into the Cement, as hereafter you will be instructed.

The rich cleansed Gold slick may also be boyld up with the following Fluss, like unto the Copper Oars: thus, To boil up Take Slick, mingle among it twice fo much Flufs, put it Gold flick in a Crucible cover it over with Salt, cause it to flow well, with a ftrong heat in a Wind-furnace, and there will be as much Gold Regulus in the Crucible as there was in the flick; then cause it to cool well, and knock the Regulus clean off from the Fluss, but because it is yet unclean from the Fluss, therefore cause it to go off upon a flat Test with a small lead Ball, until it melts and becomes deft: and altho in the quantity of the flick, the quickning is most fit to be used, yet there may (by this Opboiling) be ten pound at once melted in a Crucible, and the Gold be brought into a Regulus.

CHAP, VI.

Of Fluss to boyl up the Oars.



LUSS (of which hath been spoken) is made thus, Take one part of Salt-peter and two parts of Argol (both stampt small and mingled together) cause a glazed Pot to glow, put the matter into it, and cover the Pot quickly, so the fluss will

VII. be presently burnt out and become a black-grey Ponder; VII. or else, when the pulverized matter is put into the Pot, then put a live Coal into it, so it will burn out to a Fluss, imingle also Salt Petre, melted Salt and Sandover, and crude Argol with it, then is the Fluss ready.

CHAP. VII.

How Gold may be separated very clean from the Quickfilver.

Section.

1.
The nfe of Quickfilver in this work.

filver press d through a leather and forc'd from it, yet there will remain commonly a little Gold with it, especially when the Gold-slicks and Gold Oars have been poor, and that the Quickfilver did not become rich, such Quickfilver may be

preserved for other Work of the like nature. But if there were no more such slicks to be done, yet the Gold (which did go with the Quick silver through the Leather) must be separated from it very clean, by an Artificial Separation, and such Quicksilver doth commonly contain two or three Loths of Gold in the Centner, especially when the Quicksilver came from poor slicks, and such Separation is done thus,

How a Iron Jug or Pot is to be made and Learned. Cause an Iron Jug to be made, which may be taken assumed at the belly, lute the lower part of the inside, about half a singer thick, with very good and weighty Loam, (that will hold well in the sire, and not crack) cause it to dry, set the upper part upon it, and bind them both very fast, and close together with an Iron Wyer, and then do it all over on the outside

fide with good Clay, and when it is dry, then fet CHAP. it in an Oven (which is called an Athanor with which VII. one useth to burn Aqua fortis) and put in it fifty pound of Quick silver (if you have such a quantity of it) and place an Helmet upon it, and also an earthen Jug before it, in which there must be full three quarts of Water, and all must be luted well on the outfide, and cause it to dry, then let the fire burn by degrees to be stronger from one hour to the other, untill at last the Jug be very red, yet make it not suddenly hot, that the Jug may not burst, nor the Quickfilver fly out, so the Quick-filver will all come over into the water in the Receiver, which when the fire is kept in good order) is done in feven or eight hours: when all is come over, then let the fug cool well, and take it out of the fire, and open it, so will you find all the Gold in the bottom, then take it from the Loam, Quicklifyer from the Gold and let it flow together.

After this manner (now directed) the Gold which remaineth in the Leather (which hath Quick filver with it) may be put in and drawn off: and the Quick filver

may return to Advantage.

But because the Quick-silver will become a little weak Torefresh from the drawing over (fo that it will not attract to Quick sloor foon as in the beginning) and if you would have it fresh again, then put it into a Vessel of Wood, draw warm falt Water upon it, grind it with your hand well together, and dry it with a Spunge, then it is as good again as it was before, and you may use it again: also there is no great loss by it in the drawing it off, if the Poss 2. I be carthen h eceiver and Glasses be well luted.

In case you cannot have always in readiness an iron Jug, cause one to be made of earth (which will endure the fire) and lute the fame likewise with good and firm Clay, as you did to the iron Jug; fo put the Quickalver

Section.

off the Gold;

CHAP. filver into it, and Helmet upon it, and set before it the VII. Jug with water, and lute it well altogether, then force the Quick silver over it, and you may have it again for use, but such Labor is performed with Sorrow and danger, because if such an earthen Jug should crack or spring then the Quick silver will be lost, and will evaporate to smoak, therefore there must not be so much Quick silver put in it, as into an iron Jug or Pot.

Some use to put upon such a Jug an earthy blind Limbeck (that on both sides hangeth over) and therein they put water, and draw the Quicksilver from the prest Gold in it, and when it is a little cool, they put it out through the Pype which is above on the Helmet,

and then the Gold will remain on the Jug.

Now, which of these (that is found most serviceable and convenient to any one) he may use: only take notice, That, if you let the smoak away and the remaining Quicksilver from the Gold (without distillation) take heed the smoak or vapour go not into thy Belly, because it is a poysoning and cold Vapour, which lameth and killeth: for, he will find that it will there congeal and afterwards spoil his body.

Now, that the Reader may know how the Jug and Instruments are to be made which are to be used for quickning, and attracting, he may find exactly in the

following Sculpture, which is thus

Deciphered.

1. The Athanor or great Furnace.

2. The Ovens on the fides of it.
3. The earthen Receiver for it.

4. The earthen Helmet for it.

5. The blind Helmet with a Pipe by which mater may be pour'd in.

6. He that fitteth the matter.

Снар. VII.

- 7. He that presset the Quicksilver through a Leather.
 8. The lower part of the iron pot or Receiver.
 9. The upper part of it.
 10. The Leather purse for the Quicksilver.
 11. He that causeth the Gold to melt, by help of the Bel-
- 12. The Pieces of Metal.

Sculpture XVII.



He that profferb the Otick filver through a Leather.

CHAP.

CHAP. VIII.

How Gold-Oars are to be proved for Gold.

Section

OLD Oars are of two forts, one is partly flowing, the other partly barsh (as is discoursed in the first Book) Now from the silver Oars the common Assayers have had in their proving two Processes, namely, upon the mild and flowing Oars, viz. the Iron-streamy and

bright oars) and such as are without flints: their Pro-They used to grind their Oar or slick cess was thus: very small, and have weighed a Centner of the Fluss, which they had prepared for the Gold-Oars, (as we shall discourse hereafter) and have mingled altogether, and did put it into a clean Grucible, and covered it with Coals, and have fet it before the Bellows, and did blow about it, and when the Fluss was melted, then have they put fifteen Centner of clean Lead into it, and when it did begin to flack, then they take the Crucible out of the fire, and luffer it to cool, then beat the Regulus with the flacks out of the Crucible, and put it together upon a proof Test, in an Assay Oven, and have caused it to boil up, and flack again, as other filver Oars; and have stirred it about with a clean Iron-hook, and when it was vvell boyld up, they did let it cool; finally, they have beaten off the flacks from the Work, and upon a well nealed Coppel caused it to go off, but they have made their fluss, (for fuch proving) of one part of Litarge, and one part of Antimony well ground together and melted them, and when they did intend to use

I

it with fuch Oars (as were not Iron-freamy Oars) they CHAP. added a little filings of Iron, that the fluss might VIII. have fomething to devour and not hurt the Silver and Gold.

But the flinty Oars and flick which are harsh and unflowing they have affayed according to the former way, The flinty Gold Ourse only they have first roasted it, and some do quench it in the roafting with *Urine*, or with a particular prepared Lye, thinking thereby to obtain the more: But for my part, I do not esteem such Processes, because no more (by fuch Labour) can be brought out by it, than by the following Method, which I esteem more necessary, and through which the Proof may be accomplish'd cleanlier, and in a shorter time: yet, because the abovefaid Labour was by the Ancients in use, therefore I do leave it according to its efteem with others.

The other proving is done thus, take the Gold-Oar Another or flick, either flinty, raw, or deft, as it happens, and Proving. grind it small: Of this weigh a Centner with thy Proofweight, and put to it fifteen Centners of granulated Lead, and mingle them together in an Assay-Test, then put to it a Centner of small grounded Lead-Glass, and let it in a warm Affay oven, make it first hot so long untill the Lead beginneth to drive, and the Oar to rife, then let it cool again, that the Oar may roast over the Lead, and rise no more, then cause it be hot again, so will it slack very clean, then stir it about with an iron Hook, and let it stand a little longer, when 'tis enough, then take the Test out of the Assay. Oven, let it cool, and beat the work clean off from the flacks, and let it go off upon a Copel; when this is done, then draw up the Grain against the Lead-grain, and as much as it is heavier, so much doth the oar or flick contain of Gold, or Gold and Sil. ver, which thou maist know by this that when the Grain is very white, then put it in a leparating-Glals, to

CHAP. dissolve in Aqua Fort. but if the Grain is too rich in VIII. Gold, so that the Aqua Fort. will not touch it, then add to the Grain a little fine Silver which holdeth no Gold: fo that to one part of Gold, there may be three parts of Silver and cause this in a Copel, with pure Lead, to drive together: After this, take that Grain, beat it flat with an bammer, glow and dissolve it in Aqua fortis, as you have been instructed before, then pour the Aqua fortis off, and dulcify the Gold with warm water, put it out of the separating Glass and glow it well, when this is done, then draw it up with the Proof Scales, and you will fee how much a Centner of the Oar or flick doth contain of Gold and Silver, and by this Proof the Affayer may know that all the Gold and Silver which is in an Oar is certainly found, and hath not need of other Circumstance:, because the Lead doth take very willingly the Gold and Silver to it self.

But how the Gold is to have its due dissolution, dulcification, and what is else to be done with it, all this I

intend to declare hereafter more fully.

Hereby one may know that there is no need to take any Lead-glass for such soft flowing or dest Gold oars or Gold-Slicks, but it may eafily be boyld up, by governing the fire; one may also do the flinty Gold Oars in like manner, only they are sooner and better boyl'd up when

Lead-Glass is added.

Some Assayers have also used to grind the Gold-slickflint and other Gold oars very small, and weigh them off, A fire Gold and put it in a separating-Glass, and pour into it good strong Aqua fortis, and they let it dissolve as much as it will, afterwards letting the Aqua fortis be evaporated, that it may all come hard in the Glass, they beat it out, and boil it up in a Test, with Lead, and cause it to go off upon the Coppel. word frient works doinw

This proof I like well, and I judge, that if fomething

more of Gold may be obtained, that it must be done this CHAP. way: only the great quantities must not be regulated IX. according to this Method: Therefore every Affayer is to take heed with good Diligence, that he may order his Affayes thus, that he may alwayes find the Contents as near as he can, so that he may afterwards in melting great quantities, find the same according to the proportion.

CHAP. IX.

How Gold in Lumps, Plates, Ingots or coyned Gold is to be affayed, and first of Touch-Needles.

ECAUSE in Touch Needles of Gold, section. there is often used much Deceit, especi- Deceis in ally by fuch who do buy Gold by the Touch nee-Touch, therefore to fuch Proving it is neceffary to make true Needles, without Deceit, That one may not be over-reached by touching, so as when Gold is brought to a high colour by Graduation, that such a stroak upon the Touch-needles of eighteen Carats, with good Crown

Gold may be made, and thereby may be judged. But first you are to be instructed that some sorts of Gold (that come from separating and have no red, but ofGold and altogether white) cannot be touched upon a certainty needles, calwith Touch Needles for Gold, on the contrary, such which white. have much red and little white, as the Crown-Gold, with white Needles, which are made for the separating, and wash'd Gold must not be touch'd, much less can the Rhenish Gold, which hath more white than red, be done by these now mentioned Needles, I will therefore first describe the Needles which are most in use, how they must

X. with this Caution, that every Affayer may take good heed that he may so well order his Goldstroak, that he may not be esteemed as one without understanding, and that he may not come to Dammage, because through false Needles, not only they who are unacquainted with the several sorts of Gold, but also such who handle them dayly, are oftentimes deceived.

CHAP, X.

How the white Touch Needles are to be made.

Section.

O all Touch Needles for Gold you shall take pure and fine Gold, although such can be as little demonstrated as fine Silver, and I judge such Gold to be pure and fine, which is cast and diligently blowed off, and afterwards beaten thin,

and by Cement and other ways cleanfed (of which hereafter) now you are to weigh fuch Gold off: (for Needles) with a fingular Carat-weight, which must be a little more than a common Carat weight, and to every one

must be allowed, as followeth.

Weigh to the first Needle 24 Carats of fine Gold, which maketh the first Needle: to the Second, weigh 23 Carats and a half of fine Gold, and a half Carat, or fix Grains of white fine Silver: to the Third, 23 Carats of fine Gold, and one Carat of white: to the Fourth, 22 Carats and a half of Gold, and one Carat and a half of White: to the Fifth, 22 Carats of Gold, and two Carats of White: to the Sixt, 21 Carats of Gold, and two Carats and a half of White: to the Seventh, 21 Carats of Gold, and three Carats of White: to the Eight,

Eigth, 20 Carats and a half of Gold, and three Carats CHAP. and a half of White: to the Ninth, 20 Carats of X. Gold, and four Carats of White: to the Tenth, 19 Carats and a half of Gold, and four Carats and a half of White: to the Eleventh, 19 Carats of Gold, and five Carats of White: to the Twelfth, 18 Carats and a half of Gold, and five Carats and a half of White: to the Thirteenth, 18 Carats of Gold, and fix Carats of White: to the Fourteenth, 17 Carats and an half of Gold, and fix Carats and an half of White: to the Fifteenth, 17 Carats of Gold, and seven Carats of White: to the Sixteenth, 16 Carats and a half of Gold, and seven Carats and an half of White: to the Seventeenth, 16 Carats of Gold, and eight Carats of White: to the Eighteenth, 15 Carats and an half of Gold, and eight Carats and an half of White: to the Nineteenth, 15 Carats of Gold, and nine Carats of White: to the Twentieth, 14 Carats and an half of Gold, and nine Carats and an half of White: to the One and Twentieth, 14 Carats of Gold, and ten Carats of White: to the Two and twentieth, 13 Carats and a half of Gold, and ten Carats and a half of White: to the Three and I wentieth, 13 carats of Gold, and 11 carats of White: to the Four and Twentieth Needle, 12 carats and an half of Gold, and eleven carats and an half of White.

One must also according to this Method make the Needles: yet further, if one would do it well (but it is not useful) to touch the meaner Gold under twelve carats: or one might make the Needles from carat to carat, so that the half carats are not brought in, for they are very difficult to be discerned) but the Needles will be fewer in number: this now is left to every ones pleasure: and these white Needles are to be used upon the parted and washed Gold, as abovesaid.

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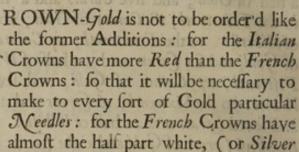
CHAP.

CHAP.

CHAP. XI.

How Touch-Needles are to be made and used for Crown-Gold.

Section:



addition) on the contrary, the Italian Crowns have their addition of one part white and two parts red (though they are not all alike, for some part have addition almost the half part white, and some parts more red then white:) therefore I will here set down the Division upon two parts red, and one part white; for, if the one sort of Gold should be whiter than the Needles (hereafter mentioned) then the half white and half red are to be used.

Weigh then to the first Needle, 24 carats of fine gold, which maketh the first Needle: to the Second, 23 carats and an half of gold, and two grains of white, or fine silver, and four grains of red, that is, pure boiled copper: to the Third, 23 carats of gold, and four grains of white, and eight grains of red: to the Fourth, 22 carats and an half of gold, and six grains of white, and one carat of red: to the Fifth, 22 carats of gold, and eight grains of white, and one carat, and four grains of red: to the Sixth, 21 carats and a half of gold, and ten grains of white, and one carat and eight grains of red: to the Seventh 21 carats of gold, and one carat of white,

and

and two carats of red: to the Eighth, 20 carats and a CHAP. half of gold, and one carat and two grains of white, and XII. two carats and four grains of red: to the Ninth, 20 carats of gold, and one carat and four grains of white; and two carats and eight grains of red: to the Tenth 19 carats and a half of gold, and one carat and fix grains of white, and three carats of red.

After this Method and Instruction one may divide the Needles more or less, so as they may decrease or increase from carat to carat as one pleases: These Needles are used not only upon the Crown or Coin'd gold, but also upon all other Gold, which is of fuch Allay, or have in them the Addition, after the above-mentioned Instructions.

CHAP. XII.

The Division of the Touch-Needles, when the Metal is half white, and half red.

> ECAUSE some Crowns are ordered section. which have half white and half red, The fairest which I esteem the finest in Colour, there- Crowns in fore weigh in the division to the first Colour. Needle, 24 carats of fine Gold, as alto in all the Needles, the highest best or first Needle shall be fine Gold: to the

Second Needle, 23 carats and an half of gold, three grains of white, and three grains of red: to the Third Needle 23 carats of gold, fix grains of white, and fix grains of red: to the Fourth, 22 carats and an half of Gold, and nine grains of white, and nine grains of red: to the Fifth, 22 carats of gold, one carat of white, and one

CHAP. carat of red: to the sixth, 21 carats and a half of gold, XII. and one carat and three grains of white, and one carat and three grains of red: to the Seventh, 21 carats of gold, and one carat and fix grains of white, and one carat and fix grains of red: to the Eighth, 20 carats and an half of gold, and one carat nine grains of white, & one carat nine grains of red: to the Ninth, 20 carats of gold, two carats of white, and two carats of red: to the Tentb, 19 carats and a half of gold, and two carats and three grains of white, and two carats and three grains of red: to the Eleventh, 19 carats of gold, and two carats fix grains of white, and two carats fix grains of red: to the Twelveth, 18 carats & a half of gold, and two carats and nine grains of white, and two carats & nine grains of red: to the Thirteenth 18 carats of gold, three carats of white, and three carats of red: to the Fourteenth, 17 carats and a half of gold, and three carats and three grains of white, and three carats and three grains of red: to the Fifteenth, 17 carats of gold, and 3 carats and fix grains of white, and three carats and fix grains of red: to the Sixteenth, 16 carats and a half of gold, and three carats and nine grains of white, and three carats and nine grains of red: to the Seventeenth, 16 carats of gold, and three carats of white, and three carats of red: to the Eighteenth, 15 carats and an half of gold, and four carats, and three grains of white, and four carats, and three grains of red.

After this Method you may divide the Needles more or less, or to increase or decrease from carat to carat, as you were instructed before.

CHAP. XIII.

How Touch-needles are to be made for Rhenish Gold, in which there is two parts white, and one part red.

hath also the addition of half white and the Division of half white and the Division of half white and the Division of Method on the Needles before set the Method on the Needles if the Addition be two parts white, and one part red, upon such you shall divide the Needles thus,

To the first Needle weigh 24 Carats of fine Gold, which maketh the first Needle: to the Second needle, 23 Carats and a half of fine Gold, and four Grains of white, and two grains of red: to the Third, 23 Carats of Gold, and eight grains of white, and four grains of red: to the Fourth, 22 Carats and a half of Gold, one Carat of white, & fix grains of red: to the Fifth, 22 Garats of Gold, one Carat and four grains of White, and 8 grains of red: to the Sixt, 21 Carats and a half of Gold, and one Carat and eight grains of White, and ten grains of red: to the Seventh, 21 Carats of Gold, and two Carats of White, and two Carats of red: to the Eight, 21 Carats and a half of Gold, and two Carats and four grains of white, and one carat and two grains of red: to the Ninth, 20 carats of gold, and two carats and eight grains of white, and one carat and four grains of red : to the Tenth, 19 carats and a half of gold, and three carats of white, and one carat and fix grains of red: to the Eleventh, 19 carats of gold, and three carats four grains of white, and one carat and eight grains of red: to the Twelfth, eighteen carats and an half of gold, three M m

CHAP. three carats, and eight grains of white, and one ca-XIII. rat and fixteen grains of red: to the Thirteenth, eighteen carats of gold, and four carats of white, and two carats of red: to the Fourteenth, 17 and an half carats of Gold, and and four carats and four grains of white, and two grains of red: to the Fifteenth, 17 carats of gold, and four carats and 8 grains of white, and two carats and four grains of red: to the Sixteenth 16 carats and a half of Gold, and five carats of white, and two carats and fix grains of red: to the Seventeenth, 16 carats of gold, and five carats and four grains of white, and two carats and eight grains of red: to the Eighteenth, 15 carats and an half of gold, and five varats and eight grains of white, and two carats and ten grains of red: to the Nineteenth, 15 carats of gold, and 6 carats of white, and three carats of red: to the Twentieth, 14 carats and a half of gold, fix carats and four grains of white, and three carats and two grains of red:

Although now the Rhenish Gold useth not to be of so small a content, nevertheless the Needles are thus to be made for the Allay or additions sake, that one may by the Touch know the Mean-Gold by it, and judge of

the nearest Content.

Section.

2Needles of
Copper:

One may also according to this manner dress or order some few Needles with all red or Copper, for some Golds especially they which are rich among the Goynes, (the Hungarians having all red:) But when one would make Touch - Needles upon a certain Content of gold, which with the addition of the Allay should be otherwise than they which are shewn before, then they may be divided after the above-mentioned instruction: which you are to understand thus: Let the Contents of gold be with Allay or addition, as it will, yet order thy Touch-Needles thus, That alwayes gold and the addition

dition may make together a full Mark, as is to be feen CHAPA in the above-mentioned instruction of the Needles.

When you have divided the Needles with dili- Section. gence, then let the division of every one severally be put The Division in a little Grucible with a little Borax, flow it together gether. and when it is flowed put it quickly out, for the fooner the division of the composed Metals flow together and come out of the fire, the better it is. Some let it go together in a Charcoal fire, but the Divisions remain not alwayes deft of it, and sometimes the Coals break, and by that division does come to nothing, therefore 'tis better to let it flow together in a small Crncible, whereby there will not be fo much care of running through.

When the Divisions are cast together, then beat them The Niceevery one feverally into Lengths, and form them accord- dels to be beaten into ing to thy pleasure, beat and cut also upon the Needles lengths. the Figures what every one containeth of fine Gold and Allay, that one may see how many carats and grains of fine Gold, every Needle hath, that in the Touch there

may be no Mistake.

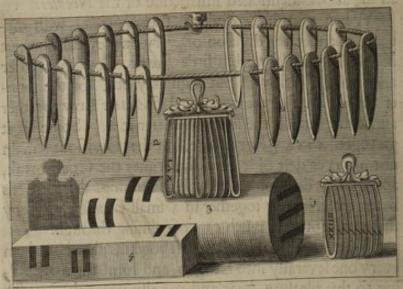
If one hath a mind he may foder together the ordered Needles upon copper or filver pieces, that only the ends may be Golden divided Needles, as also commonly of the Gold-Touch, and usually Needles are made so, else they would come to much Mony, as may be feen by the

following Sculpture.

But the Gold-Smiths take not so much Pains, nor are Needles of at so large Expences, but cut a piece of a Duccate and Gold smith; of a Crown, and of a Rhenish Gilder, and soder every on Copper piece, after this they touch their Gold: And by this they can very well fee whether the Gold have its right Content either of Duccats, Crowns, or Rhenish Gold, but if there be a different Content, then they cannot know how much properly the Content is less.

CHAP.

Sculpture XVIII.



Deciphered.

1. The Proportions of Touch Needles for Gold.

2. The Ingot to be compared with those Touch-Needles.

3. As also by the Touch stone.

CHAP, XIV.

How the Touch Needles are to be used.

Scalion.
1.
Touch ftones

HEN then the Touch-needles are prepared with diligence, and one would use them, there is need of a good Touchstone upon which the Gold is to be touched, of such are found some part which are grey and pale green, but the black ones are the best, although the same be not all good, especially, if they are either too hard or too weak. The weak ones have this property, that upon them no Gold doth touch

bright,

bright, but the Gold doth only grind on it, and becom- CHAP. eth in the aspect weak and ruffe, also the Hungarish or XV. other weak Gold will not touch it felf right upon Touch. Sections stones which are too hard, for the Gold doth run over it, that the stroak is not very well to be seen, and that Touch stone is not good which doth not touch the Gold, of what Contents foever it be, with a fine good and strong stroak, that it be bright upon it, and also the Touch-needles as long untill the fame stroak be like the Gold-stroak in the colour, and as high: then you have yery nigh the Content of the Gold: only, as I have given an account above, Observe well, whether the Gold be high-grain'd; viz. whether it hathmuch Copper added, or much white, which is called Pale Gold, according to Ginnyi. this, use the Needles, which every one doth not understand, and therefore he must have the Knowledge of the righ stroak from great Practice. But as to the bard concerning Gold, they do not give a right stroak, but they do touch brickedoldi all of a smaller content than they have in fine Gold, therefore fuch stroaks are to be judged false and uncertain.

CHAP. XV.

How the Gold is to be proved by Aqua fortis.

F you have Pieces of Gold either in Toent Plates or Ingotts, and wouldst assay Treas. them, then first cut Pieces or Plates above, at one end of it, and below at the other end, and beat the Bits thin that you may weigh so much as you have necessity to use for a tryal, but if it is a cast Ingot, then N n beat

CHAP. beat it thin only at one end, and weigh of it for thy XV. Tryal.

Section. be Small,

To fuch a Tryal of Gold and Gold-Gilders, you The Carat must have a particular Carat-weight fitted for it, and it must be small because of the Silver cut, otherwise the Ballance cannot carry the Cut (concerning which shall be treated of hereafter) the dividing of the Carat weight is as followeth.

Division of the Carat-weight.

24 Carats is one Mark.

12 Carats

6 Carats

3 Carats

2 Carats

1 Carat

6 Grains is half a Carat.

3 Grains

2 Grains

1 Grain

F Grain

Grain.

Grain

If you would prove the Gold, see if it be of a rich or poor Content, and would also certainly judge how much a Mark of it hath of fine Gold, then you must know first (and before the nearest Content of the Gold according to which you are to make your Tryal, as shall follow.) That for such contents you shall have two forts of wayes to inform your felf, First, by the Touch with the before made Golden Touch-Needles;) Secondly, One may make a nearer Trial of the Gold, for, although the Proof do not remain whole in the Aqua fort. yet you may see very near what the Gold doth hold

hold. Therefore it is best to use the Assay-proof upon CHAP. it, by which one may also find, what the Gold contain- XV. eth both in white or fine Silver. When now you have and proof. found by these waies the nearest content of the Gold, then make the cut of fine Silver (which must be without Gold;) take then the Gold and beat it with a Hammer upon an Anvil fine and thin, and make thy cut fo, that the white or Silver, which is already with the Gold) may be counted with the Tryal or fourth part (for it must contain three times as much Silver as of fine Gold.) To comprehend this the better, the following Example shall demonstrate it, which I have found by the tryed Proof, that of the Gold which containeth 14. Carats, 8 grains of fine Gold, and 7 Carats, and four grains of white; I weigh it with the small carat weight to two alike balf-Marks, then there will be in every balf Mark 7 carats, and four grains of Gold, and 3 Carats and eight grains of white, to which I add three times the weight of fine Silver as the gold containeth of fine gold; this is my Proportion. Now I do multiply To make the the feven carats and four grains (which containeth the Carat. balf Mark) of fine gold, with three, and there will come 22 carats of white or Silver to the Addition or to the Cut: from this I reckon, That of three carats, and eight grains of white there will be as much as the balf Mark had of Silver with it before, so there will remain 18 carats, and 4 grains, and thus much fine Silver you must add in an half Mark.

As this Silver or Cut and the half weighed Mark the Tryal do make together 30 carats, and 4 grains, so much also of its must be the inweighed gold, of the other half Mark cut.

Put every one of these with its Cut upon a well nealed Copel, and add nine weights of pure Lead into it, let it go off together, and see whither the grains come alike, then lay one of the grains in the Scale, and as much

CHAP. as it now weigheth less than thirty earats and four grains, XV. so much containeth a half Mark of Gold - Red - Copper, but to the fine Silver because it looseth upon the Copel, if it goeth off upon it with Lead as much as the Lead hath carryed away, may by a grain weight be accounted; for, understand it thus; In case every grain did weigh after it was gone, of 29 carats, and 4 grains: also a grain wast of fine silver, there would be wasted one Carat upon the half Mark, then there will come upon the whole Mark two carats; thus much Copper

(or red) containeth a Mark of mixt Gold.

If the grains are diligently drawn and weighed, then beat out of every grain a fine and clean piece or Roll, not too thin, and glow it often that it may not be fbivery, and that nothing may go off; at the last glow the little Roll, and roll it gently over, that you may see whether by the often glowing and beating somewhat be come off: When now the Rolls are clean prepared, glow them once more, and if they from the glowing and rolling be come hard, let such things be mended.

Diffolving.

But the glowing must be done in a golden little half Pipkin made on purpose, that nothing unclean may come in it, put then the Rolls together in a little separating Glass, put to it near so much Aqua fortis made for Goldproofs, that it may go an half singer broad over the little Rolls, stop the Separating Glass above with a hard twisted paper, that no vapors may go out, and put it thus into a little Vessel of Iron or brass made on purpose, over a sew live Coals, that the Aqua fort. may begin to work, so will the separating-Glass become brown, but let it not work too much or too fast, yet take it a little while from the sire, and then put it on again, untill the Aqua fortis hath done its working, and the Glass become white again: Then put off the Aqua fortis again

again and put fresh Aqua fortis upon it, set it again CHAP. with the Veffel over the fire, and let it work: this is XV. done, because if the first Aqua fort. were grown too weak, and had loft somewhat of Silver by the Rolls, that the other Aqua fort. might touch it again, and make it clean. Take notice also, That you may cause the last Aqua fort. to work in great Bubbles, that the Roles may become very clean, and put in the second Aqua fort, which hath not beenufed, for it hath its strength as before.

Then put clean fweet warm water upon the little Rolls, (Rain Water is the best for it) let it stand a little, To sweeten and put more warm, or rain Water, upon it again, and fet the Glasses with the Rolls over a coal fire, let it boil and work in great Bubbles, then take it off, and casting the water again away, this do three times with warm or rain water, that the filvery Agua fort. which did hang about the little Rolls be dulcified, then is it enough: When the little Rolls are thus clean and sweet, then put them out very gently, with the last sweet water in a glaz'd pot or glas bottle, and pour the water off from it, and take the Golden Rolls with clean Pincers out of the Pot, and put them in a clean cloth to fuck the rest of the water into it, and the Rolls will look yery fine and brown.

Then put them into the Golden pott, and after, put To neal the them into an Affay-Oven, but not in an exstream heat. little Gold Rolls. ing, and glow them well and they will become as fine as a pure Gold: When this is done, Take the two little Rolls, weigh them one against the other, and if they are alike in weight, then have you proved them right: next, put them together in a weigh-scale, and weigh them with the (arat-meight, and how much they do weigh, so much containeth the Mark (of the mixt Gold) in fine Gold: this only is to be observed, That the weight of the Wa-

0 0

CHAP, ter, (as much as the Water hath left after it with the XV. Golden Rolls) must be substracted always in the Weight from fuch Content. But how much there will be to substract you must search with a singular Proof, with which you use to prove the Aqua fort. but when you have once proved the Aqua fort. then you have no need to prove it any more, but may keep it for use: yet tis commonly found that upon a Mark of fine Gold, as from 24 carats you must substract one and a half, fometimes two grains for the weight of the water, and fo you must substract according to the Example of the before mentioned Proof, as upon 14 carats, and 9 grains, as much as the Golden Roll of one grain, did weigh, then there will remain 14 carats and 8 grains of fine gold, for in the gold proof, in many places, one uleth not to give in, in buying, a half grain, but in the coin-works they use all wayes to count, and give in the half grain: If then the little Rolls contain in fine gold 14 carats and eight grains, then a mixt mark of Gold will contain 7 carats and four grains of white or fine filver substracted.

Now, the Gold of 24 carats and 8 grains of the whole cut, and 24 carats of Gold & 44 Carats of filver, you shall finde (as I have said) that the Contents will be a mixt mark, 14 carats 8 grains of sine gold, and 7 carats, and 4 grains of white, and two carats of red, and these three Contents will make together a full Mark.

Section 10. Corned Gold. After this manner and method are to be proved all other Golds, likewise the coyned Gold, and one needeth not the Assay-Proof, in the coined Gold, if one knoweth the nearest Contents, but if one doth not know the Contents certain upon a carat, then an Assay of it must be made.

Now I use this Method in my Cut (and commontrucCarati, ly on the silver or Cut) to take two carats or some what less for a tryal which doth agree with the Multi- CHAP. plication (as above-heard, of the three Contents,) and XVI. it is better to take two Carats of filver less than one too much, and so the Rolls will remain the firmer and more intire, and there is no fear though somewhat of the Rolls were loft or torn off.

You may also finde in a Gold (of which you intend to prove the red and white) that if you make the way to find Assay-Proof, (as above demonstrated) then cut one red in Gold, Mark of the Gold more, and put it with its due of Lead without any other Cut) upon the Cappels, and let it go off with the Try-proof, then weigh the same Grain, and you will see what is gon off, and how much it comes out lighter, so much hath been red with it.

Thus you have the right and clear Instruction for Gold Proofs, and if you will follow it, you will do well, and thereby not be apt to err in your

proots.

XVI. CHAP.

How to prove the Aqua fort. and bow much Gold it doth leave in the Proof.

> LSO, if thou wilt prove an Aqua fort. how much is substracted in the Gold- The manner Proof, Take Gold which is cast divers times, through Antimony, and is brought to the highest: and make the proportion upon 24 carats, and weight it also in two half Marks (as you have

been instructed before) and multiply it by 3, then there will come upon every half Mark of fineGold 36 carats of fine Silver, then put every half Mark of its propor-

CHAP. tion by it felf, upon well neal'd Coppels, let it go off to-XVI. gether, weigh the grains off, and fee whether they come alike, and beat them in flender Rolls, and put them into separating Glasses, and put upon them so much Aqua fort. as one doth use to take to a Gold-proof, as hath been shewn before in the Gold proof: then place it with an iron Trevet over a little Coal-fire : Let it dissolve, and put upon it the Second time fresh Aqua fort. fet it over again; when now it is right, and well diffolved, pour the Aqua fort, on it, and make the Rolls with warm vvater very clean, and dry them, and glovv them in a little melting pot for Gold, and they vvill become fine, then weigh them one against the other, and if the Rolls be alike then the Proof is right; then lay them together, and against it thy whole mark: (after you have weighedit) and as the Golden Rolls do come out heavier, fo much is to be substracted in the Gold-proof upon this one Mark of fine Gold. Scation.

Section.

2.

Another

way.

Take this for an Example: I have weighed in two balf Marks upon one Mark of fine Gold, and have parted it vith the Aqua fort. (as above is mentioned) and after the dissolving, dulcifying and glowing, then the two little Rolls have weighed one Mark or 24 carats and one grain and a half, so that the Aqua fort. hath left behind two grains, in the Proof, thus much is to be subgrafted in this Aqua fort, upon 42 carats.

substracted in this Aqua fort. upon 42 carats.

What the Remainder is. Know also that such as is kept back in the Aqua fort. is nothing else but silver which the Aqua fort. could not draw out so clean, by which the Gold doth not become so very clean and fine, which is to be seen. If one letteth the Golden part go off with a little clean Lead upon a Coppel, to see how they become smaller or retain their weights. But if the Aqua fort. do leave its strength or spirits with the Gold, (as some do think) then the same could not remain nor consist upon the Coppels.

Out

Out of which may be concluded, That by Aqua CHAP. fort. fine Gold is made: But this is fure, That a good XVI. and well purified Aqua fort. bringeth the Gold in parting (especially if the Gold Calx (as shall follow) hath been cleanly dulcified) to 23 Carats and 11 Grains. But it is not yet quite fine Gold, for the remainder with the Gold is nothing else (as is said before) than Silver: (as well in the parting the Gold, as in the Proof) else one may drive away what is left with the Bellows, and make it clean.

But if you have no fine Gold, to the Proof of the section. Aqua fort. then take Hungarish Gold, whose Content Rules for its you know certainly, and make of the same Content the Divisions and Proportions, then you may find what is to be left behind of the Aqua fort, and how much is substracted of it: But the Gold which is cast through Antimony (as is before mentioned) is for fuch use much furer and better: And know, That the same Aqua fort. after the Diffilling must be purified and settled, before you do prove or use it to the Gold-Proof, of which afterwards an Instruction shall follow:

To all fuch proving you must have clean separating Glasses, Tunnels and little glass Pots for Gold to sweeten Separating in, these are to be made of good Venetian Glass, and the other Glass brighter, whiter and clearer they are, the better it is, that

the proofs may well be feen in them.

But the Iron or Brazen Instrument, upon which the little separating Glass must stand, is to be made four foot- An Instrued, that it may stand fast, and also with a little handle, ment for the by which it may be taken off, likewise another little foot glass. or instrument of Copper or Iron, which must be flat, upon which is to be let the Golden little Pots (if one will have it let in the proof-Oven for the out-glowing) because this Proof is the finest, most glorious and lovely, therefore all south and cloth was no made moith and gently on

CHAP. things pertaining to it must be made and prepared with XVII all diligence and cleanliness.

CHAP. XVII.

How Silver is to be proved for Gold.

Section.

1.

First Tryal.

of Metals together, but give to every proof its due, and to write of every one apart, how it must be done: Know then if one would prove a goldish silver upon Gold, it must first be proved upon fine

Silver, that one may find the right Content, both of the fine Silver and also of the fine Gold: Therefore when it is proved upon the fine (as I have taught in the Silver proof) then take the same proof Grains, beat them thin, glow them, and weigh a Mark of it with thy Pennyweight, and dissolve the Silver in a little separating glass in Aqua fort. then there will remain a brown Gold-Calx: pour off the Aqua fort. very gently, then take warm sweet water (as you have done before in the Gold Proof) and put it upon the Gold-Calx, and let it boil over the Coal-fire in a little Culbe or bottle: now when the Gold Calx hath fetled it felf again, then drain the water off, and put upon the Gold Calx two or three warm waters more, that thus the filvery water may be clean taken off from the Gold Calx, then put the Gold Calx, clean out of the Culbe, into a glass pott, that nothing may remain, then drain the water very clean off from it, and bring the Gold Calx in the golden little Pot clean together, and if there be wetness about the Gold-Calx, then press it with a clean little cloth where 'tis made moist, and gently on

To dulcify

the end of one fide, that the metness may be sucked in CHAP. (only touch not the Gold Calx with the Cloth.)

When this is done, then fet the little golden Pot upon the Trevet in the Affay Oven, but not fuddenly (that To glow. the Gold may not leap, and the proof become false) and glow out the Gold calx, fo will it become fair, then put it again out of the golden little Pot into the inward Scale of the Proof-Ballance, and fee how much it weights according to the divided Penny-weight, with which you have weighed it, so you will have the Content; now how much a Mark of Silver containeth, I put this as an Example, for I have proved, That a Goldish silver or grain'd Gold, of this mixt Mark) hath contained 14 loths and a dram of fine Silver, and fuch fine Silver hath in a dram a penny-weight of Gold, then the Content in the Goldisb Silver upon a Mark doth fignify that it doth contain 13 loths, 3 drams, and three peny weight of fine filver, and one dram and one peny weight of Gold.

Likewise in this manner one may also prove the fine Astrond Gold which is come from grained Silver, if one doth Tryal. weigh a Mark of it, and diffolve it, and if the fine Mark in such a proof do contain one dram, one peny-weight, and one Heller of Gold, and is the Contents: and if a Mark of the grained Silver containeth 14 loths one dram be reckoned upon fine Silver, then the Mark will fignify one dram, one peny, one beller of Gold, and of such proof it is counted, that by it the Gold is found a little less than the former, but I leave it to every ones pleasure to try and judge.

Some Affayers have this Method, when they would Athird prove a goldish grain'd Oar for Silver and Gold, then "a). they weigh the grain'd Metal with their penny weight, and prove it upon fine Silver, (as 'tis usual) and they weigh in a grain fuch grain d Metal after the mentioned weight (as at first) and dissolve it raw in Aqua fort.

of the Proof.

CHAP, and as much then as they do find in Gold, they fub-XVI. stract it from the fine-Silver, and this they count for the

section. right proof to prove Silver upon Gold. Difference

But that one may know that this their Proof is false and unjust, although somewhat more of Gold is to be found by it, therefore I will shew some Reasons why the same Gold is not so high in Fineness as the Gold which is separated out of the Proof of the fine Silver by Aqua fort.

First, although the Copper doth dissolve, yet the green Coppery water sets it self rather on the Gold than on the filvery water, and then the Copper which hath set it self cannot be brought off again so clean from

the Gold, as from the tender filvery mater.

Secondly, Gold cometh higher out of the separation than when the filver is Coppery, upon which the Aqua fort. doth not work so easily, as on the fine Silver; Therefore no Separater of Gold doth take upon him to separate such Silver after such proof, but all the Silvers which he separates in Aqua fort. must first be burnt upon a Test.

Thirdly, Although the first Process to prove the A Singular Goldish Silver upon Gold is the common way, and also the right Proof, by which the true Content is to be found. Nevertheless, I must further mention a singular proof (which is found upon fuch goldish filver and grain'd Work) by which, in the dissolution the little grains or small cut pieces of Silver will remain whole in the Aqua fort. (of what light Contents foever they be of Gold) and how small and subtil soever the grains be: also that one may number all the little grains of Gold after the number of the little pieces of Silver, how many there be laid in the Aqua fort, and no splitting will go off from it (as in the other proofs) yet if the grains should be weighed in, (also raw) the Gold will remain the better whole, but this proving is to be done thus, when CHAP. you have weighed off the Silver put upon it a very XVIII weak Aqua fort. which the Silver cannot well touch. and put it in a Culbe to dissolve over a little Coal - fire (as is usual) and let it be very hot, that the Aqua fort. may work with great Bubbles, and almost boyl over, this diffolution do, to long until thy inweighed Silver be almost dissolved, but that it may have the better help. put (if the Silver be dissolved) a little more than half of new and a somewhat stronger Aqua fort. into the Culbe, and the Silver will diffolye it felf clean out, and will split no more, although the second time, there be put to it, the stronger Aqua fort.) but what it doth will be done at first.

This is a fine way through which the Gold remaineth together in grains close, but twill have somewhat more time than the other common proof: there are also other wayes to fuch proofs, as follows.

CHAP. XVIII.

To prove Goldish-Silver by the Water-weight.



MUST further fignify, That the old section. Artists have also proved the Silvers First way. through common flowing Water, and known in the Weight, whether they have been rich or poor with Gold, This their Invention, because it proceedeth from natural Reason, doth please me, and

is an inductive Meditation to many other serviceable things: Now the Water-weighing with the Silver is done thus, Take a Ballance, and put in one of the scales

CHAP. the Goldish-filver, and in the other Scale so much Silver, XVIII (which containeth no Gold) as that they may be equal weight, then let down both scales just together into a Vessel full of clean water, so you shall find and see clearly that that Silver which is Goldish shall have in the water greater weight, but not so much as the Silver which hath Gold with it. The Reason of this Difference, is because the Gold in a like greatness excelleth all other Metals in weight, and is the heaviest Metal; Therefore fuch (as every one himself may judge) cannot swim so eafily in the water, but must much sooner fink down on the ground, than they which are lighter: as the like is to be feen in the Lead, which goeth much before Tin and other Metals in the Water.

Section. But that I may give the Reader to understand, That How the Goldin to be, 'tis possibly by such Water-weighing to reckon how the Water_ much may properly be in the Silver, therefore know that fuch (in my thoughts) may be done and found out

in this following manner.

First, Take fine grain'd Silver which is without Gold, lay to it good pure Gold, put it in one of the weighscales, and in the other Scale lay fine grain'd filver also, fo that it standeth just even: then fink both together in the water, and fo much as the Silver goeth before with the Gold, so much you must supply with good Gold to the weigh-Scale in the vvater, then take the Ballance out of the water again, dry it well, and weigh it, and take so much from the Silver as the Gold hath drawn to it in the water, until the Ballance standeth eyen in *Equilibrio*, then fink it in the Water again, and fupply again the difference with good Gold, and then take off from the Silver; this do as long until both weigh-scales stand just (both within and out of the water) then you shall find that in one scale will lye so much Gold as in the other: and by this way (if you do

it carefully) you may also prove in weighing a goldish CHAP.

filver, whose content you did not know.

Secondly, The water-weighing may also be done by section. Arithmetical Proportions, to which the Demonstrations Arithmet will be ferviceable, but they are not to every one known, namely thus, That if the Gold (as I have tryed it) weigheth against the filver in a like quantity 405 Marks, and 8 Loths, and the fine filver also the like quantity with the Gold two hundred twenty fev'n Marks, 4 Lotbs; this observe well, Then take the silver vyhich contains Gold, lay it in one of the meight-scales, and weigh it against the Weights which are made of pure silver, that you may know the weight to be proper, then fink them together into the water: now, as much as it dothgo for the Goldish silver, so much you must supply of with the filver weights, then make an account and observe the Proportions how the Gold and Silver stand together, as you have been instructed before, and I doubt not but you may come to a right proof by this Example.

CHAP, XIX.

To find without such water-Proof, whether Silver contains Gold.

> ECAUSE the Metals have diversQuantities of like greatness, one against the First Way. other (as has been spoken of the Gold and filver) if then you would know and finde the difference of the mixture in the Goldish silvers you must draw the Gold

through an Iron plate wherein an hole is made, into which a thin and fubtil wyer is to be put, and do the

CHAP. the good filver also through the same hole, then cut a XIX. piece of both, equally in one length as near as possible, and weigh one against the other with a Proof-weight, upon a quick Ballance, and so you will soon finde the difference betwixt the Gold and Silver. Now, if you have a Goldish-silver, and do draw it through the mentioned hole, and doth take the right length of it, like the aforesaid former Wyer, and doth weigh it likewise upon the proof-Ballance against the silver-Wyer, then you will finde a difference in the weight, out of which you may count the weight of the Gold (as much as is in the wyers which you have weighed) then also weigh such with the proof - weight, how much it weigheth, and you may compute (after this thy Account) how much Gold is in the whole weight of the Goldish-silver.

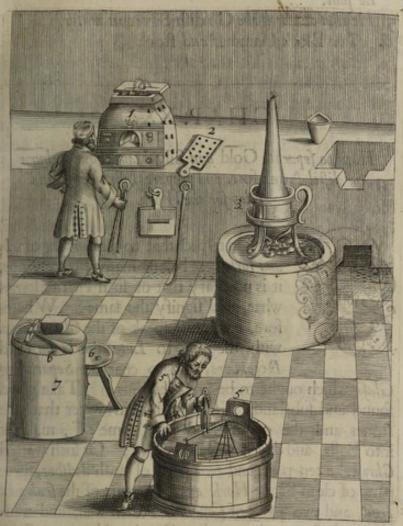
After this manner all other *Metals* may also be proved and accounted, because they have one against the other divers Quantities in like Greatness: likewise in the coyn'd Money, if it be drawn to a Wyer (in the same thickness with the Wyers before mentioned) you may find in it the Copper and fine silver by this Rule.

Also, this I would not leave unmentioned, as an Instruction for further Consideration, and it is necessary to be known, That there is a difference in weight, betwixt Tin and Lead, if they be mixed together, as also in other Metals, which I have found in my diligent searching; For, one Copper against another, and one Tin against another, hath a difference also in the weight, else I would have proceeded further and surer with such reckoning.

Section.

2.
The second
Way.

CHAP.



Deciphered White Annual Property

- 1. How the Assayer stands before the Assay-Oven to prove Metals.
- 2. The Iron on which the Proof is to be cast.

 3. A wooden Instrument to see through into the fire to prevent hurt to the Eyes.

Rr

4. A

CHAP. 4. A separating Glass for proving Gold, placed on a lit-

tle foot. wright. He that matheth the Goldish Silver in water.

6. The Block, Hammer and stool.

CHAP. XX.

How to separate Gold and Silver, and how to burn or distil Aqua fort. and prepare Instruments and Clay for the Work.

Section.

OW, in respect that to the Burning of A-qua fort. there belong many Preparations, it is necessary that of such I write somewhat, and signify the same: Wherefore, I will first speak of the Clay wherewith they use to Lute the Helms and Receivers, and to coat the Separating

Glass which ought to be prepared thus; Take good found and substantial Clay, wash it in water that the ftones and the course fand may come off, make it into Balls, and dry it well in the Sun; Of fuch wash'd Clay take ten parts, and two parts of wash'd Asbes, three parts of clean Stone-Horse-dung, one part of the scales of Iron, and two parts of Cow-hair beaten well, and mingle all these together, and moisten it with warm Oxen or sheeps-blood, and whilst it is warm, work it with an iron Instrument: one might also take, among this Clay, Venetian Glass beaten small, but not too much: and with this Clay one may lute-over the separating Glasses and the great Glasses, in which the Aqua fort. is to be distilled, fuch as will hold in the fire: it may also serve to joyn together the Ovens which are called Athanors, bebecause it holdeth fast, and doth neither break nor CHAP.

But the Clay and thin mixture with which one useth Section. to lute over the Joynts of the Helmets and Receivers, is Tolate the is to be made thus, Take the white of Eggs, as many as joynings. you think fit, beat them well, in a Penter dish, and take a clean spunge, and press the clear of the Eggs into it, by squeeling it out of the spunge into the dish, and do this until it becometh clear like Well-water, then take Milldust, 4 Loths, Bole Armoniak, one Loth, white dryed Cheese without Crust or rind, two Loths, and of Sanguis Draconis, one Loth; Grind all these very small, and fift them through a hair Seeve, mingle these with the whites of the Eggs, and with it, Lute over the foynts, which you must understand thus, That such Joynings be first with the above-mentioned Clay luted over and dryed well again, then this thin mixture is to be put upon a little cloth and laid over it, and let it dry of it felf, but this ought to be done before you bring it into the warmth, or makest a fire to it, then such mixture will hold faft, and the spirits will not go through, but if the Joynings should afterwards let the spirits go out, then do it over in the heat with Tallow, vvhereby the Clay will become bard and fast.

Here followeth another Clay wherewith to lute or Another glaze-over the Culbs or bottles, which will endure the fire, bodies, Take a good wash'd dry Clay, a little Dragons blood and Bole Armoniak, and add to it a third part of Potters clay, & a third part of a half part of Calx vive, make each apart into Pouder, and moisten it with the white of Eggs, as is taught above, or with warm Oxor Sheeps-blood, add to it fo much flox of woollen Cloth or wooll shav'd or shorn, as of the Bolus, mingle all well together with a stick or wand, and with it lute over the Glasses, but not thick, also lute over the joynts with it, and this vvill

hold

CHAP. hold fast in the fire. Likevvise other Clays are to be XX. used to lute-over, which do also hold well: But because these now mentioned do suffice, I have omitted for brevity sake to set down others: therefore every one may try which are the most serviceable unto him.

Section.

4.
Venetian
Glass.

The Glasses or Bottles in which one useth to separate, and in which they put Aqua fort. are to be made of good Venetian Glass, of an equal thickness in the midst, for if they be made too strong or thick of Glass, they will not hold well, but they which have a right equal thickness, and are not strong will endure the fire the better, but if the Glasses be made of other Glass, then the Aqua fort. will work on them, and they are subject to break the sooner, by which there cometh dammage, and they will be also dark and pale

they will be also dark and pale.

To prepare Jugs and Retorts with Jawduft,

25

One may also cause Juggs of Potters-work to be made for Distilling Aqua fort. or mixing Clay with Bran or clean fine Samdust, this therefore is done, That when the Juggs are made and burnt raw, that the Bran or Saw-dust may burn out, and then to glaze such over with Venetian glass within and without, that the Glass flow into the boles, out of which the Bran and Sawduft is burnt away, whereby they will prove very firm and hold very well in the fire, of fuch stuff very good Retorts are made, which will not break in the fire, but are much better to use than the over-luted Glass bottles, therefore such stuff is very convenient to use for Retorts: But how great the Juggs, Glasses or Bottles must be, I conceive, that every ones Work will teach what he may make according to it, for if one hath much Aqua fort. to burn at once, then it will require a great Jug or Retort for it, in which the stuff is to be put, and also the Recipient must be the bigger.

Also tis in use to burn Aqua fort.in Iron Jugs which are of two pieces, and can be done asunder, whose form

you

you will see in the next Sculpture. In such a Jug one Chap, may set in more at one time than in a glass-bottle; also XX. they need not fear the breaking of such Jugs, or that the stuff will be spoiled in it; and the Gold hath been of a better colour by such Aqua fort, made in Iron.

For this and other Reasons, I judge it to be better alwayes to burn Aqua fort. in such Iron Jugs, than in glaz'd Bottles, which can but once be used, the bigness of which must be as one may put in near 20 pounds of stuff at once, but if one would burn less, the Opportunity will shew it self, how to proportion it, but for strength it must be the thickness of a singer, so it will endure the longer.

If now one will burn Aqua fort. in such Jugs then section. must the joynings be well luted over, that no spirits may Luting the go out, lute over also the Jug without, with thin Clay, Jug. that the sire may the less hurt it, and lay before it a Recipient of Glass, but of such a bigness that the mentioned spirits may have room enough in it, and that such may not break out of necessity or force, by which there will be dammage.

After the vvork is finished then must the Jug be suffer to gain the red to cool, and put water in it, then will it mollify Caput mort the Caput Mort. put it out gently with an Iron, and so Jug. the Jug will become clean again.

The form and likeness of such separating Glasses and earthen Juggs you may see in the following Sculpture, thus

Deciphered.

- I. A luted glass bottle covered with an Helm.
- 2. A luted glass-bottle without an Helm.
- 3. Another fort of Glass-bottle.
- 4. The Form of an Helm.
- 5. An half Glass, or half * Pipkin with one Ear, and a * Abfuzchal Month.

The Second Book

CHAP. 6. A Receiver with a Pipe.

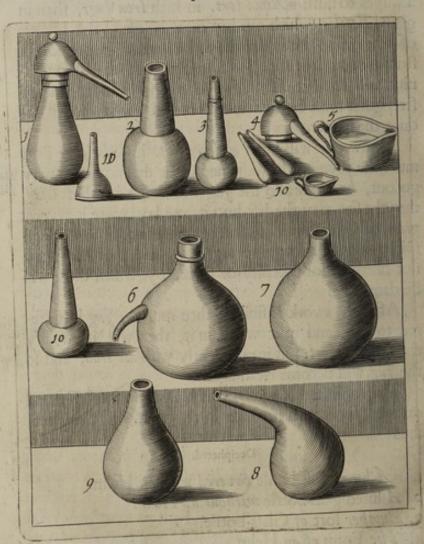
XX. 7. A Receiver without a Pipe.

8. An earthen Retort.

9. An earthen Jug or Culb to burn Aqua fort.

10. Other kind of Bottles, Glasses, half-Glasses, Tunnels:

Sculpture XX.



CHAP. XXI.

How to make Ovens to Distill Aqua Fort:

VERY one useth to prepare the Ovens to the distilling of Aqua Fort. according to his pleasure: But there is one Form much better, and more profitable than the other (as I have feen and used many

Section.

my felf) for I finde, That the Ovens called Athanors, which, as in the following Sculpture is Athanors, properly delineated, are the best to be used to distil Aqua fort. and they are to be formed thus, Make a Steeple in square or round four Ells high, and below in it lay an Iron Grate, under which must be a Wind-hole, according to the demonstration in the next Sculpture: and then make again on both fides of the steeple, in the fame wideness, according to the height of the Juggs or Glass-bottles round or square Ovens, in which the Glasses or Juggs may stand: Put also below in the steeple or tower, Iron-Grates, so that it may have mind-boles below: in fuch By-Ovens must be left holes from the Tower, that the heat (as you shall hear) may come out of it, and if they are about a large span wide, and four fingers and a span high, then are they wide and high enough: only observe, That when you do set up the high Tower, you do not make it two thick near to the boles, but rather narrower, that the fire or heat may go the better into the By-Ovens, then cause to such holes, through which the heat doth pass, fit Instruments of Potters-work, with which you may govern the fire as you please.

Some

CHAP.

Some cause such Instruments or Registers to be made XXI. of strong Iron, but they are not so good as the earthen, for, if the Iron one become hot and glowing, then they give likewise great heat, and if they are drawn before the fire, then they cannot well be managed or govern'd

by it, and there is also danger therein.

Further, you must also have to every By-Oven (in which you let the Jugs or Glass-Bottles) covers made of Earth or Potters-clay, which must be cut out also, that they close just on the neck of the Jug or Glass-Bottle, and that the Ovens may be thut very close, and leave Air-holes through it (being called Registers) and have Pins of Wood which go in very close to govern the Fire by it, as you may fee in the eighth figure of the next Sculpture. Likewise upon the Tower a cover is to be set, which must be so large that it may cover all the upper holes of the Tower; and so is the Oven or Athanor prepared to distil the Aqua fort. But how it should be governed with the Wind-holes followeth hereafter in the next Sculpture

Deciphered.

I. The Athanor.

2. The Mouth-hole over the Grate.

3. The Mouth-hole under the Grate. 4. The Grates in the By-Oyens.

5. The By-Ovens.

6. Instruments to open or shut the By-Ovens Mouth.

7. A Cover for the By-Oven.

8. The Pins for the Registers or Wind holes.

9. A Semicircle piece of Wood by which the Athanor is to be made round.

10. The Cover for the Athanor.

11. The person that tends them.

12. A dish of Metals to be used.

Sculpture.

Sculpture XXI.

CHAP. IIXX



CHAP, XXII.

How the Ingredients are to be prepared for distilling of the Aqua fort.



OR distilling of the common Aqua fort. Section. there are used only two Ingredients, Nitre and Vitriol, which must be prepared Calcining of before they are put in: first, the Vitriol must be calcined which is to be done thus, Take at once four pound of those Ingredients Tt

Calcining of

CHAP, dients, and put them in an earthen glazed Crucible, fet XXIII. it over the fire, that the Vitriol may melt to a water, let it boil gently, and ftir it about continually with a wooden spatula, until the wateriness be evaporated away, and the Vitriol begins to be thick, then take with the wooden spatula, some part out of the Crucible while it is warm, and grind it upon a Grinding-stone before it be cold, then take more out of the Crucible, upon the Grindingstone until all the Vitriol is out of the Crucible and ground small, for if you do not take the Vitriol warm out of the Crucible, but lettest it be cold in it, then it will become as hard as a stone, and so its difficult to be brought out, neither is it easy to grind: Thus the Vitriol is to be prepared for the distilling of the Aqua fort.

Concerning the Nitre, it needs not be calcin'd, yet Salt-Petre. one may fet it upon a Oven that it may be dry, and then beat and grind it fine and fmall, then is it also prepared: But because it is not all pure, but some part of it is very Salt, therefore it is first to be clarified and purified from its Salt (which every one who converfeth with Distillation of Aqua fort. certainly should know) and that with the hand: But how the clearing should be done, see full Instruction in the first Book.

CHAP. XXIII.

How Aqua fortis is to be distilled.

In a Glafs

AKE four pound of clean Nitre, and three pound and a half of calcin'd Vitriol (as is mentioned) grind them very small, and put them in an over-luted Glass-body (brush'd with an Hares-foot bound to a little stick) the neck of the Bottles

Bortles being taken off, that the water may go clean CHAP. over, and not have cause to ascend, when then the stuff XXIII. is put into the Bottle or Jugg, then put it in one of the By-Ovens, on the Grate (with a Copel made for it on purpose) and lay upon the By-Oven a Cake made of Earth or Clay, and daub it close about the neck of the Jug, and over-lute the joynings every where with the Clay very well, that no heat or vapours may go out of it, and let the Air holes on the side be open (as you fee in the former Sculpture) yet not too wide (for if they are open near three fingers wide, then 'tis wide enough:) But you must not put the Bottle (as now 'tis mention- section. ed) naked into the Oven upon the Iron-grate, as you copeis to do with the Iron Jug, but in a small earthen Test (made barn Aqua on purpose) which hath below a little Foot which is called a Coppel: and in this put ashes or clean Sand, that the Glass Bottle may come to stand a good square hand above the Grate: when you have put in the Stuff fet an Helm upon it, and dawb the Joynings very well over with the Clay, which you have prepared.

But some have another way, viz. When the Bottle is put in, then they lay round about the Neck good pre- Another pared Clay, and over the Clay they lay Paper, so that the "19. Helmmay not quite stand on the Clay, and this is done for this Reason, that the Helm, (after the distilling) may loosen it self clean; and then they do set upon it the Helm, and lute it over with good Clay; and lastly, apply the thin stuff upon a little Cloth, that no spirits at all

may go out.

You ought also to prepare the By-Oven, and likewise water in the Jug or Bottle with the Helm fet in Order, that the the Receimouth of the Helmet may go out a pretty distance over ". the Oven, then lay before it the Receiver, that the mouth of the Helm may well reach into it, that you may fee how the water doth go, and the drops fall.

CHAP.

And that you may also know how much the Vitriol hath loft of its weight; first, in the Calcining, you must put sweet or flowing Water in the Receiver, else the Water will be too strong, and very little water will remain, also lute all very well over the Joynings on the Receiver and Helm, thus, Take some of the prepard Clay, and lay it about the Joynings, then put in the Clay (through the joynings, in the Receiver) with a little smooth sprig of a Broom) which will do this Service, that the first and gross spirits (as you shall hear hereafter) may come through it; then upon the Clay lay a little Cloth, as abovefaid, that the Joynings may every where be luted-over, and let it be dry: Thus also you may fet into the Oven, the Jugs with the stuff on both sides the Athanor, and with one fire burn and make perfect two or three works, and mannage every one according to its necessity without hindrance to the other, of giving or taking heat, as hereafter somwhat more may follow.

CHAP. XXIV.

How Aqua fortis is to be distilled in an Iron Jug or Pot.

Of Pags caft

UT if you will put the stuff in an Iron Jug, which is cast or hammered, and distill Aqua fort. in it, then put the Jug withits short feet, upon an Iron Grate or Roafter, that it may stand firm and fast, but if the Jug hath no legs, then it must stand upon a three-legg'd Iron, proportioned to the Jug,

and before you do put the Helm on it, first place upon the Jugs neck an old broken neck of a glass Bottle, and then then put the Helm upon it, so the Helm will remain CHAP. whole in taking off: But if you have not a glazed Neck XXIV. (as is faid) then lute the Jug's neck round about with the prepared Clay, and lay over the Clay a Paper (as abovefaid) upon the Helm, and over lute it the best you can, then the Helm will go from it the better.

When you have let into the Athanor the stuff with the Fug, and all the over-luting is well dryed, then put fame, into the Tower of the Athanor, live Coals upon the fame, with other dead Coals; fo that the Tower may be full to the top; then cover the Tower with a thick Cover made of Potters-Earth, but you must lay Ashes upon the Tower half an hand thick, and fo fit the Cover, that no vapor at all may goe out, and let the wind-hole below, on the Athanor, be open which is mark'd in the beforefaid Sculpture, with Figure 3: and thut the windboles of the By-ovens, and the Month-hole of the Athanor very close, mark'd with the figure 2. and draw it not open too foon with the Instruments noted at Figure 6.

But, when the Aqua fort. doth begin to go, then of govern open but one wind-bole, and, if it will not go well, then ing the Adraw the Instruments a little nearer to the Tower, to the heat will go through the same space, under the Jug or Bottle which is let in, and in which the Ingredients are, and presently, the water will begin to run better.

Now, if it thus proceeds, then a Vapour will come into of diposing the Receiver (these are the gross spirits) then let them the gross spirits, go out through the little Pin of Wood near the Lymbeck of the Helm, then stick it in again, and lute it over the best way you can, that no more spirits may go out, and when the drops fall into the Receiver to five or fix, to the water will go in the beginning from the calcination fluff, with which governing, shutting and opening of the Instruments, you may alwayes keep the Oven in order that the water may go well. But when you put the ftuff

ram

CHAP. raw, uncalcined in; then you must do it very gently in XXIV. the beginning, that the drops may fall in, to 15 and 16, &c. But tisa tedious and long while in distilling, and there can no more water be had than of the calcined fluff, therefore it is always first to be calcined, and when from the calcin'd stuff, the drops are fallen one or two hours to 5, 6 and 7 drops, then you may draw a little more with the Instruments which are between the Athanor and By-Ovens, and then the heat will be stronger, and

the Drops will fall faster.

Now, when the Drops come but to two and three, When doth it goeth too hot: then with the mentioned Instrument So 100 bot. Thut the under wind-hole again, very close: whereby they will go flower again, for in too hot going there is danger, that the stuff should ascend, and dash all in pieces (whereby cometh Dammage) and although the calcined stuff doth not eafily ascend, yet it may so happen in going

on (especially if the Jugg be filled too much with the (Inff.)

And know that You must number the drops according as one beateth with a hammer or fift, or keepeth a be conneed. tact or time as in Musick: viz. as many common stroaks as can be done betweet the drops, may be 4, or 5, or more, they are to be called fireaks, therefore govern the fire also in an equal heat, untill the water come almost over, and the Helm and Receiver become Cherry-

brown.

Then you must strengthen the fire with opening of the To force the Instruments while the Spirits go through the Limbeck or Nofel of the Helm and Receiver of the water, by which the Helm and Receiver (as is faid) becomes brown. Then haften not with the forcing of the fire, till at last, when the spirit is gone an hour to fix or more, according to the quantity of the stuff, and the Receiver be no more so brown, then open the Wind-holes markd with

Section.

How the

the figure 8. and lay in the same holes under the Jug CHAP. or Bottle) small split Wood, and force it with the XXV. fierceness of the slame, that the rest of the spirits may come over, and that all strength may come into the water, so as the Helm and Receiver become white again, and that also the Jug or Bottle which is put in, may glow near an hour well with the Caput mort. so that which remaineth behind in the Jug or glass, may have no more sharpness in it but become dry and of a reddish Brown.

When the Aqua fort. is thus distilled, then let the Atbanor be opened and cool well, and lay over (above the neck of the Helmet, where it is luted) a wet cloth, also near the Lymbeck of the Helm over the Receiver, mollifying the overluted hard Clay well, that it may sedion. go off, that you may not break the Limbeck of the Helm, The Glass which that you may not break the Limbeck of the Helm, the Glass which that you have good Aqua fort.

You may also be instructed, That when you are dissilling of Aqua fort and that the Coals in the Atbanor are almost gone out (which happens hardly in 10 or 11 hours) then lift up the Cover from the Atbanor, make it sull again with Coals and cover it, else the Fire will go out, and all will be cold, as Oportunity it self will teach thee and make thee to remember.

CHAP. XXV.

How to distil Aqua fort. in 4, or 5 Hours.

F one in haste would distil Aqua fort, and cannot have such an Athanor, then must be made a little Oven on a wall three quarters of an Ell square, and two Ells high, and put in it an Iron-Grate. so that below there may remain a Windbole,

Section.

CHAP. hole, and on this little Oven make another little Oven, in which may be put the Jug with the stuff, cause an Hole to go out of the Oven, which is let first into the By-Oven, lay also a Grate in it, as you have done in the Athanor, and you may in stead of the earthen Instrument before noted with Figure 1. use a smooth Pan-tile, and it will do the fame thing: or, if you will not spend so much time about an Oven, then make but one square Oven, which hath a grate below, and under it a windebole, in which you may fet the Jug or Bottle with the stuff, take then of the above-mentioned stuff four pound of Nitre, and three pound and an half of calcined Vitriol; Grind both very small, and among it put fix pound of Calx viva, and let all be well mingled together (but put not so much water in the Receiver, as above is taught.)

Now therefore, when all things are well luted over, and become dry, then make a fire under it, and let the water go ftrong over it, so that at all times the water and spirit may come over together, and because the stuff is mingled with Calx viva, therefore you need not take care for running over, then strengthen the fire immediately untill the water and spirits are come

over.

And lastly, the stuff in the Jug will glow so well through this Labour, that you may distil in 5 or 6 hours an Aqua fort. to which else you must have 24 hours, but you will have but little water, yet twill be very good to use for Separation.

CHAP.

CHAP. XXVI.

Another good way to diftil Aqua fort.

O use uncalcind Vitriol for Aqua fort. Section. it must be dryed in the Sun till it be To Me unwhite, then take thereof four pound, and triol, two pound of Salt-Petre, beat it small, mingle it together, and fet it in the Oven (as is done with the first stuff) put

no fweet or clear water into the Receiver: this also yields good Aqua fort. only you must (as abovesaid) do very gently ingoing on, that the stuff may not run over:

Take to such Aqua fort. good Hungarian or Goslarish Hungarian, Vitriol, or which is boyled out of a flint, and of a fine Goffaran Vitriol, or and high colour, and not of fuch Vitriol of which Alum such as is is made, for the pale Alumish Vitriols do not yield fines. good strong Aqua fort. Some take also one part of Copper water, and burn Alum among their Additions, which is left to every ones freedom. This only is needful to be mentioned, That if one take much Vitriol among the stuff, such Aqua fort. which cometh out of it, doth very well work in separating, and gives much brown spirit, nor do they improve in the separation, as other Aqua fort. for they hold not fast on in leparation.

Likewise some take to their Aqua fort, four pound of Anther Nitre and as much Vitriol, which of the two is the best, "". you may (like my felf and others) learn by Experience.

CHAP.

CHAP, XXVII.

How to make an Excellent strong Aqua fort.

Section.

1.
The Ingredients.

OU must, for the making of strong Aqua fort. Take three pound of calcined Vitriol, 3 pound of Nitre, one pound of burnt Bruxish Alum, out of Belgia, and two pound of burnt slints; burn these to a mater, the sust mater let go, until the

Helm begins to be colored, cast it away, lay the Recipient again before it, and lute it all over vyell again, and let the other vvaters go over (as I have taught above) at last, force all the spirits over vvith a strong fire : this water keep in a good Vessel, and put to it, in an overluted glass Bottle, 6 Loths of Nitre, 4 Loths of Vitriol, and tvvo Loths of burnt flints, and one Loth of Verdigreafe, and one Loth of roasted Antimony, and one Loth of filed Iron, and half a pound of white Lead, and let all these be beaten to small pouder, and put upon it, of the Water now distill'd, a little and a little at a time (for it useth to make a Noise until 'tis all put in) then cover it very vvell, let it stand some dayes in a Celler, and stir it every day tvvice, then set it in and distill it as an Aqua fort. only that the Helm may foon come upon it, and let it go as long as tvvill go, for it vvill begin of its ovvn accord to go; then give it very gentle fire, and dravv it most gently over so long till all the water is brought over, then augment the fire, the fiercer the better, until the spirits with great heat are all come over, (which hardly is done in two dayes and two nights) like as you have done before with the Aqua fort. then let the Oven be cool, and take of the Aqua fort. and cleanse it from the feces, and preserve it in a found Vessel which CHAP. holdeth well, for 'tis an exceeding strong water, and XXVIII. use it.

Some will fay of this Water, That by it somewhat more of Gold, in the Separation, is to be obtain'd, than More Gold by common Aqua fort. Experience will manifest it; for by this way. my part, I believe it not: and for fuch Hopes without ground, I was neither willing to expect, nor to try in distilling.

You may also be instructed, That to this Water you had need of a great Recipient, wherein the spirits may A Linte up have room; and, if you will take off the Recipient, spirits do not work. and lay it before again, then you may lute over the foynings with lute made of two parts Clay, and one part of Quick lime, and moistned with Bupe Oyl, and lute it : finsted fuch a Clay the spirits do not touch, but the other which is used, by some, to lute with, they touch, and thereby are made alwayes leaky, and never holds well.

CHAP. XXVIII.

How to distil an Aqua fortis, called Aqua Regis, which dissolveth Gold, Copper, Iron, Lead and Tin; also Mercury sublimate and Arsnick.

> ROVIDE good Aqua fort. which is distilled only from Salt-Petre and Vitriol, and purified with Silver from its dregs and faces, and in which one may dissolve Silver as necessity requires, put it into a found well luted glass Bottle or

Culb, and add 8 Loths of melted Salt, which Salt in flowing must not run over, but as soon as it floweth must be put out, that it may remain in its strength and virtue,

CHAP. Virtue, and only come off from the flegm or superfluXXVIII. ous moisture; now, as soon as the Salt comes in it, then
lay the luted glass Bottle with the Aqua fort. and Salt
side-wayes in the Oven in which one useth to distil Aqua
fort. but thus, That you may lay to the Bottle the
Recipient also, and lute it well, then it will soon begin
to go off, by its own Virtue, then draw the flegm over
with a small fire, and strengthening the fire more and
more, at last force the spirits to come over, as is usual
in distilling the Aqua fort. and you must drive the spirits
section.

Then you may finde that by this way of distilling by degrees, there will be a fine yellow and stronger water, because the spirits will not ascend too high, (as over the Alembeck:) But it requires good diligence and observation to prevent the water from running over: This Aqua Regis when its thus burnt, may presently be used,

and hath no need to be purified from its feces.

But how to distil it by degrees you may see in the following Sculpture, thus

Deciphered,

1. The Tower of the Athanor, in which the Coals are to be put.

2. The Oven in which the Bottle is to be plac'd.

3. How the Bottle is to ly in the Oven.

4. The Glassy Helmet, made for it.

The Recipient or Receiver.
 The Pot full of Materials prepared.

7. The empty Pot.

8. The Person that tends the Athanor and By-Ovens.

Sculpture

Sculpture XXII.

CHAP.



CHAP. XXIX.

To distil Aqua fort. in Retorts with other Advantages.

no old Invention, and no long Labour, but a fhort way; if Retorts may be had which are made of one piece, and will hold Aqua fort. and Oyl; then lute such over with good and found Clay, let it be well dry, put in it the Ingredients or stuff, which shall be calcin'd and mingled with Calx viva, and lay the Retort in an Oven made on purpose (whose Description shall follow hereafter) and fill a Receiver with water before it, then make a fire in the Oven (and speedi-

Section

CHAP. XXIX. Section. Calx viva binders the

ranning over

For want of

a Receiver.

ly increase it) then the stuff, because it is mingled with Calx viva, will not run fo foon over, because the spirits and water are to go over together, at last force the spirits with Fire, so that the Retort may glow bright, near two hours, at least: In such a Retort you may distill the Aqua fort. in 5 or 6 hours, but it will not yield fo much water as through the Alimbeck, but it will be strong and good for use.

If you cannot have a great Receiver (as it often happens) to the distilling of the Aqua fort. then take a great Waldenburgish Ing, or one made of the like Clay, (that it may hold Aqua fort. lay that before as a Receiver, and make the Process, as now is signified, such an one I esteem better to the distilling of Aqua fort. in Retorts, than

in a glazed Receiver.

But when you will use it (in stead of the glazed Receivers to lay before the Jug and Helm) then you must have a neck of a glass Bottle: Lute it well over in the Fug, so that the Neck may reach out of the Fug near a Span, in the same Neck lay the noffel of the Helm, and lute it also well over, so you may see in the neck of the glass Bottle, how the drops do fall, and govern the fire accordingly.

Glaft.

Some who diftil Aqua fort. do make (on purpose Earthen Receivers with for the Receiver) great Jugs with great Bellies, of good and folid Clay, fo that near the Jug's neck, are to be cut in it fquare holes, then they fit to it fquare Glaffes of good Venetian Glass, and then they lute over the Jugg with a thin Clay made of Varnish and Bole Armoniack, and cause it to be dryed well, and when they will lay the Jug before, then they place the Glasses to the Jug and Noffel of the Helm, fo that they may fee the drops fall well, and that they may govern the fire as it should be.

To fit the glass spouts

Also it often comes to pals, that the Helms have not alwayes

always right spouts, they are either too high or too low: CHAP. Now, these you may make your self, as followeth, XXIX. viz. flake a Coal-fire upon a Test, hold the spout so as that it may be only warm, then nearer and nearer; at last, lay it on the glowing Coals, and the nofel will glow, then bow it in the fire, as you wouldst have it, but you must not take it so quickly out of the fire again, left it break in pieces, according to this way others are to be bent and fitted like Pellicans.

I have taught before, how the Ovens are to be made and prepared in which Aqua fort. is to be distilled: if it Tyla Bynow should happen, that one would at once resolve to Athaner. diffil more than two at a time: then for such the Athanor must be made somewhat greater and larger than for others, but not much, yet may ferve three or four By-Ovens, which are to be governed with one fire, only the Instruments which in other Athanors are drawn on the fides, in this must be drawn upwards, and hang them on the wall by nails, as the following Sculpture doth

Besides this, one may make another Oven to distill dustilents Quantities, in which four or more Jugs may be fet in length one after another: fo that the Oven standeth free, and you may alwayes come to lay one Receiver on one fide, and also another on the other fide; for this Realon, not only that it may not hinder one the other, but also that on the backfide under every Jug may be laid wood, and that the spirits may be forced strongly.

Besides, such an Oven must have on the lowest part but one hole, in which the fire upon a grate is to be stored with wood, and under the grate one wind - bole more, and the same must not be opened, till the water is almost over, that one may strengthen the heat; likewife on the upper part, as on the head must be placed

CHAP. wind-hole, that the fire may have its draught in the

XXIX. length.

If then you would distill Aqua fort. in such an Oven, then first calcine, and prepare the stuff afterwards; put it into the Jugs, and the first Jugg which stands next the sire mingle with Calx, then there will not be so much danger, that the stuff will run over: After this, when the water is almost over, then open the mind-boles, which are alwaies to be behind by the Jugs, and force the spirits over, according to every stuffs necessity, by this you will have also good Aqua fort. and maist distil much of it at once, but how the Oven is to be formed you may see at the sigure 7. in the next Sculpture.

But to return to the Aqua fort. I find it necessary to mention, That some conceive, if they have too strong Aqua fort, they will go as far in separating one Mark, as of two Marks with weak Aqua fort. which cannot be: the Reason is, that though the strong Aqua fort is do touch strongly, yet it cannot take more Silver to it self, than the Aqua fort. hath wetnes: I say then, That an Aqua fort. which is of a middle strength, and made of good stuff doth more in separating according to its worth, than a very strong water, for the weak water endures longer in the operation, on the contrary the very strong water consumeth away suddenly, and leaveth

off the fooner. The following Sculpture

Deciphered.

1. The Tower of the Athanor.

2. The two sides or By-ovens in which the Jugs are to be set, with the Stuff. 2.2.

3. The Glass Receivers. 3. 3.

4. The earthen Jug or Receiver.

5. The Oven for the Retorts.

6. The little Receivers to be added to the great Recei-

ver,

Strong and weak Aqua fort.

D'

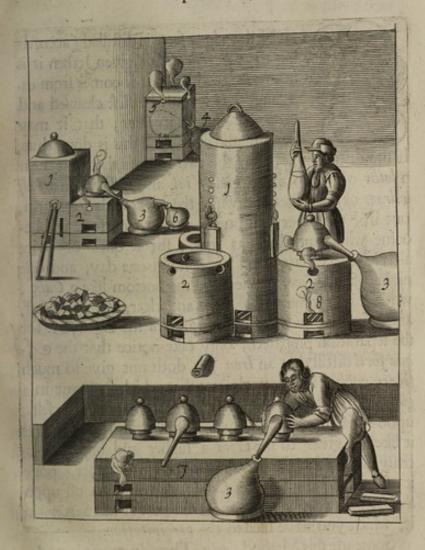
Of Gold Oars.

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CHAP.

ver, that there may be room for drawing the Spirits.
7. The Long Oven.
8. The By-Ovens, by which the spirits are to be forcid into the Aqua sort.

Sculpture XXIII.



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CHAP.

CHAP. XXX.

CHAP. XXX.

How Aqua fort. is to be separated and cleansed from its Feces.

Section. The way.

HEN the Aqua fort. is distilled, (according to the Instruction given) then it is not to be used raw, as it comes from distilling, but it must be first cleansed and precipitated from its feces; that it may be pure and clear, and this is done thus,

If the distilled Aqua fort. be two pounds, then put near 2 loths of it into a little glass Vial, and dissolve in it half a dram of fine filver, and while the Solution is yet warm, put in, the other new burnt Aqua fort. so it will become white and thick as milk, ftir it once or twice a day, every day, then let it stand one day, and one night till the feces do fettle in the bottom like a Calx, when it is become wholy clean and clear, then put it off, and you have purified or precipitated the Aquafort. for the separation prepared; only take notice that the Aqua fort. distill'd in an Iron Jug. doth not give so much feces, neither is it so unclean as that which is burnt in a glass Bottle, because the Iron-Jug is a Metal of it self, upon which the Aqua fort. doth partly purify it self, and it likewise gives to the Gold a higher and finer colour than the other: Keep the feces clean together, pour it off, enter them into the Lead, and let it go off upon a Copel, so you will find the most part of the Silver in it, which you have used to the precipitation.

Some use this Method, viz. They do precipitate the To bring the new distilled Aqua fort. with Hungarian or Bobemish Pence, or fuch like Money, which to the separating is

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all

all one, only the Aqua fort. remains not fo clear, fine GHAP. and white, but because there is Copper in it, therefore XXXI. the Aqua fort. becomes a little green: for this Reason, this Aqua fort. lettled with Coppery Money cannot be used to the Gold-Proof, for the Copper which is in the water (ticks rather to the Gold Cala than to the Silver, and then 'tis not eafily wash'd off so clean : which is prejudicial to the Proof: but, if after the first fetling, the Aqua fort. be unclean, then you may lettle it once more, and then use it to Separate or prove Gold, according to your plealure.

CHAP. XXXI.

How weak Aqua fort is to be made stronger.

F it should be neglected in the distilling of the Aqua fort as easily may be done, To Prepare when the Joynings are not well luted over, to that the water will become too weak, and in the separating will not touch the Silver: fuch weak waters may

be made stronger by two wayes: First, set in again a new stuff of Nitre, and calcined Vitriol, and put the weak Aqua fort. in the Receiver before it, and distil the stuff: after this make the spirits to go well over, so the Aqua fort. will become stronger, that it may be used well and fafely in leparations.

The other way is shorter: thus, Set the weak Aqua fort. Second proin a glass Bottle or Culb, which must be luted over upon a Coal fire, heat it till it begin to boil, then the waterinels of it will boil off, which you may often prove while it is boyling, whether the water do become strong enough. Or, fet the weak Aqua fort. in a Bottle, which is luted

Section.

the flegm.

CHAP. over in the Athanor, or in another Oven, (in which one XXXII. useth to burn Aqua fort.) and put an Helm upon it, and draw off from it the Flegm or superstuous wateriness, until the Helm begins to be brown, so the weak Aqua fort. will become stronger and is sit for use.

The Flegm which is drawn off you may retain, for if you do distil another Aqua fort. then you may use it in the Receiver again, for this flegm is much better than

common vvater.

CHAP, XXXII.

How Gold and Silver in the Aqua fort. is to be feparated.

The Pres

O separate Gold from Goldish Silver in the Aqua fort. Knovv that the Silver must first be burnt clean upon a Test, then cast it into an Ingot, and beat it thin upon an Anvil, and cut it into little lamins or thin pieces, bovv them

that they become hollovy, glovy them in a Crucible that the Aqua fort. may touch them the better, fuch glovved Lamins vyhen they are cold, put them into a luted neck separating Glass, and put not above five or fix of those Mark-Goldssh-silver Lamins in at once; (because of the Danger in breaking,) and if you have much Silver (for they take much room vyith the Bottles) then put upon it so much of the purify d and settled Aqua fort. that it go over the Silver a good large Finger, and as soon as it begins to vyork of it self, put the separating Glass vyith the Silver upon a marm Sand in a great earthen Test of good stuff upon an Athanor, that the Sand, may alvvays remain hot, and vyhen the

first Aqua fort. hath work enough, that it will touch CHAP no more, then put away the Silvery Water into another XXXII luted Bottle, but not too hot, that the Bottle may not break, and put upon it other good Aqua fort. which hath not been used, set it in warm Sand, and let it work the second time, but a little stronger than at first, until it will work no more: Then put it clean off to the Silvery Aqua fort, and put upon it the third time Aqua fort, and let it upon the bot Sand, and let it work strongly, and with great Bubbles, until all the Silver be diffolved from the Gold, which will come out very clean through the three waters now mentioned: But, if one had more to separate, one might use the last water upon other Siver, and put it upon it the first time, for it will touch and work fo that somewhat of the Aqua fort.may be ipared.

Know also, that upon one Mark of beaten Silver, there The Second will remain one Mark and a half of good Aqua fort. and Preceeding. upon a Mark of thin graind Silver, (because the Grains remain (omewhat thicker, and not fo light as in beating) two Marks; now when the Aqua fort, hath separated and attracted all the Silver from the Gold, then put the Silvery Aqua fort. together in a Bottle, as abovefaid, and upon the Gold or Gold Calx (which remains in the Bottle) clean, boyling bot mater, so that it go well over the Gold, and put it over again, let it boyl well with the Gold calx, then put it off in a particular Veffel, clean and pure, that nothing come off from the Gold, and put up- To duleify on it another clean bot mater, let it boyl with it, do the Golds. this until the water goes off from the Gold very clean and clear, and hath no sharpness at all in it, and that it take to it felf the remaining Silver which the Aqua fort. hath left behind with the Gold in the moistness, till it cometh clean, this is called dulcifying, but that you may be fure that you have the Silver sweetned clean, prove it

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CHAP. thus, let fall a drop in a Coppery clean dist, and if it do not stain it, then tis dulcifyed clean, such sweet waters are all to be put together, because of the Silver init, and use it for precipitation, (of which you shall have an instruction hereaster) When the Gold calx after this manner is taken clean off, then hold in your hand the Bottle, and put the Gold or Gold calx very gently out into an half Giass Bottle, with the last clean water together; then put it again into the Bottle or Culb, and hold your hand before it again, and turn the Culb so that all the remainder of the Gold (together with the water) may see some some solution to the band, then put it finely and gently to the other Gold in the half Bottle.

When all the Gold calx is settled in the half Glass Bottle, then drain the water off cleanly, and put also the Gold calx (being moist) into a clean Crucible, and set it on the fire, and let the water softly evaporate, and boyl in; then set the Crucible warmer, and at the last very hot, that the Gold calx may glow clean out, then the Gold will receive a fine colour, let it be cold, and weigh it, then in the casting all together nothing will go

from it

then mingle it with a little Borax, and put it in a new clean Crucible, (but rub it at first very clean with chalk) and set it in the Fire, and when the Crucible gloweth, blow to it that the Gold may come to slow, of this you may use a little in the Fluss, and when you will cast it, then lay a clean little Paper upon it, which is Luted with Venetian Soap and Wax, and while the Paper yet burns upon the Gold, cast it out under the Flames, so it will receive no scum, but will casts it self also clean, but if you will cast an Ingot, then make the Ingot warm, and Lute it with Wax, and then quench the cast Ingot with Urine, and so the Gold will become fine and left.

Section.

4To glow out
the Gold
Calx.

To cast the

But if one have much to separate, if it be Golden CHAP. grain'd or Gilt Silver, and you would separate it in the XXXII. water, then it must be first burnt clean upon a Test, and the burnt Silver must be Grained, (for it would be a hindrance to the Separator, if all Silver should be beaten) especially in a great quantity, yet he who hath time and opportunity, will do better to beat the Silver, or cause it to be beaten, whereby the separation will be done sooner and with less Aqua fort. (as above is fignified) but if you want time and opportunity to beat it, then take the burnt Goldish Silver, and let it in a Crucible in a Wind Oven, and grain it with a iplit or round flick, or flir the water with a flick fast about in the Vessel, to make the Silver cast it self into Bubbles, whereby it will To separate grain it felf thin and hollow, and when 'tis drayn'd, the Silver then dry and glow it, and put it in the separating Glass, ing. and put Aqua fort. upon it, that it may go over it pretty well, and let an Alimbeck upon it, that it may begin to move of it felf, and, when it ceafeth working, then let the separating glass upon the Copels in the fand upon the Athanor, and let the Alimbeck or Helm stand continually upon it, and what Water goeth off from the Aqua fort. keep that same by it self, for itis in the diffilling of the Aqua fort. to be put into the Receiver, and is better than common Aqua fort. and you must still govern the fire in the Athanor by strengthning and weakning it as the work requires: and of this graind Silver, put 9 or 10 Mark of it into a bottle at once, for it will not take fo much room as the beaten, yet if there were a quantity to separate of the Golden filver, one may prepare more of fuch Athanors than one, that divers of the Bottles may be fet in at once, for the gran but you ought to observe this, that one must put upon silver. the Graind more than three times fresh Aqua fort. for the thick Grains fake, that the Gold may be pure.

And

Whenaglas breakse

the Silver.

CHAP. And if it happens that a Glass Bottle should break, XXXII. and the Silvery Aqua fort. run into the fand, 'tis not quite loft, for one may boil most part of the Silver out of the Sand again with warm Water, and that which remains in the sand may be mingled with that which is swept off, and passes through the melt Oven, and be made to profit, but of fuch danger there is little Fear upon the Athanor, especially if you have good separating Glasses, and also are careful.

When the Silver is separated clean from the Gold then fweeten the Gold Calx well out, dry, glow and caft it together (as often as hath been mentioned) and know, if you have been diligent in separating and sweetning it the Gold which comes out by the separation, will be 23 Carats and one grain; but commonly it cometh to 23

Carats and 7 or 8 grains.

Further, I add as a Caution, That you must not The Content let the Aqua fort. evaporate too dry upon the Gold of parted Gold. (as many times it happens by Negligence) whereby the Silver can not fet it felf on the Gold Calx again, which afterwards the other Aqua fort. will hardly touch, and therefore to foon as one part of the last Aqua fort. be poured from the Gold, one should quickly cast upon it hot flowing water before it be cold, that the Silver may not settle it self too hard on the Gold, and turn to To finate in- Cristals, and though hot boyling water will dissolve those Crystals; yet tis better, it may not be, but be soon dul-

cified.

Likewise, if it be neglected so that the Gold should come too white out of the separation, and were not of a high Content, then it is by the Cement (as in next Sculpture is fignified) to be perfectly cleanfed. But that you may understand the Labour of the Separation, and how the Ovens and separating Glasses use to stand, you will alto fee in the following Sculpture.

CHAP.

CHAP.



Deciphered.

1. The Tower of the Athanor.
2. The Side-Ovens upon which the Copels are placed on Sand.

3. The Glass Bottle for Separation covered with Helmets, 3. 3.

Выь

4. The

CHAP.)4. The Receivers which are laid to the Helmets.

XXXIII. 5. How Aqua fortis is by them to be drawn from the Silver.

6. An Iron Instrument by which the Glasses are to be taken out and in.

7. The Person that attends the Operation of the Glasses, in figure 5.

8. Another person to take off and put on Glasses upon the shelves.

9. The Ingredients prepared, in a dish or pan.

CHAP. XXXIII.

When the Gold is abstracted, how the Silver is to be brought again, out of Aqua fort.

Section.

F one have diffolv'd silver from the Gold, through Aqua fortis, and the Aqua fort. hath fuck'd the same into it felf, and if one would bring it again out of the Aqua fortis; this may be done feveral wayes. The common Method is this (which is used by most Goldsmiths) if they separate but a little filver, and require no great pains, then they take the fettled water with which they have purified the Gold (as is faid before) and put it in an half Bottle made of Copper, to the filvery Aqua fortis: only observe the right measure, for if the setled water be but little, and on the contrary, if the filvery Aqua fort. be too much, then it will begin to work too hard in the Copper Bottle: to prevent this, put into the Copper Bottle, to the fettled water, and to the inweighed Aqua fort. a little more warm common flowing water, and then it will not so much hurt the Copper-bottle; and the

the Silver will quickly and apparently fall down in the CHAP. Copper Bottle : Let it stand a while, then put the Cop- XXXIII. per Bottle (together with the water and fallen Silver) over the fire, let it boyl a little, then the Silver will the better and closer come together. The and and bus

When this is done, then cause it to settle and pour the clean water off (which will be fair, clear and transpa) rent) put the filver Calx into an half-Glass bottle, or, if it be much, then into a clean Kettle, and pour clean warm water upon it, two or three times, until the filver Calse be clean and pure, and fee that the silver alwayes fettle well, and preserve it carefully together, that nothing be loft.

The Reason why the silver Calx must be dulcified, is Because the sharpness which the Aqua fort. hath left in why the Sil it may come out of it, for the sharpness doth rob some sweeted of the filver in the fire by drawing over the Helm as shall

be shewn.

Now, when the water is drain'd from the filver Calx then put it in a clean Copper half Bottle, and let the water of it boil off and evaporate, that it may be very dry, then put it in a Crucible, let it in the fire in a wind-Oven or before the bellows, according as it is more or less: make it not too fuddenly hot, that if there be left by the filver Calx, any Spirits of the Aqua fort. that they may evaporate before the filver Calx floweth, and the waste of the silver may become the smaller, which waste is not often fmall, and comes all from the spirits, for if they could be retained in the separating Glass then little would go off from the Silver.

After the melting together of the Silver in the Cruci- The content ble, then grain it, or cast it in an Ingot, as you please, of the Prethis is the old manner of the Goldsmiths and common separators to cleanse the silver out of the Aqua fort. and this filver which is thus settled out of the Aqua fort. is

CHAP. not fine filver: but it worketh on the Copper from which XXXIII. it is to be cleanfed, and the stronger the water is in cleanfing, the more it will touch, and mingle among the filver Calx, and it holds commonly a Mark of cleanfed filver, and this thus cast, holds near 15 Loth of fine silver.

Section.

Tobring the to profit.

The fettled blew water is to be used again with profit when you distil Aqua fort, and have put the prepared stuff into a Jug (whereof Iron ones are best) then put of this blew water two pound upon ten pound of calcin'd ftuff; as foon as this is done, fet the Helm upon it, for it will prefently go off it felf, without any fire, and lay the Receiver before, (without any sweet Water) lute it well every where, and let it first go over the flegm, then increase the fire till all the spirits are driven into the water (as is faid, when we spake of burning the Aqua fort.) then you may put this blew Aqua fort. into a great Culb glass, which is cut off in the Neck, and luted over, and evaporate the moist flegm with the fire, then it will become ftronger, and so put it to the stuff in the distilling.

But the Aqua fort. which comes of it, when the blew water is put upon the calcined stuff hath not so much feces in cleanling and feething down, and is not fo unclean as other common Aqua fort. which is burnt of other stuff, because the blew water becomes Metallick by the Copper in the precipitation, and hath purified it self in the

Jug or Bottle.

To precipien veffel.

Know also, That one may in a glazed or earthen Vefin an earth. [el (if it be good, and will hold Aqua fort. and Oyl) cleanse the used silvery Aqua fort. and the silver precipitated in it, namely, one must put such Aqua fort. together with the clear water, (as aforelaid) mixed in the glazed or earthen Veffel, and lay in it red hot pieces of Copper, and let the Vessel warm, then the filver will quickly fall to the Bottom, but 'tis better to cleanle it

in a Copper Veffel, which may be done in a coppery or CHAP. earthen vessel, yet in the cleansing of it, put iron La- XXXIV. mins, then the filver will come clean out of the water, as Experience teaches.

tore,

CHAP, XXXIV.

How Aqua fortis drawn from Silver may be used again.

> HE Second manner of bringing the Silver out of Aqua fort, and to draw off Aqua fort. To that it may be used again for Separation, is a fingular ART and Dexterity; 'tis thus, Put the Silverish Aqua fort. in a good glass Bottle which

is luted over, and wherein Aqua fort. may be distilled, fet it in one of the Ovens which are for distilling, and luted over (but in an Athanor is the best, and not so dangerous, as in a common Oven) let it be dry, then put the silverish Aqua fort. through a long glazed Tunnel, warm and not cold, into the Bottle, then let a Helm upon it, but not fo strong luted over, lay the Receiver before, and lute the Joynings over so that you may take the Helm off again, (as you will hear hereafter.) And being thus fet in, then drefs the Athanor, and put fire and Coals in it. And by the Instruments (of which we have spoken above:) first give it a gentle fire, and let the flegm go over 9 or 10 beats or times (as before) and when the water or flegm is almost over, then shut all the Instruments on the Athanor, and take off the Helm again, and fill more filvery water through the long Tunnel, warm into the Bottle, (else it may break and do hurt) and put the Helm on again, and lay the Receiver be-Ccc

CHAP, fore, it but lute it not too strong (as at the beginning)

XXXIV. and let the water go over again gently.

In this manner itis to be done the fecond and third time with the filvery water; and when you think it be filvery enough in the Bottle, or hast no more to put in, and the flegms are over, then take off the Helm again, and cast into the Bottle (to the Silver or Stuff) a piece of Tallow as big as half a bazel Nut, then the Silver will not ascend in the Bottle, put on the Helm again and lay the Receiver before it, and lute it all over well, and the best thou canst: then let the fire go on the stuff again, and make the fire fiercer (as you fee convenient) At last, give it a strong fire, and force the spirits, near 12 hours, pretty well, yet not too high in the beginning, but by degrees increase it, that the spirits may go over with great force, and that the Culb may glow very bright, let it stand in the fire, near two hours, that the Silver may almost melt in it, then the spirits will come all into the water, and the Silver freed of them, for if they were not clean forced from the Silver, but remained by it, they would hurt it in the casting together, and draw it away; which may be seen apparently upon the Coals, that there will lye thick leaves upon it: They therefore who are ignorant of this, do many times work with danger, and great loss of Silver.

One may also put the filvery Aqua fort. into the glass Bottle luted over upon the Atbanor in deep Sand, and draw the flegm (as now is mentioned) gently over, by which may be seen how it governs it self in the Bottle, and how the water decreaseth, and so have more care in putting in more water: finally, the spirits will be forc'd over, and the Silver be glowed out in the Bottle, yet the last out-glowing is better to do in my mind,

as above in the Athanor.

When the water is thus drawn over, then let all be cold,

Section.

cold, and take off the Aqua fort. in the Receiver, which CHAP. you may use again very well to separate, especially to XXXV. the Gold proof, and hath no need of further cleanfing: then take out the Silver which was left in the Glass, and

put it into a Crucible, and cast it together.

Some of the Gold - Separators have also this manner section in drawing over the water, that they do add to the fil- Another very Aqua fort. in the separating Bottle, if it be fix way to draw pounds, then one pound of the stuff, of the Aqua fort. Water. (viz. of Nitre, and calcin'd Vitriol, as above is fignified) and do not put it into the Bottle untill the water be almost gone over, and if the spirits begin to go over, they lute it again very diligently, and keep the Fire (as is necessary in burning of the Aqua fort.) that the spirits at last may come over too: and yet they do think that the Aqua fortis will receive a virtue and strength again from the added stuff, and is better for use in separations; then they force the Silver with the Caput Mort. (which yet is but little) into a Crucible, and cast it to. gether: Whether now this way be better than the first? Experience must teach. So then you will have a good and right Instruction concerning the Silver and Gold feparation in the vvater; and tis a compleat vvay of feparating; especially if one be provided with all things necessary to it.

CHAP. XXXV.

How to separate Gold and Silver by Fusion.

S it is an excellent piece of Art to sepapate Gold and Silver (in Aqua fort.) How to understand Seviz. The rich Gold containing Silver; paration by to is also the Separation by Fusion upon the poor Golden Silver, where the Mark contains one peny and an half

CHAP. of Gold, to two or three drams, which is an handsome XXXV. and profitable separation; so that I know no better way: but upon the rich Goldish Oar, that way is not to

be used.

But this separating by Fusion is to be understood thus, That, because the Gold in the poor Content of Goldish Silver is largely distributed, (through the Addition of Gold in the Fusion in a little Silver) it may be brought into a narrowness; namely, as when the Goldish Silver is thirty Mark, and one Mark contains a dram of Gold, then the thirty drams of Gold (which are in the thirty Mark of Silver, will bring in two Marks of Silver, and then separate it in the Aqua fort. which is a very great profit, because that one hath not need to refine all the thirty Marks of Silver, and then to separate them in Aqua fort.

If you have a goldish Silver, which is poor of Gold, put it in a Crucible, let it flow, and grain it in the water, and if it be but wrought Silver, and not fine, 'tis nothing: then weigh the graind Silver, and prove it up on fine Silver and Gold, how much it contains, that you may keep this Account, that there remaineth nothing behind on Gold or Silver, and also canst certainly know, how much the waste hath been in the Silver by

the feparation.

After fuch proving and weighing, make the grain a little wet again, and take to every Mark of Silver, four Loth of yellow small beaten Sulphur, put also the grains wet into a glazed Pot, and put the Sulphur upon it, mingle it well together, and cover the Pot with a Cover, then lute it well over, and make a gentle fire round about: so that the sulphur may melt on the grains.

When this is done, Let the Pot cool, and break it in pieces, then you will find the grains and the Sulpbur burnt very black together, beat it asunder, and take heed

that

that nothing of it spring away. After this put the CHAP. grains (thus with the Sulphur prepared) into a good XXXV. Crucible, and upon the Grains put also a Mark of wrought Silver, and half a Loth of Copper; but if it be burnt filver, then take to every Mark two loths of Grain'd Copper, and fet the Crucible in a Wind Oven, which is made taper-wife with good and found Clay under the Iron grate before, towards the wind hole, that if the Crucible should run over, yet the scoria's or dross of all the stuff may flow out of the Oven into the hole under the wind-hole, then there is no need to gather it fo largely dispersed; and, that also the Grates may be taken out and laid in again: After fuch Crucibles are fet in, then cover them with an Iron-cover very clole, let the stuff flow well, and when 'tis flowed, uncover the Crucible, and ftir it well with a glowing Iron book. of a finger thickness, and cast the Silver first down with grained Lead, vig. that you may spread the grain'd Lead upon the stuff in the Crucible, in which the Gold will cast it self down with some little silver, then put Precipitaalso upon it some of the stuff (as is directed hereafter) ing down. and stir it once with the Iron hook, then cover the Crucible again with the cover, and let it stand thus a while in the fuff, then uncover it again, and cast it down with grain'd Lead and a little grain'd Copper; do this three times, and always use afterwards of the mentioned fluss; but take notice, if you have in the Crucible 20 Marks of filver, that you may not use of the fluss (to three times casting down) above 10 loths, and one and a half of grain'd Lead, and 4 loths of Copper; torif you should use more, then the salver Regulus might be too great. Now when you have precipitated, or cast it down the third time, let the Crucible stand with the stuff a long time in good fluss, then take it out of the fire, and cool it, and beat it alunder, and of 20 Marks of filver you Ddd

CHAP. will find in the bottom, a Regulus of near 6 Marks XXXV. weight, or something lesser, in which there will be as much

Gold, as in 20 Mark of filver.

Section
6.
When the
Scoria's contains Gold.

After the finishing of the first running or casting the Metal, then prove if you find the scoria's or dross upon the Silver, and the Silver upon the Gold, and that if the scoria's doth contain Gold, set it again in a new Crucible, and let it flow, and use your casting with the grain'd Lead and a little Copper (as before) but not so much, unless the scoria's were rich in Gold, and then one useth much of the grain'd Lead and Copper, whereby the filver Regulus will become the greater, and the Gold will come better together; especially observe, that if much Gold be in the filver, then use at first most of the lower casting, that you may precipitate all the Gold, and when you have all the Gold in the two Regulus's, and do find that they are still too poor in Gold, that is, if you have not in the same a fourth, or at least a fifth part of Gold, by which the Gold in separating did not remain whole, then set in the Regulus again, grain'd and prepared with sulpbur (as at the first time) and put the same ashed grains in a new Crucible, and spread a little Copper upon it, and cover it with fluss, and put a cover upon it, and set it, thus covered, again into the fire in the Wind-oven, and let it flow well, then precipitate it again with grained Lead, and use to every one of the castings the flus, (hereafter fet down) and ftir it well about with an Iron book : now that the filver Regulus be not toogreat, and not so much (as that you need to separate it in the Aqua fort. in vain,) you may help it with the lower fluff or castings, whether the Regulus be great or small, (as above hath been demonstrated) and so deal also with the remaining scoria's, when such is yet rich in Gold; for by diligent proving one may always perceive whether the Gold be all in the Regulus, or whether some be yet

When the Regulas is poor in Gold. behind in the scoria's, that you may regulate your self CHAP.

accordingly.

When then you have done all things in the Cruciple by precipitating and stirring about, and hast lifted out the Crucible, then cast the stuff out of the Crucible into an iron Morter, luted with Tallow and a thin Clay, and made a little warm (which I judge very good) for in fuch a calting the Regulus comes clean together; and as foon as this is cast out of the Crucible, then set the Crucible quickly in again in the Wind=Oven (especially if the Crucible be good, and, That you may trust to it) Put the stuff out of the Morter, and beat the Regulus from the Scoria's, and presently put the Scoria's in the Crucible, let it flow till it doth flow very eafily, and cast it down again, and do it as you are instructed at the first, then put it again into the Morter, and cool it; Lastly, when all the Gold is cast down in the Silver-Regulus, then take the Regulus and burn it clean upon a Test, and grain it afterwards, either in the bubling water (as above mentioned) or cast it into an Ingot and beat it thin, then separate it in Aqua fort. as I have taught.

To this separating there doth belong good and sound Crucibles, in which you at once may set in to separare near 50 Marks of silver or more, besides, I have seen a Gold-separator in Saxony, in such a Crucible hath set in, and cast down near an hundred Marks of good burnt silver, thus prepared with sulphur: But, because it causeth some fear to set in so much at once, therefore I judge it better, especially, if one cannot trust to the Crucibles, that one in one Crucible may set in no more than 50 Marks (except it were so much to separate) and then some more Wind-Ovens must be made, and more Cruci-

bles be put in.

But for a true Instruction of the Precipitation (with the before given manuduction) know, That it hath this Con91

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CHAP. Condition, viz. When there is put (after the former XXXV. Directions) much Goldish silver with sulphur prepared in a Crucible, and the Gold is cast down with the Lead, Copper and Fluss, then the Gold will precipitate or cast it felf from above, to you may with a little glowing draw out of the Crucible Iome scoria's, but not the half part, then cover the Crucible again, and preciptate it again, and at last put the stuff (as I have mentioned before) in an Iron Morter, by this way, I suppose, that the scoria's of the Gold will be clean at once.

Another

I must also further Instruct, That one may use upon the poor Goldish Silver (of which a Mark contains cipitate at but a Heller or Penny-Gold) this following Method of separation in the Fusion, first, that one must put into a Crucible of the graind Gold, with sulphur prepard as above is taught) near 50 Marks, and let it flow well, then precipitate it with graind Lead, and a little Copper and when the Precipitation is right done, and the scoria's with all the stuff cast together with the precipitated silver, and the Regulus and the Gold put in another hot Crucible, and again out of the same, into the first, and then to cast it into an iron Mould of an Oval form, well wash'd with Clay, and dry'd again, so that it may flow in bredth, and the filver Regulus with the Gold may lettle (yet broad and thin) and then you will find, that in fuch calting that all the Gold will give it felt in the filver Regulus at once, and you need not let it in the scoria's again, but it will be clean and tree at once: this now is an ingenious Method, though I never used it : because the filver Regulus is to often cast through with the scoria's, and doth spread among the scoria's, so that the silver may the better catch the Gold, and take it to it felf.

> To fuch cafting one must have a singular iron-Instrument made on purpole to open and close again with two handles, the fame is to be holden with thick wet Gloves

on the hands, and poured out to avoid the heat thereof; CHAP. Every one may confider of this, but, I judge it most XXXVII convenient, the casting of the Crucible, as followeth:

CHAP, XXXVI.

How the Scoria's or drofs is to be made to Profit.

HE remaining filver which in the precipitating comes not into the filver Re- The first gulus, but remains in the scoria's, you may make to profit, and bring it from it; only observe this, If one useth to the precipitation much Copper and little

Lead, then the Scoria's will become rich in Copper, therefore to make fuch good again, requires much Lead: But if you use to it much grain'd Lead and little Cop... per (as hath been taught in my former Instructions) then the Scoria's will become rich in Lead and poor in Copper, and the Gold will precipitate never the less (after this manner) into a filvery Regulus, which in the well making of the Scoria's is very profitable, without any

great dammage to the Silver.

Therefore make it thus, If the Scoria's be 30 Mark which you would make to advantage, Prepare a very flat Test, of good wash'd Asbes (as I have taught in the first Book of the filver work) fet it before the Bellows, that it be not too strong, let it be warm, and then put upon it 15 pounds of clean Lead, blow it gently, and when it begins to drive, then put continually one piece after another of the Scoria's into it, so the Lead takes the Content of it to it felf, and the Sulpbur is blown off from the Test, also the Scoria's doth not stick to much in the Test, because 'tis poor in Copper: But if there

CHAP. be not enough of Lead, then you may add somewhat XXXVI. more, till all the scoria's be suck'd in: then drive it upon the Test clean off, so you will find, that not much more than a dram is gone off from the Silver in the separation.

Section.

2.

Another

war.

Also, one may put again all the Scoria's into a Crucible, and let it flow in a wind-oven, and when 'tis flowed very well, the filver (with filed Iron, or Iron-Scales and grain'd Lead) is to be precipitated, stir it well about, and with the filed Iron follow it so long, till the scoria's doth touch no more the iron Hook, then list it out of the fire, and let it cool well: In this precipitation (with the Iron) the Sulphur will loose its strength, and lets fall the Silver, and thus with this precipitation the most part of the silver settles it self in the Crucible, which with the remaining scoria's is easy to be brought to prosit, especially because it is rich in Lead.

Now, because I am just come to the scoria's, I must (in kindness to the Reader) mention somewhat of its rare The Scoria's nature; for first, When the Scoria's is cast into an Inis master got, while 'tis yet hot, it may be hammered and beaten,

as one pleaseth, like Lead.

Then one may cast figures and medals which will look like glassy Oar, and if one cast forms of it, and turn it over, and lay it upon a gentle coal-fire, till they are warm, then set it over a coal-fire, and the filver will glow out of it, as if it grew in the Myne, and, 'twill look lovely and fair: and this I signify, that any one may use it at their pleafure, and, like an Artist, know what is to be done therewith.

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4.

CHAP. XXXVII.

How to make a Fluss for Precipitation.

and not fuddenly; and if you will use it, you may do

So you have a clear Instruction how you shall do separation with the Separation in the fluss all in all, which is well to in the fluss be observed, for it requires a more fingular and exact ligence. diligence in the Aqua fort. than in other leparations, as

you will finde.

tage.

LUSS is made by taking Litharge, Glass section. gall, and melted Salt, of each a like quan. How to tity, small beaten, and filed Iron, and a make it. like quantity of graind Lead, this Flus or fluible Composition maketh the scoria's deft, so that the Gold will lettle it felf the easier, and precipitate gently,

it the more fafely in the Precipitating with the Graind Lead and Copper, lest the filver Regulus be too great.

Concerning the old used Crucibles and Tests, which The wife of come from fuch separations, they are to be kept toge- the Test. ther, for they are not without Silver, and to make fuch ferviceable, fet one of the old Crucibles in the Wind-Oven full of Lead, let it drive gently, and lay the pieces of the used Crucibles one after another in it, then the Lead will draw all that remains of the Scoria's to it felf, and becomes as wash'd: and you may use the same Lead, in stead of other Lead, or add but a little of it upon the Test, and then you may make it be profitable; for the more you keep all things together the less is the dammage of the Silver: but all is to be swept together, and wash'd at once alike, and then melted for your advan-

And

CHAP. Section.

And, when in this Separation a Crucible runs cut, XXXVII (as it oft hapneth) then is this fluff and scoria's (because tis heavy, and remains in the water) like another Silver to be fearch'd and found out. But, that you may fee the Wind-Ovens (with all the appertaining Instruments and Vessels to this Labour severally formed) I have in the following Sculpture for this end delineated them.



1. The inward part of the Wind-Oven.

2. The outward part prepared.

3. The holes next the wind-holes.

CHAP.

4. The Pot in which the Sulphur and graind-Mettals XXXVIII are prepared, with a fire under it, and a person attending it.

5. A single Crucible, and a cover to it. 5. 5.

6. The iron Tongs, by which Crucibles are put in, and taken out of the fire.

7. The Instrument in which the Crucibles are to be set.

8. The iron Vessel into which the stuff or melted matter is to be cast.

9. The person attending the Wind-ovens.

CHAP. XXXVIII.

How to make good and found Crucibles for separating the Flus.

found Crucibles to the Separation in the Fluss, therefore I will give here a little Instruction how they are to be made: The chief and that of most concernment is good Clay, that holdeth well in the fire, of which may be made good Crucibles.

When you have such Clay, let it be well dryed in the Sun, beat it small, and sift it through an hair sieve; put among it the tenth part of small beaten slint-stones; which is burnt and wash'd: and half so much small ground Chalk, or in stead of that Glimer or Tallow, or in stead of these burnt Water-slints small grownd, mingle all these well together, and moisten it a little; work it well together with your Feet, and after with your Hands: then take smooth pieces of Pear - tree, or other strong wood, suitable to the bigness of the Cruci-

Section.

CHAP. bles; which may be taken in two parts afunder, on which XXXVIII may be laid two iron Rings or moulds, beat and press the Crucibles into the same, but let the upper part of the Crucible be first well oyl'd over, that it may the better go out. After the preparation of the Crucible, let it be dry in the Frame, then the Crucible will go out whole, for if the lower part be oyld, then the wet Crucible might with the upper part, lift up it self out of the frame, and hardly remain whole; or, take one part of Potters clay, a fourth part of good (lay, and a fourth part of the above mentioned flint-stones: but you must observe whether the stuff or Clay be too fat or dry, and those Portions which you take unto it, and to you will have good Crucibles which will not fail.

Section.

Some use Crucibles having three feet, below, upon which stand the Ovens, and need not be set upon a foot of the Crucible; fuch (rucibles I much esteem of, for the heat may eafily come without hindrance of the thick bottom, that the silver or Mettal in it, may become fooner hot, than in fuch (rucibles which must be fet upon a thick foot, they stand also and hold better and longer in the fire than they which are fet upon particular feet of (rucibles, especially when the feet, as well as the Ashes of the Crucible are not so very dry, then it draweth the bottom of the (rucible, and the Moistness to it felf, and cracketh it very eafily, and by this may be feen that out of a common three-footed pot (used for boyling and casting Copper and Brass) in an hour and a half you may alwayes make warm and cast a Fluss of 12 pounds in a Windy-Oven; yea, one may well cast some Fluss out of it, especially, if one have tongs to it, to lift the Pot out of the Fire. I was willing to mention this as an Instruction, and the form of such Crucibles you will find in the following Sculpture. Hooms said notes

other strong wood, suitable to the bigness of the Cruci-Sculpture.

Sculpture XXVL



Deciphered.

- 1. The lower part of the frame of a Press, for making Crucibles.
- 2. The shape of the whole Press, and how the Crucibles are to be forc'd under it.
- 3. The iron-Rings or Hoops about the Frame.
- 4. The shape of Crucibles to be made in the Press.
- 5. The Handle by which the Screw of the Press is to be turned.

CHAP.

CHAP. XXXIX.

CHAP. XXXIX.

Of Cementing, and what it is.

Section.

EMENTING is a fingular fine ART through which one may draw and feparate from the Gold, Silver, Copper, Brass, and other Metals, by a moistned Pouder, that the Gold may remain separated from its Addition and Allay:

But 'tis only to be used to such Golds which are not much more than half Gold, for if the Silver and Copper be more than the Gold, to this the other Separations are better, and tis done with the same in a shorter time, and with less labour and expence: and according as the Gold is rich or poor, the Cements is likewise to be pre-

pared.

But to Cement there appertains such stuffs and matter as will work upon the Silver and Copper, because of their sharpness, and consume them as a sharp Salt species, among which is to be taken Verdigrife, calcin'd Brafs, and fuch like, that they may give a fine and grateful colour to the Gold, or else Lapidem Hamatitem, Grocum Martis, Tutiam, or calcined Vitriol; which Ingredients, how to be put into the Cement, is left to every ones Liberty, but he must observe that he take nothing which is contrary to the Gold, or that may make it unclean and do hurt. The Pouder of Tile is to be used in the Cement, that it may attract what the other Ingredients do scarify, and loosen, as Silver and Copper from the Gold with their sharpness and moistness, which else would stick and hang about the Gold, whereupon the Gold becomes Therefore fine and clean.

Therefore I have fet down some Cements which I CHAP. have used and found very good; But, because in this Art XL. of Cementing there is necessary a particular Oven, which holdeth fire long, therefore I shall first mention how it is to be made, with its Form.

CHAP. XL.

How the cover'd Oven for Cement is to be made.

F one hath much to Cement, there is section. no better way, than to prepare such an Oven as in the following Sculpture; and although there may be other Cement Ovens, yet I conceive that this is the most profitable; for it will hold about 24 hours fuch a continual fire, that there needs not any attending of it, and it is done thus: Make a square of Tile.stones, the inside an Ell wide, and an Ellhigh, to the edge (where the Oven is to be tapering) and then from the same edge to the Tower of the Atha-

nor is to go half an Ell high, and that the Tower of the Athanor be an Ell and a half or two Ells high, and the infide an Ell and half wide, and so the whole Oven three Ells, or three and a half high, and there must be on the forefide of the Oven two Mouth-holes, the lower a third part of an Ell long, and a fixth part of an Ell high, through which the wind may go, but the upper an Ell and half a quarter wide, and so high; and by the same Month-bole there must lye (in the inside of the Oven) an iron Grate, with an edge, as in the next Sculpture marked with Figure 3. and out of the same Grate, before the Mouth-bole in the Oven, an earthen plate upon which a Muffle as high as the Month bole is to be placed, and then

Ggg

under

CHAP. under it the prepared Cement comes to stand pure and clean, or else the Pot with the prepared Cement is to be fet in it without the Muffle: you must also make four smoak-holes upon every side one, as in the next Scul-

pture at figure 4.

Scation. Concerning she Cement oven.

5.

Now, if you will Cement in the Oven, and the Cement is fet in, then put in above in the Athanor (or Tower) live Coals, and fill it after with dead Coals; then cover it so as no 'Air may go out of it, onely leave the Month-hole open (marked with the Figure 1.) and the air or smoak-bole, (noted with figure 2.) that the fire may begin, and have air; then that all the other air or wind-boles close, and let open only the uppermost hole of the Tower near the cover (noted with figure 5.) About the bigness of a little finger, that the Cement be not too hot, and not to suffer any dammage.

In fuch an Oven you may keep a Fire 24 hours, (as abovefaid) that there needs not much waiting on it, nor casting fresh Coals into it, for the Coals in the Athanor will follow one another, and keep the fire all the time in due heat (as you please). But if there be cause to continue the heat longer than 24 hours, then put more Coals into the Athanor, and fo keep the fire as long

as is needful.

Now, concerning the Cement ovens which have been used formerly, those I leave in their esteem; and when you have try'd both, the Difference will be found.

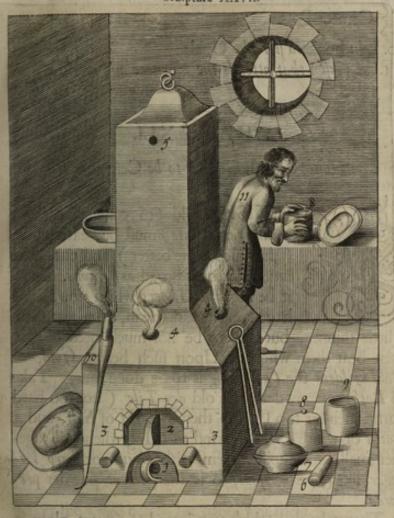
But if one cannot quickly have such an Oven to the Cementing, then put the prepared Cement between Tilestones in a clean Goal-fire, and let it glow its time (as hereafter) but so that it may not melt. Thus, you may do all the cementing: but be diligent, and careful of the coals: Now the form of the cement Ovens may be feen in the Sculpture following.

Sculpture.

Of Gold Oars.

Sculpture XXVII.





Deciphered.

- 1. The Athanor and lower Mouth-hole.
- 2. The upper Mouth hole.
- 3. The Edge upon which the iron Plate doth lye on the
- 4. The Registers or Air-holes above the Grates.
- 5. The little air-holes near the top of the Athanor.
 6. The stopples for the Registers or air-holes.

CHAP. 7. A Test fitted for the Athanor.

XLI. 8.7 Cement Pots.

10. An hook to stir the Coals.

11. A person that attends the Furnace and works.

CHAP, XLI.

How Rhenish Gold is to be Cemented.

Section.

1.

How to prepareit.

HENISH Gold (to cement it either in Ingot or Plate) must be beaten thin, (the thinner the better) and cut it in littles pieces, as broad as Crowns. But if it be Rhenish Gilders which you would have cemented and clean, then beat them

a little thinner, but if there be not much need of that, then beat them whole: Upon such beaten Gold, or Gold Gilders the Cementing is to be done thus, Take 16 Loths of powder of an old dry Tile (not too hard burnt, neither too sandy) then 8 Loths of Salt, and 4 Loths of white Vitriol, grind these Ingredients all together small, and moisten them with Urine or sharp Vinegar, like Copel Ashes, so is the Cement powder pre-

pared.

Then take that which you intend to cement, glow it first in the fire, and let it be cool, then spread some of the Powder in a Test or Pot, which is to be of an equal wideness, a finger thick, and lay the Gold (which you must first moisten in wine or vinegar) upon the cement Powder, one piece near the other, as broad as the Test, then spread upon it again some of the moistened Cement Powder half a finger thick, and upon it (as now is mention'd) the wrine moistned Gold, lay one lay upon another, until the Test

or

or Pot be full, cover it over with the Cement pouder CHAP: the thickness of one's Finger, that one may see the Gold: XLL then put over it another Test, or cover very well luted, that no vapour or spirits may go out; then let the Test (or Pot) with the Gold, and cement, thus prepared, in a Cement Oven: and observe, that it may stand in like heat 24 hours, and glow brown, that the Gold may not flow in the cement (to prevent Dammage) for, if it should flow in the Cement, then the Silver and Copper which the Cement hath extracted, may fuck in the Gold again, and thereby all pains of beating and Gementing will be in vain.

Now, when the Gold hath stood in the Cement 24 section? hours, then shut the Oven every where, and let it be This second cool, then take it out and open it, and wash the Cement Cement. Pouder off with warm water, then the Gold will be found very near 23 Carats on the Content; and if you will have it higher Gold, then do the Gold over again with another fingular fresh (ement (to which take 16 loths of Tile-pouder, and 8 Loths of Salt, and 4 loths of white Vitriol, one loth of Salt-petre, and one loth of Verdigrise) and let it cement again (as before) 24 hours, do this till the Gold is very clean, and high to your delight: It is done well in a few hours, but when you have spare time, let it stand the 24 hours, 'tis then better and furer; But, how much properly every Cement makes the Gold better, the proof will shew.

If one lay Rhenish Guilders whole in the Cement, and To coment cement it, then there will not only come filver off from it, Rhomifiguile and Copper, but it will come to be of the Content of the ders whole, HungarishGold, yet they retain their Impression and Circumscription, only they become lighter as much as Copper and Silver have been in them: in this manner is to be cleanfed through the Cement, a light Gold, in an Hungarish Content: only observe, it you have according to vour

CHAP. your pleafure made it higher through the Cement, then you must boil the cemented Gold at last in clear water or lye, until all the sharpness come off from it, so it will XLIII. become cleaner, than by washing only.

This you must do with all Cements, so you will re-

ceive Gold as high as your defire is.

CHAP. XLII.

Another Cement upon light or mean Gold.

Section.

PON light Gold alwayes the first Cement must be made of two parts of the pouder of Tyle, and one part Hunga. rifb, or other Salt; but to the other shall be taken two Ingredients, viz. of Virdigrise, Lapis Hematites and calcined Vitriol, as much of the one as the other, and Vrine

boiled very dry and small beaten, thus the Gold will become high and fine.

CHAP. XLIII.

Agood Common Cement for all Golds

AKE fourteen loths of Tyle - powder, 4 loths of Hamatites, one loth of Crocum Martis, one loth of Verdigrise, fix loths of white Vitriol, and three loths of Salt-petre; Grind them all small, and the Gold with Urine moistned, and

as before after the first Cement, to be cemented, and it gives a very fine Gold: Some use among this and other Cements

Cements, Antimony and Sal Gemma, this is left to every Chapones freedom: but Reason tells us, That if one cement the Gold right, as it may be, with 2, 3 or 4 of those Ingredients, and, that it is not needful to take above 7 or 8 of them, for, I have found it so: But, if you will do something more for the Graduation sake, it may be done, for it is certain, That every Gold which is very clean and high, brings his right Gold-Graduation and sine natural right Gold-colour with it self, but one may give the Gold (besides this) a high colour, that it may excell with this colour all other high Golds. But in my Judgment, the same looks not so lovely, as a Gold which hath with it self a high sine Colour.

CHAP. XLIV.

More Instructions for Cementing.

HEN the Gold is cemented, and almost section; clean then some do use this Method, The Compos they put the same Cemented Gold into an stion. other Cement made of four parts of the Ponder of Tile, one part of Sal Armoniack, one part of Sal Gemme, and one of Salt, all small ground together, and the Gold moistned in Urine, and put it into a Cement Test (luted as above) and clarified 12 hours: until the Gold becomes very clean: But why they use Sal Armoniack among it (which useth to touch the Gold) I cannot tell: therefore know, That it will not do it raw, especially when 'tis mingled with the watery Salt, (as here) but it purifieth rather that no other Metal (which is made loose of the other Cement, and yet partly doth hang on it, and in it) may remain.

Then

CHAP. XLIV.

Then some when they have much to cement, and yet are not willing to beat the Gold thin, they put it in a Crucible, and grain it in a water, and when it falleth thin and hollow, (as is mentioned in the filver work) they mingle fuch Grains with the cement Powder, and cover it also with it, that the graind Gold be not feen, and fet it in, as they have done with the Cement before, and when it hath stood its hours, they make the Grain clean from the cement Pouder by washing it with warm water, and fet it in again, with the fresh cement-Powder. But because the Grains cannot fall all alike thin in casting, but some are thicker than others, which the cement cannot quite bite through, like the thin Grains, and then they grain it (when it hath been twice thus in the Cement)once more, then it will come among the other again, and the cement will work the better, and purify the Gold.

Section:
3.
To cement the brickle Gold.

This manner of cementing is best upon the light brickle Gold, which suffers not it self to be beaten. And though the Gold must be graind once or twice (yet tis better, first to make the Gold deft with much pains) and then to beat it thin: Therefore when the brickle grains are set in, once, four or six times, and hath stood in the cement, and is become clean, and of an high content, to thy desire, then is it dest enough: For all Brittleness and uncleanness of Tin or Brass the cement draws out of the Gold; And the Copper and Brass is much sooner and better drawn out of the Gold, through the cement than the filver. In this cement the Gold suffers a great dammage, for the silvers will still contain the Gold which is melted out of the cements.

Another

One might also cast the clear or light Gold in thin leaf's (like as is usual in the coin-works in casting of small Money) and then to lay the cast Ingots in the cement in pieces, which when they are cemented twice, and so be-

become more deft, then one may beat them a little thinner, CHAP. and cement them, and follow them with beating and ce- XLIV. menting till the Gold becom's very deft, and so you may beat it thin, and then it will become high enough in the Content. By this way the Gold may be better holden together, and the Graind may be brought out of the Cement; and will not go into the Gold, nor will any Gold come into the Cement.

When the Gold is thus made pure by the Cement and brought upon the Content, as one would have it, then make it clean from the Cement (as above) and do a Crucible over with Borax, put the Gold in it, and let it flow, force it off from the Bellows or in a wind-Oven, untill it appear very bright, and holdeth the blow, so is it deft, then lay a paper anointed with Wax or Tallow upon it, and while it yet burneth, cast it in an Ingot, which is done over with Wax, and is warm, then quench the Gold in Orine, so you will have fine Gold and deft Gold.

You may also be instructed, if you have quite done cementing, and hast much of the used Cements in which Tobring the is the Silver, and Addition which hath been in Gold, Gement to then melt the same Cement with other sweepings which is not Goldish through a melt Oven, and bring it to profit, so that the Silver which the Cement hath suck'd in out of the Gold may be made again to profit, for the Cement takes no Gold to it.

But, as for the Cement of which the Philosophers and Alchimists do write, by which one may change Cop- Philosoper into Silver, and Silver into Gold, those I leave to ments their worth, for such belong not to these Cements. For in my Books I write nothing else, but what is natural and approved, upon which one may trust, and not labour upon a vain hope.

111

Finegar, and

CHAP.

CHAP.

CHAP. XLV.

How to graduate Gold.

Section.

1.
The first way.

give the Gold a higher Colour above its fine natural Colour, to become more red, its right high Gold colour) is to be done thus: take good Rhenish Gold, add to it as much fine Copper, cast it together, beat it thin, and cement it off again that

it may have its first Gold-weight, then fet to the Gold, and so much pure Copper again, and cast it together, beat it thin again and cement it the second time, and so do untill the Colour pleafeth thee: By this Process, some think the Gold may come to fuch an high Colour, that it will exceed the Copper in colour, if it were thus cast 30 times with the Copper, and cemented off again, only that one must use the Cement (written hereaster) which is much better than a common Cement: namely, Take the Ponder of Tile which is well dryed in the Sun, and common Salt once diffolved through the Filtre, purified and once glowed, make out of every one, a part of small powder fearfed through a hair fieve, and then put in Roman Vitriol, first rubified, as followeth: Take good red Vinegar distilled through an Alimbeck, and in this diffolve the Vitriol, and purify it through a Filtre, fair and clear, and let it evaporate upon warm Ashes till you find it fair, then put it in a new Pot, fet it betwixt Coals, and stir it about with a little wooden stick, till it becomes blood Red, let it be cool, and grind it fmall, and then 'tis rubified: also take Verdigrise, and dissolve it in distilled Vinegar, and distill it by Filtration, and let it evaporate,

A very

evaporate, and glow it, as you have done with the Vi- CHAPI triol: Take also so much Sal Armoniack, dissolved in XLV. red Vinegar: and of these now mentioned powders, take of one fo much as of the other, mingle them well, and sprinkle them with the Vinegar wherein the Sal Armoniack was diffolved, so is the Cement prepared.

Some do write, I hat one may mingle the Gold with section. the Copper, alike in weight, and then to cast it through Another Antimony, and then blow it off and purify it, and again 50%. with the Copper, and so mingle and cast it through so often till the Gold receives thy defired high Colour: I believe also, That if one can have good Antimony, that it will give the Gold an higher Colour.

But the common Graduations may be done thus, That one may make a Powder of two parts Copper, and one part of Sulphur; Calcine them together till no blem flame goes off them, so you have a Graduation Powder, grind it: and when this Powder is used, the Gold will be of a little lighter (ontent.

Of fuch high Graduated Gold, and how to be used, How the many of the Philosophers do write, but tis nothing to Gold smiths this, for in my Judgment, when 'tis indifferently brought may Gild. high, it may be most convenient for the Goldsmiths to use tor guilding, that they may reach the further with it, because of the Colour, yet it is free to every one to make Experience of it.

ling to, mught flow in the I excelled before the Saft Peter

CHAP. I and this enob even now as it

XLVI. CHAP,

How to make brickle Gold, deft.

Section.

HIS Labour hath formerly been efteemed a fingular Art of the Coin-workers and Goldsmiths and other Gold-workers, and indeed it is a fine and useful Art, not to every one known, and is necessary to be know to all Goldsmiths: For there

are several wayes to make the Gold deft, only one is more easy and better than the other. And I will here shew some wayes, which partly I have tryed my self, and out of which every one, according to his occasion may take Instruction, to use that which will be most convenient for him.

Hungarifts Crowns or Gold.

When you have the brickle Gold (it may be Hungurian Crowns or Rhenish Gold) and wouldst make it deft, then do it thus : First, Cast the brickle Gold into an Ingot, then put it in a Crucible in a coyn'd Oven or before the Bellows, and give it a strong fire, and observe when the Gold sweateth, and will soon flow: Then cast good purified Salt petre upon it, so the Gold will burn, because of the Salt petre, and quickly flow, and as foon as it flows, then the Salt petre will quite cover the Gold, then you must not drive it hard, so as you may not see the Gold under the Salt Petre, but pour it out under it, into an Ingot, luted with Wax, so is it Deft; Calx viva fome use among the Salt Petre, Calx Viva, it doth the same, and the Gold becommeth deft.

But if it should be neglected, that the Gold in the setling in, might flow in the (rucible, before the Salt Petre were cast upon it, then pour it out again into an Ingot,

and

and put it in again, for else it will not be smooth and deft Chap. although you do cast much Salt Petre upon it; but if XLVII. the Gold (as in the Rhenish Gold sometimes hapneth) were not too brittle, that it at once doth not become very dest, then put it in the second time, and it will become

deft, although there may be Brass in it.

You may know also, That when the Gold shall be driven too hard with the Salt Petre, and that it appeareth and may be seen under the Salt Petre, then it is not dest, for the brittleness driveth it self again out of the Salt Petre into the Gold, therefore 'tis to be observed, That the Salt Petre be cast upon it in the right time, and also the Gold cast out again, in the right time, and so you will have dest Gold.

CHAP. XLVII.

Another way to make Gold, Deft.

ONCERNING the good Gold, or of Hungarish Content, if the same be brickle, Test. then take a flat Test, made for it on purpose, that the Gold may have room upon it, Lute it over with pure Littarge, and set the Gold upon it (yet you must

not set in it, at once, above two Mark) and set the Test with the Gold before the Bellows, and drive it; But if it will not endure the blowing, then add a little Ball of good clean Lead, and drive it again, until it will endure the Bellows and become dest, then put it in a Crucible, and cast it into an Ingot, and quench it in Vrine, and so the Gold will be dest, one may also cause the Gold to K k k

CHAP flow with fresh coals, upon a flat Test, and then drive it,

XLVII. and this also doth well. Section-

But if you will cast such Gold (if it be good or To bring the light) out of the Crucible on a Plate, then take a Paper, and dawb it over with Wax and Venetian Soap, cast a little piece upon it, and while it yet burns, lift the Crucible off, and cast the Gold out under the flames, and so it will remain warm and have no fcum, and cast it self clean. that nothing may remain hanging on the Crucible.

When the

out of the Crncible.

If a good or Hungarian Gold become brickle, because of an unclean Fire or bad smoak, then it may also be evil Vapor. made deft, upon a flat Test, with the Bellows, or one may, when tis cast into an Ingot, lay in one of the before written Cement Pouders, an hour or two, and so it will

become deft.

Or melt it with good Venetian Borax, and drive it before the Bellows, till it endureth the blowing, or in defect of all these Ingredients, if a Gold be only brickle by an evil smoak, then make it deft with Venetian Soap, and let the Venetian Soap burn upon the Test, then there will remain a gray Pouder, which you may use instead of the Borax, and so the Gold may be cast clean.

Sublimatum.

Some also cast upon the Brickle Gold in the Fluss, Mercurium Mercurium Sublimatum, and blow the Gold with it, and it will be deft (which is a good way) others on the contrary use yellow Sulphur, but the Gold must be cast out foon after it, or take Antimony, and cause it to flow in a Crucible, and when it is flowing, then they cast as much Sulphur and Argol in it, and let it stand so long in the fire, till it become a Glass, and with this Glass the brittle Gold is to be driven deft. How how and whole book

Some of the Goldmiths use a Pouder, made of Brass calcin'd and Verdigreafe, but it should not be so, for both these species are Metallish and go in the Gold, by which

it becomes higher or meaner.

CHAP.

Sulphur, Antimony, Glafs.

6.

CHAP. XLVIII.

How to make Gold Deft upon the Copel.

HEN you have good Gold, fet it with Lead upon a Copel, and let it be very hot that it may stand pure and clean upon the (opel, but before it hardens upon it, put it with the Tongs gently on the Copel, that the Gold may simper and quit. ver; do this till it become hard and standeth still, then 'tis deft, but if it harden upon the Copel, before it be moved, then 'tis not deft, but all fuch Gold receives a pale colour of the Lead.

And although many other Ingredients do make the Gold Deft, which are often used of many, yet I will not fet them down (for brevity fake) but leave it to every ones freedom, to follow mine or their own Instructions, only I defire they would dilligently observe my meaning, not only in this, but in all my Books, and not neglect Alternions the Work it self, then I hope they will find it right, as they defire, and the Work will judge it felf. For fuch a thing cannot well be so pictured on paper, as thereby to judge and comprehend all out of the writing, but by reading Instruction comes, and by Practice the Experi-

fine and to the higheft) which is done thus. If the co

part of the Gold (if it be of a pretty rich Content) and

ACHAP make it was 17, 18 or 20 Circus, and

CHAP.

CHAP. XLIX.

How to cast Gold through Antimony.

Section.

1.
Through fine Gold.

through Antimony, so that the Gold by it may be made very clean and fine, and therefore, they have supposed, this to be the only means, and none else besides, by which fuch may be done. Now this is true (when the Antimony is good) that the Gold may be brought out very high, and almost fine out of the same, so that it will become the finest Gold that is, and no Cement can be made like it. But because Antimony is not all alike good, but some much better than the other, therefore the Gold becomes fome finer than the other: fo it is not well to truft to this, that the Gold should alwaies come out fure and very clean. And although the casting through Antimony be used sometimes upon many Marks of Gold, yet 'tis not taught fo, that all fuch with it may be brought out very fine, and upon the highest Content, but it may satisfy, if it be brought in the quantity, upon the Content of good Duccats, for by the higher driving, the Antimony comes into the Gold, and without a fingular Care in purifying of it, it goeth much more off, than by Cementing; therefore the best casting through is upon a little Gold (to bring fuch almost very fine and to the highest) which is done thus. If the content of the Gold be of 16, 17, 18 or 20 Carats, and you would make it very pure and fine, then take one part of the Gold (if it be of a pretty rich Content) and

two parts of good clean Antimony (because the clean

T is an old Invention to cast Gold

Gold is sooner to be cast through) put it together in a CHAP. a Crucible, blow it, let it flow, and when well flown together, then pour it into a warm Cup, made of Iron or Brass, and greated with Tallow or Wax, let the Antimony and the Gold be cool in it, then you must turn the Cup, and dash it upon a stone, whereby the Antimony may go together with the Regulus (which hath setled below and looks of a gray-yellow colour) and be eafily beaten out.) But that you may bring the Gold upon the highest Content, cast such Regulus once or twice more with fresh Antimony, and at all times into the Cup, after set the Regulus upon a flat Test in the fire, blow to it, and it will melt quickly, but blow with the Bellows very gently, so that it may just blow upon the Gold in the Test, and do this until the Antimony be evaporated, again very clean from the Gold, and that the Gold do endure the blowing well, and becomes deft, then let it be cool, and quench it in Vrine, cast it then to thy pleasure, so you have very fine and high Gold, which is judged fine Gold.

But if the Gold be poor upon the Content, or very light, then take more of the Antimony, and add to a through Mark of Antimony 4 Loths of Sulphur, and cast the Poor Gold. Gold through with it, as hath been faid, and put in the Regulus with fresh Antimony, the second and third time without the Sulpbur: Lastly, drive it upon the Test, that the Gold may become very clean: you may also take to such casting through, upon every Mark of Gold, 4 Loths of Copper or scales of Copper, so it will receive a fine colour from it, but when you take Copper to it then take the more Antimony that it may consume it and the Addition.

Some use to the casting of light Gold, which containeth Another of it, from 12 to 18 carats, a singular Powder of one part Geld. Sulphur the other Antimony, and one part of prepared Caput

CHAP. Caput Mort. and take to it of Mark Gold, 12 Loths: XXIX. let it flow well together, then cast it into the Cup, and beat the Regulus from the slacks, and cast it with half so much Antimony again twice or thrice, then drive it upon a Test, so you have good high Gold.

Now, how the Cup, Ingot and other Instruments to the casting through are to be formed, the follow-

ing Sculpture will shew.

Sculpture XXVIII.



Deciphered.

- i. The Form of the Common Cup, cast in Brass.
- 2. A Cup made of Smiths work.
- 3. A Crucible for the Work.
- 4. A flat Test for it.
- 5. The Ingot.
- 6. The Plates:

7. Of Antimony with a Gold Regulus. CHAP. 8. Of Antimony when the Gold Regulus is beaten from the Gold Regulus, which will be rellow antimor?

When the Gold which is come out of the casting To lay the through, is blown clean, yet it may retain a finack of the Gold which Antimony: to prevent this: Beat the Gold very thin, through the lay it in a particular Cement made on purpole, as is mentioned in the Description of the Cements : Let it stand fome hours in it, so it will extract such also, and becomes way if one have need of the Gold in hall, elie der mals

once or evice with Sulphin, that it may be driven delt. and then cast into and Leve Line and coment-

How the Blick or light Gold, containing much Silver, is to be Separated.

at laft the Gold, recain finely, and put it HE Silvery rich Gold, especially that which comes of from melting, of which a Mark contains from 9, to above 12 Carats off fine Gold, this is to be leparated thus: Grain it in a boyling Water (as above is faid of the fine, thin and

even Silver) then prove it, so as it hath a like Content, then take the Grain'd and moisten it with water, and take to every Mark (of the above-mentioned Pouders) 12 loths. of good yellow Sulpbur, and mingle it with them, and put it in to a glazed Pot, luted with a cover, and make a fire round about it, till the Pouder on the grain'd be well flown; let it cool, then beat the Pot in pieces, then take and put the grain'd into a Crucible, let it in a Wind-Oven, let it flow very well, and cast upon it a little ground Sandover, mingled with grain'd Lead, let it stand a little longer, then pour it into a warm luted Iron MorCHAP. ter, and if much of it setleth to a Regulus on the bottom, and the Silver becomes a scorias, then beat it off from the Gold Regulus, which will be yellow and gray, but because the Silver of the first Fluss, will not all come into the scorias, therefore grain the Gold once more, and prepare it with the Ponder, and let it flow, and pour it again into the Morter; Lastly, take the Gold, and cast it through only with the Antimony, blow that which is cast through upon a Test, and cast it clean, so you will have good and Deft Gold; This casting through, is a way if one have need of the Gold in halt, else there are other and better ways, namely, when the Gold is cast once or twice with Sulphur, that it may be driven deft, and then cast into an Ingot, then beaten thin and cemented, whereby not so much will go off from the Gold, but it requires greater time.

The used Antimony, through which you have cast To east the at last the Gold, retain fingly, and put it again in a Crucible, and let it flow well, and add to it filed Iron, fo much, that the stirring-hook with which you stir it about, may no more be touched, fo the Antimony, cats it felf weak on the Iron, (which it doth eafily touch) and doth let the Silver and Gold fall, as much as it hath with it, then pour it into a Morter, and according to the quantity, the Regulus will fettle it felf on the bottom,

this retain fingly or apart.

The scorias which is come from the first casting (as above is mentioned) put likewise into a Crucible, and beat down the Silver in it with grain'd Lead and filed Iron, as long until the scorias, with the Iron Hook (that stirreth it about) toucheth no more, by this time, almost all the Silver will fall down, and of this Silver, retain also a part.

The remaining scorias with the Antimony, which is left out of the Silver and Gold, (as now fignified) be-

To beat (through casting) the

Section.

used Anti-

The Iron

takes the virtue of

the Anti-

mony.

ing precipitated; take them together and put the Lead CHAP. upon a Flat Test, or in an unglased Clay Dish, set two LI. of them within one another, and when it is entred, then let it go off upon a Test (as is usual) and observe when the entred Lead begins to drive upon the Test and goes clean, then put the Silver Regulus (which is fallen out of the scorias) upon a Test, that it also may go off clean, and then this Silver Proof upon Gold, will shew how rich it is in Gold; also prove the Regulus, which is fallen out of the Antimony upon Gold. If now the same Regulus, (which before by it felf is to be burnt upon a Test) be not very rich in Gold, then put it also among the Silver, and separate it apart in Aqua fort. and you will hardly find a nearer way to make such Gold clean: and although this Instruction looketh as if there were an Ambiguous way, yet it is not; but when one is in work, then it goeth foon to an end; for the Gold, thus with the Sulphur and Antimony prepared, floweth eafily, and thereby many castings may be done in a day, or in half a day; yet every one may require a confideration, how the best is to be done.

CHAP. LI.

How to separate the used Antimony!

N regard that the burnt Antimony keep. eth back somewhat of Gold, yet there re- To Refine Antimony. mains Gold and Silver in it, now to bring this clean out of it (which is called to refine the Antimony) do it thus: Put the used Antimony together, in a Crucible, and if it be a pound, then add 4 Loths of filed

Mmm

Iron,

CHAP. Iron, I Loth of Copper, 4 Loths of Lead, and 4 Loths of LI. Littarge to it, let it flow well together, then cast it into a Cup, or let it cool in the Crucible, then set the Antimony again in the Crucible, and beat it down with a little grain'd Lead and Littarge, and cast upon it melted Salt; let it stand well in the Glass, and cast it into

melted Salt; let it stand well in the Glass, and cast it into the Cup, then drive off the Regulus which cometh out of it, upon a Test, then you will receive the Gold and Silver, as much as the Antimony had retained; this you may cast, once more through with fresh Antimony, and so the Gold will come out, yet the Antimony will re-

fo the Gold will come out, yet the Antimony will retain still some of the Gold, (which comes in the Silver, made out of the Antimony) and this is to be separated in the Aqua fort. and if it be too rich in Gold, then must

be added to it, fine Silver, that the Water may touch

it.

But some do use the parting of the Antimony thus, they take a part of Antimony and one part of Vitriol, one part of grain'd Lead, one part of Salt Petre, three quarters of filed Iron, and a little Copper, and this they put into a Test, and let it evaporate, so there will remain among them another mixt matter, to this they add (according to the quantity of the Antimony) more fresh Lead, and boyl it clean up, then drive the Lead off upon the Test, and so will it find in it self the Silver and Gold,

which the Antimony hath had by it felf.

Rich Antis

When the Antimony is very Rich in Gold and Silver, then may it be made pure, as followeth (and it is the best cleansing, only that it taketh much labour and somewhat longer time) Take the Antimony, put it upon a Test, let it slow well, and add to it filed Iron, and stir it about always with an Iron, and cast as much of the filed Iron into it, until the Iron, with which you stir it, touch no more the Antimony (as before mentioned) which is then very easy to be seen; then add to the same Anti-

mony,

mony, Lead, and boyl it clean up, by this addition of the CHAR. Iron, the wildness is taken away from the Antimony, so LII. that then (which is very easily boyled up) it will go clean off upon the Test, and will not work upon the Test, which is a good way.

CHAP. LII.

describe of the Gold Outstand their

How Gold may be made fine and clean through Aqua Regis.

ly the Gold and not the Silver, therefore I judge the Gold may be made pureft and finest by this way. Take good bigb Gold, set it upon a good Test, made on purpose for it) let it go off upon it, with clean Lead, that you may be sure

no Copper remains in it, then blow the Gold upon the Test, unless it become deft, then beat it thin, glow it, and then put it in a good and well luted Glass Bottle, pour upon it AquaRegis, and dissolve all the Gold, and what will not dissolve but remain in the bottom of the Glass, that is no Gold; then pour the Aqua Regis (in which the dissolved Gold is,) clean off, and put it in another glass Bottle, and draw the water from it, then the Gold will remain in the glass Bottle; cast it together and blow it clean, and this Gold thus prepared may be judged, as fine Gold, because the Aqua Regis toucheth nothing but Gold and Copper, and if the Gold be first made clean from the Copper, upon the Test, then can nothing else but

CHAP. pure Gold come out of the Aqua Regis, but how much LII. good AquaRegis (as I have faid) is to be made, of this, you have been sufficiently instructed before.

CALISE due Aqua Regir couchenn

with clean bead, that the man be

I judge the Cold may be made purelly and fireft by this way. Take cood

Thus much Courteous READER, I was willing to describe of the Gold Oars and their Labour, as a furtherance to Experience, and for the use of common Mine-Workers, and yong Assayers, and so leave it to further Consideration.

How Gold may be made fine and clean chain

The END of the fecond Book.

then put it in a good and well lined Ghele borde, pours upon it Aqua Regis, and dissolve a take Gold, and white will not dissolve but remain in the beston fields Ghe Ghe Ghe that is no Gold; then pour the endma foreit (in which the dissolved Gold is,) clean off, and put it in another glass Bottle, and draw the water from it, then the Gold will remain in the glass Bottle; cast its together and blow it clean, and this Gold thus prepared may be judged, as it clean, and this Gold thus prepared may be judged, as fine Gold, because the state of an earn nothing the but from the Copper, and it the Gold has first made clean from the Copper, and it the Gold has first made clean from the Copper, upon the Test, on a can nothing else bust

OF Copper OARS.

BOOK III.

CHAP, I.

How to know Copper Oars.

HIS Third Book describeth Copper section. Oars, and how they are to be known, The Purpose and then how to affay them, as also of of this Book. the Black Copper; and lastly, how the pure Copper is to be tryed, and also how after the High Dutch and Hungaan manner the Silver is to be refined

out of Copper, with Instructions annexed of a singular new way to refine Copper, and how Brafs is to be made out of Copper, and how white Iron may be made Copper.

Now, Copper Oars are more eafily to be known than Coper Oars any other metallick Oars, as having in them varieties rield fine of Colours, so that many more delicate colours come out of them then from any other metallick Oars. And of thele there are three forts.

First, Copper Glass, and this is to be numbred copper among the deft, and smooth flowery Copper Oars, for the Glass. Copper-Glass Oars which are blewish, (and yet their colour come near to Grey) are the richest Copper Oars, and contain the most Copper and Silver, and yield deft and good Copper.

Nnn

Se-

Copper

CHAP. Secondly, the green Coppers which are rich in Copper I. but poor in Silver, also the fair lazure colored Copper or blew and Green-mixt-copper-Oars contain likewise much and good Copper, but generally very little Silver.

Thirdly, the brown copper Oars (like an iron Vein)

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Thirdly, the brown copper Oars (like an iron Vein)

Gamabes. Snails, and other Resemblances and representations of corporeal Creatures) and also rich in copper, and commonly do contain Silver.

In brief, all copper Oars and sbiffers that have no flinty, speizy or other harsh matter within them, are to be

reckoned among the foft flowing Oars.

But there appertains to the barsh flowing copper Oars, the harsh copper Flint, and what is splendy, mispickly, glimery or spady, as also all flint Oars by themselves without any other Oars mingled with them, or shifters in which the copper slint doth stand streamingly intermixed.

Also the raw flack stone, copper-stone (Oven-breach-

ers occasioned from melting such raw Oars.)

Now, as the filverOars are known before the proving and melting, (as to their natures) and how they may do in the fire, so it must be known likewise with the copperOars, that one may help them in proving and melting: And because they differ, therefore the raw, unflowing copper oars do not prove like the weak flowing and milde, as will follow in my Instructions, but it must first be shewn how the Assay Crucibles also the little Ovens for proving copper Oars are to be made, (and in case of necessity) that an Assayer himself may prepare his stuff and Instruments.

CHAP.

Section,

CHAP. II.

How to make Crucibles and Ovens to prove Copper.

O the copper Oars which are to be proved for Copper, one must have little and good Crucibles for them, which the Goldsmiths do use: But, because they are not to be had in every place good, and in a fit Mould, therefore I Judge ent, That every Assayer do make such

it convenient, That every Assayer do make such

himfelf.

To the making such Crucibles, Frames or Moulds of 2: Brass are necessary (or of Pear-tree wood, so that one form. may put on it an Iron ring, that the Mould may not be

fo apt fo break.)

The stuff or clay out of which you intend to make The Clay? fuch Crucibles, prepare them of Potters Clay, like the Tests for making Proofs of Silver Oars (as is before signified) then take a Ball of fuch Clay (as much as you think fit) and press it into the frame or mould, so that the Clay on the fides may well go up and in the middle remain a pretty deep hole: after the manner that the Crucible is to be: then anoint the upper part over with Bacon, or Oyl; and put it into the Frame, in which the Clay is to be pressed until it toucheth the top of the Frame, then turn the upper part of the Frame down. wards, and that which is put in will eafily be drawn out again; and thus the Crucible is formed in the frame, as it ought to be, fet also the frame (while the Crucible stands yet in it) a little while before the Sun to be warmed, then the Crucible will go out very well and found, and, although it might be pressed out otherwise, yet it

CHAP. cannot be done so conveniently as when it hath stood II. a little near the warmth, because thereby the Clay doth shrink, so that the Crucible by that heat may well fall

out of it self.

But why the lower part of the Frame must not be fastned, the reason is, that the Crucible may be lifted out of the upper part of the frame, and it could not be brought off again without spoil, therefore it is better the lower part remain ungreased, that the Crucible may be brought out whole. But when the stuff is made very brittle, and the clay not fast, then annoint the lower part with fat, and the Crucible will easily be brought out with your singers, and so remain whole.

Thus they make Assay-Crucibles, and when they are well dryed, let them burn in a Potters-Oven, or a Tile-Oven, yet let them not be set in too strong a heat (lest they melt) and they must be taken out in time.

Section.

4

Little
Ovens for
Copper.
Proof.

But what concern the little Ovens, (wherein they use to take the Copper proofs) the best are prepared of Potters stuff or Clay, to be set and used at pleasure: and make them thus, Take the prepared Potters-stuff, and form of it a little round-Oven, the diameter nine inches wide, with which the Proof Oven useth to be divided, (of which Instruction is given in the first Book) and 12 inches high, and in the midst a Belly of 11 Inches, and no bottom below, yet it must be an Inch and half thick, and as much as the clay shrinketh, so much must be added again, and whilst tis yet fost, it must be cut in the edges, that one may put Iron-boops about it, and with Gross-Bars joyn the upper and lower Hoops, or else it will very eafily fall afunder: Now, when this Oven is very well dryed in the Sun (or warm place) then let it be burnt hard in a Potters or Tile-Oven, and lute it well about with the Iron-boops and bonds (as has been already taught)

After

After this make a foot with a bottom, to this Oven CHAP. of Potters stuff, being three square singers deep within, and just so broad as the little Oven below, having a hole in the fide, as wide as the breadth of a large Finger, through which the Bellows is to blow (as you will hear hereafter) and there may be an edge within the top upon which you may lay a little Iron-Grate, as in the Sculpture: this foot must also be burnt in a Potters-oven, and bound about with iron-boops and bonds, as the oven: then lay the Iron-Grate in it, and fet the Oven upon it, then tis prepared as it ought to be.

Now, when you will prove in it, fet it upon the Grate, in the little Oven, on a little foot made of Poters Clay, which must be three square fingers high, but not full three fingers broad above, upon which the (rncible is to

stand with the Proof.

Also there must be little Covers to the Copper-Proofs, which must be put to, or luted upon the Assay (rucibles: and they must also be made of Potters-stuff, and burnt as the other, but not by a fudden heat left they crack: and be careful to cover the (rucibles, that no Coals or uncleanness fall therein, whereby the proof may become falle.

There may also a little oven be made, just in the form section. and wideness as before, only that it have a Bottom and Another be 14 Inches high from the bottom, and that two inches Form of a little Oven. from the bottom there be two holes quite through it, in which you must fix two Iron Bars a finger thick, and lay upon it a little iron Grate (like that before) and under the Grate let there be made a hole of a finger wide for the Bellows, This little Oven which also must be Hoopt about with Iron, and is in all things like the other only this is whole, but the other may be taken alunder in two

In case you want Bellows to such ovens, there is ano- oven of 000 ther Tiles.

II.

CHAP. ther Oven to be made, in which the proofs may be proved: thus, Take burnt Tiles, joyn them together in a square, about a span wide, with good Clay, and lute the joynings with it, and leave a Wind bole before, as wide as the oven is, a Tile and half high, and over the Wind-hole in the Oven, lay a little Grate of Iron, and four square Bars, a finger thick, and a span high from the Grate, fo is your little Oven prepared, but before you prove in it, you must glow it with fire; that it vapour not in proving, then fet upon the little Grate a little foot, for the Crucible to stand on, and when the Crucible with the proof is set in, and coals and fire put upon it, and that it grows warm, then fan in some air with a wing, by the Wind-hole in the little oven, fo the wind will ascend through the Grate into the fire strongly, and the Copper-Proof will boyl it felf up in the Crucible: This is an eafy way for preparing this little oven, but you must observe to do things exactly, that the Proof may be compleat in the fire.

There are also used to the Copper Proving Furnaces (fuch as Gold-smiths have) to boil up the Proofs before the Bellows: but I judge because the blowing in the Furnace goes but on one fide of the Crucible, therefore the Proofs cannot be so well boyl'd up on all sides, as with Bellows which go from below upwards. Also when the Bellows blow but on one fide, the Crucible is apt to break, especially when 'tis not good: therefore how the above-mentioned Ovens are to be formed within and

without, is shewed in the Sculpture following.

Section. Proof of Furnaces.



Deciphered.

- 1. The infide of the little Oven made of Tiles.
- 2. The fame, when it's closed.
- 3. The foot of the Crucible upon the Grate.
- 4. The little Oven of Potters-Clay, bound with Hoops.
- 5. The foot of it.
- 6. The iron Grate in it.
- 7. The Crucible upon the Grate with the proof in it.
- 8. The Wind-hole through which the Bellows are put.
- 9. The Whole little Oven open with the Bottom.
- 10. The Iron-hoops which go about it.
- 12\ The Bellows, Brush and Instruments.

CHAP. HI.

CHAP. III.

How to make a Fluss to prove Copper Oars.

AKE two parts of Argol, and one part of Sulpbur, grind them small and mingle them, put it in an unglazed Pot, then put live Coals in it, when it begins to burn in the Pot, let it burn till it gives over of it felf, let the Pot be cool,

fo the Fluss is prepared; then take it out of the Pot, put the Coals away, and keep the Fluss small ground in a warm place, so it will remain good; for, if it be set in a cool and moist place, it will turn to oyl: or, take the pot, let it be warm, pour the Fluss into it, and cover it; thus the Fluss will kindle it self in the pot, and burn out: this Fluss is to be used to good and deft Copper Oars: But what be flinty, and other Oars which are hard to separate, to such this Fluss is too weak, and there must be something added to it, as you will hear in the fequel.

CHAP. IV.

How foft flowing Copper Oars are to be proved.

CH smooth - flowing and good copper oars (which are not flinty and speizey) prove them thus, Grind the oar fmall, and weigh of it with thy proof-weights two Centners, and put them in a Crucible, and three times fo much of the before

before mentioned Fluss, both well mingled, and cover CHAP. the Crucible above the Oar and Fluss with common IV. Salt a full finger thick, press it down and cover the [rucible luted with Clay, that it go not off, nor Coals fall therein, and make a fire in one of the faid little Ovens, fet the Crucible upon the little foot, cover it with Coals higher than a hand breadth, let it be warm, and blow through the hole under the Grate, that the wind may go alike round about the Crucible, and let it stand a while in the fusion, so the proof will boyl clean up, and if the (rucible doth not break, then take the upper fire off and lift the Crucible hot, out of the Oven: set it upon a plain Tile, that if the Grains of Copper be not run altogether, it may be helpt: Then let the Crucible cool, open it, and in the bottom you will find a grain of Copper which is fine. For these good smooth Oars will yield fine Copper: Then draw it up with thy proofweights, and try how many pounds of Copper a Centner of Oars doth yield. But you must observe in the proving, that you drive not the proof too hard in the Crucible, for the Copper will burn, and drive it felf very easy in the flacks, as one may see in the flacks; (which will foon receive the colour of the Copper Oars) for when they are very red in the Crucible: then the Copper - Proof is driven too hard, and the Content is lighter, but if the flacks are brown, then the Proof is

Ppp CHAP.

ore mentioned Flags, both well mingled, and cover

CHAP.

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How hard flowing Copper Oars are to be proved.

Section.

1.
The manner of it.

ARD flowing Oars are not to be proved as the smooth, but in another manner: thus, Take the Copper Oars, beat them as small as the Seeds of Hemp, and and mingle them together: weigh two Centners of it in the proof-weight, put it in a proof-Test, set it in a proof-

Oven, give it a very gentle fire, that it may begin to roast it self, then stir it with an iron about the Test, else the Oar will turn to Ashes together in the Test, and will not rost: and when its stir'd the first time, then give it a little stronger fire, that it may glow well, list it out of the Oven, and let it cool, then put it in the Oven again, and let it roast again untill it hath done smoaking (and smells not of Sulphur) then grind it a little smaller, yet not so small as Mill-dust, and roast it again till it stinks no more Sulphurish, then stir it once or twice with the little hook, that it may not be ashes again.

2. The Oar burnt quite dead. When 'tis thus ground anew, and wash'd the second time, let it cool, and set it the third time in the Assay-Oven, then roast it, and grinde it very small, then wash it once more that it may be burnt quite dead, then grinde it again very small, so is it prepared for the Proof. Then divide the Oar upon a Ballance in two equal parts, and put one part in an Assay-Crucible with 3 times so much of the foresaid Fluss, and with a fixt part of slowing Glass-Gall, mingle them well in the Crucible, and cover it with common or slowing Salt (as in the proof before)

and lute it over on the top with Clay, that the Cover CHAP. be fast, so that no Coals may fall in, then set it in a little V. Oven, blow the Bellows, give the proof a strong sudden fire (a little stronger then the former proof) and when the proof hath stood in a pretty good Fluss, then lift the Crucible out of the fire, and let it cool, and break it, and so you may find in the bottom a Grain of black Copper, of fuch Goodness as the Oar and Flint is in the melting, and may thereby get Copper, which is the right proof of it.

Yet there is of one fort of flinty Oar, fairer Copper section. than of another, and commonly all flints which are of an some Copiron Nature) yields iron streamy Copper, therefore they for not fitter.

are not to be used for making of Brass.

Of this graind Copper (as it comes out of the Proof) weigh it with a Centner weight, then you may fee how many pound of black Copper, a Centner of flint or raw Coper Oar do yield, so you may easily reckon how many fuch Centners, do afford one Centner of Copper : and know therefore, that if you do weigh two Centners of flinty oars to the proof, if the proof should be amis, then you have a Centner more of the roasted Oar or flint, to make another proof, otherwise it will be a great hindrance to roast but one Centner to the Proof.

But on the contrary, the old Assayers have used this Method, and proved every Copper Oar or flint upon pure Copper, and thereby know how many Centners of it, will yield one Centner of pure Copper: this I believe to be a just proof for them, who have roasted and purifyed the Copper themselves. But those who work the Silver in it, and fell it with the Silver, it is better for them to know how many Centners of black Copper they may have in a roaft, so they may know how many Loths of Silver, a Centner of black Copper contains.

And among all meltings, the Operation of Copper upon

CHAP. (upon which is to be made a proper Account) is the most pleasant and fairest Experiment; for if the Proof be

right, then what is produced will be fo too.

Section. To boil Copper.

Therefore, if you will (with the old Affayers) prove the Copper-Oars upon boiled Copper, do it thus, Grind the Oars small, weigh of it two Centners: if they be unflowing or flinty then roaft them (as above) in an Affay-Crucible, and weigh to it four Centner of Fluss or Lead-glass, made of Littarge and Flint-stones (as in the first Book of Silver Oars) and mingle them well, and cover it with Salt, and also cover the Crucible, and fet it in a little Oven before the Bellows : and let it flow like another Copper Proof, and when 'tis cool open the crucible, and in the Bottom is the Regulus, among which is copper, and lead together, put it upon a flat Test luted with Littarge, drive it till the copper appears to be of a clear Green, then lift the Graind-copper from the Test, and quench it in Water, and weigh it with thy Proof Weight, so you may finde how many pound of boyled copper you have from two centners of flinty-copper Oar in the Proof: one may also very easily burn the copper, especially if the Oar be poor in copper (as you may finde by the Operation). Therefore I conceive it better, to prove the copper Oars first upon black copper, and then upon boild copper: and this way, the Proof of the light contenty copper Oars cannot so easily be hurt.

CHAP. VI.

How to prove light Coppers.

OOR copper Oars (especially the copper Flints and copper Glass which are in the Mountains or in light shiffer Mines) they must be proved thus; Take a common Proof of the Oar, grind it well, and weigh with thy Proof weight

twenty or more centners, and draw it in a Vessel, so that therewith the light clay may be separated from the pure slick and copper Oars; weigh the slick which comes from it, thus, and mark how many centners yields a pound, that you may know how many centners of raw Oar (from the Rock or vein in the Mine) do yield a clean centner.

Weigh then two centners of fuch pure flick, and put them in an Assay-test, to be roasted in an Oven (as you have done with the copper Oars) but that the proof may not be false, (because the flick doth use to sparkle in the first setting of it into the great heat, especially if pibbles be among it,) therefore cover the Test wherein the weighed flick is, with another Test; let it remain thus covered till the flick glow well; then take off the upper Test, and roast the slick (as you are instructed before) and then grinde it very small, and divide it into two equal parts, and mingle one of them with the Fluss (appertaining to the copper Oars) and put it into a crucible, covered with Salt, and do as you have done above with the harsh copper Oars, and you will find in the bottom of the crucible, a grain of copper: then weigh this with your Proof-weight, fo you may know out of how Qqq

Section.

VI. many centners or quantities of fuch ram, rocky or wash-VI. work you may make of a centner of black copper, which grain'd copper you may prove afterwards for Silver, and find the Content, and maist order thy matters accordingly.

Sellion.

This proof upon poor mixt copper-oars, I have put here because experience manifesteth, That the Copper Oars do not break throughout clean upon the Veins, but have much flint and subtil copper - glass mingled with them, yet in the washing they do willingly separate from it, and bring it into such a compass that one may know that all the rest of the Oars from those Veins may be wrought to good prosit, which could not be, if they should be melted raw.

Concerning the poor Shiffer which contains very little Copper, they cannot well be brought into compass, for they rise for the most part in the Water, and are fugitives, although some do separate in the water, and afford a slick, and thus they may be brought into compass, and may be thus proved, and made to profit like

Then the Copper-flint will stand apparently mixt and streamy, in some shiffers which are to be proved either raw or among others, or the shiffer apart whereby it may be found what copper the Shiffer doth yield,

and the melting ordered accordingly.

the other oars.

The other mixt copper-Oars (as Lasure Copper green, or brown rich copper-Oars) cannot be well separated in the water from their mixtures, for they are very light, and run not in weight, like the other stints, but go forth in the water, therefore such are first to be proved for Silver, if they have none (as commonly they are poor) then tis not much to try, but if they contain Silver, glow them hard, and suddenly quench them in cold water, then the insperged or mixt Copper Oars will

run

run together in little Grains (as above is fignified of the CHAP. Gold Oars) then wash and grind them small, and draw VII. it into a slick, and when it separates, then you may in the great Work according to the quantity of slicks regulate your self. But how these copper Oars are to be dryed in the little oven, you will be directed hereaster.

Home to prove III CHAP. VII.

How light Copper Oars which are mixt and insperged with flint, may be brought to profit.

HE light flinty insperged copper Oars

(by reason of their hardness and unflowingness) cannot well (in a great quantity) be melted throughly, or brought to profit (the flint being to hard, and before it become small enough in the Beating) it makes insperged oars, subtil, and rife in the water: therefore there can no furer or better Method be found for fuch oars, than to roaft them in an high roalt oven, made on purpole, (as before is often mentioned.) And when it burns to a great heat, pour water upon it, and let it cool luddenly, so the frighted Metal will run together in grains in the flints, which are heavy, and remain fast by setting them in the water, and then they may be walked and separated, and that which is not clean Copper will be a good and heavy Copper stone, that to the slinty copper Oars (when they are roafted and are brittle) may very eafily (in a great quantity) be buck dithrough, and the Metal which is gathered may be washed, or so much of it, as in one gathering can be melted throughly (like raw Oar) which is to be made into ten or more equal

CHAP: equal parts. And the roast oven which is to be used VIII. to this Washing, may be formed (as in the first and second Book of flinty Gold Oars) are more fully described.

CHAP. VIII.

How to prove Copper Oar from Copper-stone.

F one would try and prove Copper oars especially the flinty (containing much or little Copper, called raw flack-stones, or raw Copper-stones) you must doit thus; Grind the Copper oars or the flint small, weigh from it two Centners, put them thus, unroafted in an Affay-crucible, and weigh to it four Centners of the flus made of Salt petre, and Argol (as before) with two centners of flowing Glass-galls, mingle all in the crucible and cover it (like a copper-Oar) with Salt, and fet it in a little Oven, and boil it up also before the Bellows, and let it be cold, then you will find in the bottom of the crucible a copper-stone, then separate it from the flacks, and weigh it, so you may see how many centners of the flint yields a centner of copper-stone. But if the slint be very rich in copper-water, then there will be no stone with the fluss; therefore try the flint in another manner, viz. Weigh it raw, and put it in a crucible, mingle among it three times fo much of clean good flacks (smooth ground) which yield no stone, nor contains any Silver, but come from poor Oar, cover it with Salt, and let it in, let it flow with strong

blowing: then you will find as much as the flint hath in it felf: But the flints that are rich in copper-water do yield a flack-flone which is not good to be melted, for

in the roafting, it will shrink too much and retain no CHAP. Silver in it self, by which many times hurt is caused. IX.

CHAP. IX.

How to prove Copper Oar another way.

L Copper-Oars that are rich or poor in copper may be tryed upon copper-stone, after this manner, Take a pound of the Oar or Flint small ground, and prepare a little Oven of Tiles square or round of a span wide, or let it be joyn'd with Potters - clay, bind it about with iron-

rings, and lay below in it, Powder of Coals and Clay, (as in the Melt-ovens) with a hole on the back of the Oven, through which the Bellows may go; then put in your fire and Coals, and blow them well, that it may glow, and fet the raw Oar which is ground, in it; yet not at once, blow continually strong at it, that the oar may melt through the Coals down into the little Oven, and when it is enough, let it cool, and take it out of the Oven, and beat it, so you will see what it yields of copper or copper stone: if you finde in the stones either copper or slacks like grains, beat them small, and draw it into slicks, then will the copper and stone separate from the slicks.

This is a fine Tryal upon the copper shifter and poor coppershiftinspersed copper Oars, but when the Oar doth not yield stone or copper, you will see it in the slacks, when they are not coppery, but all is turn'd to slicks.

Further, if you would have such through-proofs of when there copper, and the slint yeild no stone, then first roast the will be no slint quite dead, and melt it in the little Oven, and you proof.

Rrr will

Section.

CHAP. will finde a Regulus of black copper, or such as the flint X. or copper Oars do yield, which put together and weigh, and see what it hath yielded, so you may know how many Centners of flinty copper it yieldeth from a Centner of copper, for all roasted Oars work themselves fresh, and

separate better than raw Oars.

But if one will try more than one or two pound in the little Oven, then one may flick it off from the copper with a little hot Crucible, and separate it from the flacks, but what remains in the little Oven together with the flacks, which are not flown out, must be beaten and washed, and what is found shall be reckoned the Content.

Also in this wise one may melt raw copper flint unroasted in the little Oven, and drive it off, and see whether it give good copper-stone or raw slack-stone; also whether the stone in the sire be fixt or volatile: Only observe, that the little Oven must be first very well glowed, before it be melted in it, or else it will become all cold in the little Oven, and will not come together, as experience teacheth.

CHAP, X.

How to prove melted Copper_stone.

OPPER STONES are best prov'd like a raw Copper.Oar or flint (as hath been formerly shewn) viz. if one beat the same very small like Hemp.seeds, and then weigh it, and in a gentle fire upon a Test, let it be roasted, and put in the ground pieces, until it burns it self dead, and then let it be ground smaller, and mingle it with stuffs, and a little Glass-galls, and cover it with Salt in the Crucible lu-

ted

Another way.

DE

ted in a little Oven, it will boyl like a raw Copper Oar CHAP. or flint before the Bellows, and will fettle it felf to a copper Grain in the bottom of the Crucible, draw this up and weigh how much it contains, and make thy account upon it, how many Centners of copper - stone yields one Centner of black and unpurify'd Copper.

There is another Tryal, namely, to weigh two Centners of Copper-stone, and mingle them with Borax and a little Venetian Glass, and let it show upon a Proof Test, and blow with a hand Bellows until it appears green, so you will see how much the Copper-stone yields of Copper: and in this Proof the Copper will become clean and pure and most ready, and yield no black Copper (as in the Proofs above it doth.)

That you may see the form of the little Ovens, and how to make the Copper-Proofs in them, they are in the following Sculpture

Deciphered.

- 1. The melting Oven to try the Copper Oars from the copper-stone, and the Man that blows the Bellows.
- 2. The luting it with Clay.

 3. The buck'd and vvash'd Oar.
- 4. The little Ovens in which the copper-Oars are to be proved with ordinary Bellovvs, and the man that attends them.
- 5. The Bellovys as they are used.
- 6. A copper Instrument with a neck in which water is put, and then set over the fire, and used in stead of Bellows (call'd the Philosophical Bellovys. See Sculpture II. Book I.
- 7. The Pot in which the Flus is to be made.
- 8. The Affay Crucible.

Sculpture

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The Third Book

CHAP.

Sculpture XXX.



CHAP. XI.

To prove Flinty Copper by Sulphur.

Section.



them (yet some more than others,) if you will try them, and make a proof upon them, Weigh two centners of the Flinty raw Oar, and put it in a Proof-Test, and roast it dead (as I have mention'd

weigh such roasted Oar again, now so much as these IX. two Centners have lost, so much they have had of Sulphur, for the Sulphur goes in the fire and in the air, this proof is easy, yet it is not manifested what Sulphur it doth yield, but that you may have the same Sulphur apparently; Beat the slint small, to the bigness of an Hazel nut, put it in a great Retort made of the best Potters-Retort.

Clay, that the neck of the Retort may hang in water, make a wood-fire about it, then the Sulphur will ascend from the slint, and you will find most part before in the Receiver of the Retort, fine and yellow, but tis yet unwashed, and must be cleansed in a strong fire.

How, this is further to be done, is to be seen in great iron Retorts when the Sulphur becomes red. But this is to inform the Reader, That all slints burnt in iron Retorts to Sulphur do yield red Sulphur, which Painters use to highten yellow or orange Colours, but the manner of making Sulphur with great Retorts do not appertain to this Treatise, therefore I have named it only for the

Proof-fake.

GHAP. WIL. and the same

How to prove Black Coppers by defty or smooth Coppers.

S all Coppers come black out of the oars upon melting, yet some much siner and cleaner than others, which must after be cleansed and made ready, as they which contain no silver, and not purified, must be made ready and deft:

Also to know certainly how many Centners of it after

CHAP. cleanfing it yields of clean Copper (which must be pro-XII. ved in a little Fire.) Some think it may be known by of copper some some time of copper Touch-Needles, made on purpose: but because the black Coppers are not all alike, but some iron-streamy, some tinny, spizy or leady, I cannot certainly determine concerning such Proofs: But the best way is thus, First, cut off from the cast Copper Ingot, and weigh 2 or 3 Centners of it, and lute a Test with small ground leady Glass, put the weigh'd Copper in it, and blow it in a fresh coal fire, till it hath a clean green copper Colour, then presently, take the Test out of the Fire, and take the Copper out of the slacks, and quench it off, then cut it assumes with a Chissel, and you will see whether it be good: then weigh and count how much the inset black

Copper hath yielded ready Copper.

This proof, although the Copper be furer to be found, than by the Touch-Needles, yet tis not certain to ground upon; because the Proof is small and the Copper little, therefore very easily the Fire may take away somewhat too much if it be over-burnt, which in great Works cannot be done, and so somewhat more of red

copper will be brought out.

If you will have the right proof, and know the right Content, the same must not be esteemed too great a Labour, to make more than one Proof of the black-Copper,

and then take the middle out of it.

You may use to this Proof, Borax, which cleanseth the Metal much, and brings the copper to be sooner ready: but, because one cannot use Borax in the great Works, it were better this proof (especially iron-streamy Copper) might be helpt with a little clean Lead, because its used in cleansing: and the copper will become leady, which doth much cleanse the Copper, but if the copper be leady, then there needs no lead to be added.

Some Assayers use this Method in their Proofs, viz.

Another Manner.

They take a Test which is made moist, and make a lit. CHAP. tle hearth in it of Coal Powder, mixt with clay, having XIII. a flat smooth hole cut out: upon this they fet the copper which is to be proved, and blow it with the Addition of a little Lead-glass, this will the sooner make it ready, but I think there is small difference in what ever is driven off from it: but be fure you drive not the copper too hard, and yet let it be of a right copper or blick colour.

And, because many times copper - flints are to be found, in which almost the half is Tinn. stone, and if cop- Copper flint per be melted out of it, it would be very tinny and fi- flore may be my, also if it were done among other coppers, all would be spoiled in the cleansing. To prevent this, there is a particular way, viz. that by beating and washing one may separate both Mettals by bucking or cleansing, and then melt every part afunder, and bring it to profit; of which way I should write something here, but because I do not give a full Instruction in these my Books of the great Works (viz. of Bucking, Washing and Smelting Metal Oars) but only leffer Works, therefore I will here end, till another more convenient time, when they may be further discoursed of.

CHAP. XIII.

How to prove whether Lead be very Copperish.



F you think your Lead have much (opper with it, and would be affured thereof, Then weigh with the great weight a Centner of the Lead, put it upon a very flat Hearth, and make a small fire of of flat Wood upon it, lay also a green wood before

XIV. under the before laid wood: Now, when such lead hath copper in it, if only two pound in a Centner, so the copper will remain on the hearth, and what you find is but leady copper, but if you will have it very clean, then blow it with a Bellows upon a hearth, till it becomes ready, but in the little proof, tis seen upon the Coppel, for when the Lead which hath much, begins to go, then touch the Copper flowers, and the coppels will become black after 'tis gone off.

CHAP. XIV.

Twelve necessary Instructions for an Assayer to follow.

Section.

IRST, whether Iron doth become Copper? to which the Reader shall have this Answer, That I have a long while supposed, because the Iron in the Coppery waters, as in Vitriol, green Argol, and such like, do precipitate the Copper, that

the Copper only is precipitated in such iron water, and not the Iron it self becomes Copper, yet I have seen in Vitriol Mines, (in a Mine called Hesper) when the nails and other Iron Pins sixt in the copper-Oar, by length of time have become a good Copper mearly by Penetration; therefore I must conclude, That the Iron doth become Copper; for though in the Vitriol, and other copper waters, the Copper precipitateth the Iron, yet there is not so much of it therein, as to turn it to copper; only know this, That while the Iron in such Coppery waters doth precipitate the copper, so the copper will precipitate the Silver(if it be in it) therefore 'tis sit, that to the common

mon precipitation of Silver in the Agna fort. that the CHAP. copper with iron pieces or lamins be put into the clean- XV. fing (as above is mentioned) with which the Copper and filver are precipitated, and what hath been in the Aqua fort. cometh out whole.

CHAP. XV.

Twelve Directions bow to separate Silver from Copper in the great Work.

> O separate thus is a curious ART, which sedion. for many years the Refiners have kept as a great Secret, how the Precipitations are to be made right. But because the large Works are very great, there- One was of fore it could not remain fecret, but is Preparati-

now known; yet there is still a difference, for in one serve for Furnace it is better refined, and the prepared copper is made purer than in the other, also the Additions are not every where alike, and then many forts of coppers cannot be refined all in one way, therefore for their fakes, who either know nothing, or but a little of fuch things, I will write iomewhat as a tendency to that Art.

First, observe whether the black Copper be weak, deft, hard or brickle, for if they be weak and brickle before the refining, then the Silver will not come to foon out, but if one will give it its just due and heat, then the copper will flow under the lead through the Oven, and may cause hurt; therefore to the weak Coppers, there is no better way than to mingle other hard or brickle copper among it, that the one may hold the other.

Secondly, one must be instructed how much the fopper holds in Silver, by a diligent Proof, for according to it, the Copper must be mingled with lead. And if

CHAP. the Contents be unequal as from 24 Loths, to 14, 8, or XV. 10 Loths, then it must be made into a Cake by weight, near 27 pounds and an half of rich Copper, and 55 pound of poor Copper, upon this make your Account, how much Silver is in this 3 quarters of the Centners of Copper, and how much the Lead containeth which is to be used to the Addition, and then to every Loth of Silver which is in the copper and lead) 17 pound of How much lead is also to be counted; and thus, of the refined lead (which is to be parted from the copper) a Centner will not contain above fix and a half, or at the highest seven Loths of Silver. But if the refined lead should contain more than 7 loths, it is a fign that the Cakes remain too rich, and that the filver is not all come forth of the copper, and that there was not lead enough to the Addition.

But, that one may know how 'tis with the Additions upon every Copper, and what is to be observed in the refining Furnace, I shall demonstrate it by Examples.

Take two Centners of lead, and three quarters of a Centner of Copper (of a rich and poor Content) either weak, hard or brickle, one among another, if therein is not 12 or 12 and an half loths of Silver, then take lead Oar or other lead to it which is filvery, that you may have the above mentioned filver in the fresh piece, and then add Lead, or Littarge, as much that there may come to four pieces, 8 Centner of Lead, and three Centners of Copper, and of this there will come out in parting 6 Centners of refined lead; every Centner of which contains 6 Loths and a half of Silver, the other Silver and lead will remain in the cakes and lead, which will almost all come to profit again, as you will hear hereafter.

Another Addition upon two and a quarter of a centner of Lead, viz. take three quarters of a centner of cop-

II.

per, and if there be not in it 15 or 16 loths of Silver, CHAP. then take to it rich lead, which may enter in a fresh piece XV. of such Silver: or, Take fresh and hard lead and Litarge, so that from 4 Pieces (upon an Oven) may come 9 centners of Lead, and 3 centners of copper, of this there will be 7 centners of refined Lead, of which a centner is to contain 6 loths and a half of Silver.

Also, take two and three quarters of a centner of Lead, and three quarters of a centner of copper, and if there be not 18 or 19 loths of Silver, then take rich lead that it may reach the Silver and Litarge, and hard and fresh lead, so that (upon an Oven) in 4 fresh Pieces may come 11 centners of lead, and 3 centners of copper; and in dividing of this again, there will be 9 centners of fine lead, and one centner is to contain 6 loths and an half of Silver.

Or take three Centners of Lead, and three quarters of a Centner of Copper, if there be not therein 20 or 21 loths of Silver, then take rich lead which came in a fresh Piece of the filver, viz. from 4 Pieces (in one Oven) 12 Centner of lead, and three Centner of Copper, and when this shall be separated, then 10 Centner of pure lead; and one Centner will contain seven loths of Silver in the Keinstocks and Thornells, and there will remain 15 or 16 loths of Silver, and they are surther to be wrought, as hereaster will follow.

But if there be very rich, or much other rich copper, and little of the light Contents, and that you cannot reach the right Addition, as above mentioned, then one must oft times add a rich fresh piece, viz. to three quarters of a Centner of rich copper add three Centner of lead, and so the separating Work will prove rich: and although the Keinstocks may also remain rich to 4, 6 or 7 loths: yet they may further be added to the rich Copper, and the fresh pieces be so right, that the

CHAP. refining lead may come out upon the true content, at XVI. fix, or fix and a half, or feven loths of Silver, at the

section. highest.

But, if there are poor contenty coppers (not to be re-koned with the rich) yet you must do with them as before; but never take more than three quarters of a Centner of Copper to two or three quarters of a centner of lead, and if such black copper contains 8 loths, the centner of the separating work will contain two loths and an half of Silver: and the poor separating lead which comes from poor fresh may be added again to other fresh pieces, (as by the following Instructions may be seen) but there is no help for it, and, if possible, the poor fresh lead may be left alone.

CHAP. XVI.

Thirteen additional Instructions about good Copper.

TEM, One piece shall have 2 Centners and an half of Lead, and three quarters of Copper, and there shall be no more in one piece than 18 loths.

Item, Three quarters of a Centner of fresh Copper to 21 loths, and three quarters of a centner of Lead: to three loths and a half, half a centner: to two loths three quarters of a centner of fresh lead, and a centner of Litarge: thus you have four Pieces of 77, and a half loth of silver, in 11 centners.

Item, Three quarters of a centner of copper to 18 loths, and an half centner of lead: to four loths and an half, three quarters of a centner: to three loths, one quarter of a centner: to two loths, one quarter of a cent-

centner of fresh, and one centner and 18 pounds of CHAP. Litarge, mingled in 74 loths of lead, do yield 10: and XVI. a quarter and an half of a centner of lead.

Item, Half a centner of copper to 15 loths of Silver content; and one quarter of a centner to 20 loths, and one centner of lead: To 4 Loths, half a centner: To two loths, one quarter of a centner of fresh: one centner of Litarge leaded in 70 loths of Silver doth yield 10 centners of lead:

Item, Half a centner of copper to 15 loths: one quarter of a centner to 17 loths: one centner of lead to 5 loths: half a centner to one loth and an half; one quarter of a centner fresh; one centner of Litarge leaded in 70 loths will yield ten centners of good lead.

Item, Three quarters of a Centner of Copper to 17 loths: one centner of lead, to 4 Loths: one dram, one quarter of a Centner to 4 loths and an half: one quarter of a centner to one loth and an half: and one quarter of a centner fresh, one centner and 18 pound of Litarge leaded in 74 loths yields 10 and an half centners of lead.

Item, Three quarters of a centner of Copper to 18 loths and half a centner of lead: to three loths and an half, a quarter of a centner: to four loths and an half three quarters of a centner: to three loths one quarter of a centner of to three loths one quarter of a centner of fresh, and one centner of Litarge leaded in 76 loths and a half yields 10 centner of lead.

Item, Three quarters of a centner of copper to 16 loths and half a centner of lead: to 3 loths and a half: three quarters of a centner: to four loths and an half: one quarter of a centner: to two loths one quarter of a centner of fresh: and one centner of Litarge (or instead of it, three quarters of a centner of fresh) leaded in 70 loths and a half do yield 10 centners of lead.

Item, Half a centner of copper to 19 loths: and a

II.

CHAP. quarter of a centner to 7 loths: one centner and a half XVI. of lead to three loths and a half: and half a centner to one loth and a half; and one centner of Litarge leaded in 69 loths and a half, yieldeth 10 centners of lead.

Jeem, Half a centner of Copper to 19 loths: one quarter of a centner to 16 loths: one centner of lead to 4 loths: one dram and half centner to one loth and a half: one quarter of a centner fresh, and one centner and 18 pounds of Litarge leaded in 74 loths do yield 10

centners and an half of lead.

If there be no Litarge to be had, then take half a centner of good copper to 9 loths, one quarter of a centner of copper to 30 loths: one centner and a quarter of lead to 4 loths, and an half centner to one loth and an half, and a quarter of a centner fresh: thus make all times the additions upon the hard lead, that there may be in a piece 10 centners, 10 and an half, or 11 centners of lead, also the filver in 4 pieces, 70, 72, 74, 75, 77 loths, thus the lead doth contain 7 loths of filver, happily one dram more or less.

Item, Three quarters of a centner of fresh copper to 20 loths: three quarters of a centner of lead to 4 loths; and half a centner to two loths, and one centner of Littarge: and half a centner of fresh lead leaded in 76 loths

yields 10 centners of lead.

Item, Three quarters of a centner of Copper to 21 loths: three quarter of a centner of lead to three loths and an half; and half a centner to two loths: and half a centner of fresh lead, and one centner of litarge, or three quarters of a centner of fresh lead, leaded in 77 loths and a half do yield 10 centners of lead.

CHAP.

CHAP. XVII.

Six additional Instructions about proving of fresh Oar, called hard Lead.

TEM, Three quarters of a centner of Section.

Copper to 11 loths; and half a centner of fresh lead; 2 centner of Litarge is leaded in 8 centners, into 4 pieces, contain 33 loths.

loths; a quarter of a centner to 15 loths: one centner and a quarter fresh, is leaded in 8 centners, into 4 pieces contain 31 loths.

Item, Half a centner of copper to 15 loths; one quarter of a centner to fix loths, three quarters of a centner to two centners of Litarge leaded into 9 centners, into 4 pieces, contain 36 loths.

Item, Three quarters of a centner of copper to 11 loths and a half, and half a centner of fresh; and two centners of Littarge leaded in 8 centners, into 4 pieces, and contain 34 loths and a half.

Item, Half a centner of copper to 13 loths: a quarter of a centner to 10 loths: half a centner of fresh, two centners of Litarge leaded in 7 centners, into 4 pieces, contain 36 loths.

Take notice, if the Copper be very poor, then you may add fuch lead, as doth contain one and a half, or 2 loths of filver.

CHAP.

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CHAP. XVIII XIX.

CHAP. XVIII.

Three Additions concerning Thornels, or parts of Oars not fully melted.

AKE two Centners and an half of Thornells, that is half separated Oars, and halt roafted, and a centner and a quarter of hard Lead: and a quarter of a centner of Litarge, the Lead must contain 3 and a half: 4 loths, 4 and a

half, till to 5 loths.

Item, to a Centner of Littarge is counted 3 quarters of Lead; and a Centner of Littarge is counted at 135 pounds; and also upon 145 pounds of bard Lead, one centner of foft Lead, although to some separating Works are taken 130 pound of Litarge in stead of a centner of Lead, and 140 pound, hard Lead, instead of foft lead.

Also there goes commonly off from 10 centners one centner and a half of Lead; thus you may know how to substract from the additions together with the Loths,

which will be found in the centner.

CHAP XIX.

Six more Instructions concerning good and deft Coppers.

TEM, Take Copper to 11, 12, 13, 14, 15, 16, Loths, and of this one may make hard Lead, being commonly taken as Additions: of which 65 pounds will yield at all times in 4 pieces 39 loths of Silver; but if it be not

enough

Section.

enough (with the 65 pound of Copper in the Content) CHAP. then one may take of the Copper three quarters of a XIX. Centner, and at all times upon one loth of Silver 29 pounds of lead, and this will make in one piece, three Centners four pounds of fresh lead, and in four pieces, 12 Centners, and 16 pounds, in which are 42 loths of Silver.

Item, 65 pounds of Copper to 15 loths: one centner scaling and a quarter of a centner of fresh lead, and 305 pounds of Litarge, there will come upon 4 pieces 11 centners 31 pounds of lead, in which will be 39 loths of Silver; and if one doth sever it in an Oven, and with such Additions, there will come out of it 9 centners of lead, which will contain to three and three quarters of a loth, or three loths and a half: this is together, 33 loths, three drams; so there will remain in the Thornels and Keinstocks sive loths (if well wrought) but it consumes much lead by it.

If the Copper contain 18, 19 or 20 loths, 'tis usual to take fixty or fixty five pounds of Copper, according as one hath poor or rich lead, and the Addition is made thus, that together in 4 pieces, may come 75 loths of Copper and lead; and upon this 75 loths, is taken one loth and 15 pounds of lead; if then one do sever it in an Assay-Oven, it will yield 9 centners and an half of lead; and this will contain 6 loths and a half, or six loths three drams, and then there will remain in Thornells and Kein-stocks, 11, 12 or 13 loths, but how the Additions are to be made, is hereafter specified.

Item, One piece shall have (with lead and copper,)
3 Centners, 25 pounds, and four pieces; together
13 Centners, and of lead 11 Centners, 25 pounds, so
there will come in one piece 65 pounds of Copper, to
17 loths; and two Centners and a half of lead to three

Xxx sodge doum loths;

CHAP. loths; yet the 4 pieces will contain no more in copper and

XX. lead, then 75 lotbs.

Item, 65 pounds of Copper to 18 Loths, make 47 Loths addition in the Lead. Take one centner three quarters of Lead to 4 loths, they do bring in 4 pieces; 28 loths one quarter of fresh, and 30 pounds of hard, so there will come 11 Centners, 25 pounds of lead, in 75 loths.

But the Thornels which are to be severed from it, must have this Addition, Take to one piece, one centner and a half of lead-Thornels, 1 Centner of roast Thornels, 1 centner 18 pounds of hard, and one quarter of a centner of fresh Lead, and 30 pounds of Litarge, then the lead will commonly contain 3, or 3 and a half, to 4 lotbs of silver.

CHAP, XX.

Seven more additional Instructions about good Copper.

TEM, if one take to a piece of 80 pounds of Copper, which may contain 15, 16, 17, 18 or 19 loths, and so there will be of 4 pieces, ten Centners of lead, and so in one piece, 2 Centners and an half, the process is thus, Take one Cent-

ner of Litarge, one centner and a quarter of lead, to 4 loths, one quarter of hard lead, and a quarter of fresh lead, as it happens, yet that in 4 pieces will come to no more than 72 loths of Silver, and take to one loth 14 pound of lead, and this in one piece will be two Centners and a half, and 2 pounds of lead, yet 'tis always better to take much Litarge and little lead, for the Litarge doth draw better to it self the Copper than the fresh lead, likwise much Copper than little, and so the lead will not consume

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consume so much, and there will be wrought much more Chap. copper with less lead. Therefore if you take 65 pounds XX. of copper to one piece, then there will be to four pieces, eleven and a quarter of a centner of lead, and one melting may make just so many pieces. But if you do take 80 pounds of copper, for 65 pounds of lead, then there will remain in the Thornels and Keinstocks, 10, 11, or 12 loths.

Item, Take 75 pounds of Copper (rich or poor) and in four pieces 72 loths, that upon one loth may come 14 pounds of lead into four pieces, 10 Centners, 8 pounds of lead, and this doth yield commonly good Keinstocks, and if this be thus severed, then the lead of it will contain 7 loths of Silver, and a dram more or less.

Item, to make bard lead, take 65 pounds of Copper to 19 loths, and 200 pounds of Litarge, and 190 pounds of bard lead, and 40 pounds of fresh lead, to two loths; and thus there will be in 4 pieces 52 loths, and one dram, and ten Centners, and 80 pounds of lead.

Item, take 75 pounds of Copper to 16 loths, and not more than 48 loths in 4 pieces, and to one loth 21 pounds of lead, that the most part may be Litarge, so the lead will contain 4 loths and a half, or 5, and remain in the Keinstocks 6 or 7 loths.

In brief, to fresh Copper one may take three quarters fresh Corof a centner of Copper, and two Centners and an half of perlead, and in four pieces not above 34 loths, this doth
well; and to the hard lead, three quarters of a Centner of
copper, two and a quarter of a centner of lead, and no
more, and it will bring into it 33, 34, to 38 loths of
Silver.

Concerning the poor coppers (they are partly fevered in *Hungary*, and contain to five, fix, feven, eight Copper. loths of Silver, or nine at the highest) they must be so severed

CHAP. Severed, that the severed lead may come upon the right XX. Content, as a centner upon fix to feven loths of Silver, fo the copper will be good, and if you add lead according to the Content, the copper will not have lead enough, and the Silver will not come all out, and the Keinstocks will remain rich. wog 20 10

Section.

Now, when the Melter makes the fresh Pieces, then must all their Additions first be weighed upon every piece apart, and then he must put the Copper and bard lead first in, and afterwards the Litarge; and lastly, the lead in the Oven, and when the Division of one part is almost gone down, put after it a quantity of flacks, that when he feeth the fame, he may know how much hath been weighed (in one piece)out of the Oven, before he put in the other, and when that goes down in the Oven, pour the first piece out of the furthermost (rucible into the pan, and then take care that one piece may not be heavier than the other, and so he must still labour till he hath cast all the pieces (as such practite will shew) But how the fresh Oven is formed, and the fresh pieces cast, you may see in the Sculpture following, thus

Deciphered.

1. Copper and Lead in pieces, weighed.

2. The Oven for Assaying those piecs of fresh Oar.

3. The Copper-pan into which those fresh pieces are to be put and melted.

4. The fresh piece melted.

5. The Melter.

6. The Vault in which the Dust and Smoak is received.

7. The little door out of which the dust is to be cleansed.

Of Copper Oars.

Sculpture XXXI.

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CHAP.

CHAP. XXI.

CHAP. XXI.

Nine Rules, sheming bow the Regulus of poor black Copper-Oar is to be affayed, after the Hungarian Method.

Section.

IRST, I will mention how the poor Coppers are to be split before their melting in the separating Works, and the content made rich, that they may the better be melted and separated.

Item, in the Sheds or Houses where

black Coppers (which commonly contain 5,6, or 7 lotbs of Silver) are used to be smelted there, the melting Oven for them is formed like a driving harth with a Vault, and in the fore-part thereof the fire is to be made of Birch, or other small split fire-wood (as is used in Kitchins) and the melting oven must have a Crucible before it, in which the black Copper (when 'tis wrought enough and becomes good Copper) may run out of it : On the other place of the Oven are the flacks done off, and the Bellows are not to blow in the midst of the Oven, but on an iron Pipe, which is directed against a corner of the Oven, in which the Wind may blow, so that it may go through the Pipe into the spleis Oven in the midst of it upon the copper.

If you will smelt them, then put into the smelting Oven 38centners of black copper, of which the centner contains fix loths of Silver) when this is smelted, let the slacks go off from it; that it may be 11 to 12 centners, then 4 to 4 centners and an half, in which you must be diligent, that you may know how to give it its due heat. open the smelting Oven near the foremost Crucibles, and

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Toe Melte

fet the copper in it, and fmelt of the 38 centners of black CHAP. copper, out of the Crucibles 18 to 19 centners of good XXI. and rich copper, but of the Imelted Copper, every Cake section. is to be cut out, and cast into Ingots, of which a centner holds commonly near 9 loths of Silver, the remaining Silver you will have in what is Iwept off, and in the flacks, as follows.

But because much smelting at once (as in great works) is counted by the Smelters a Work for half a week, therefore to this belongs a Master and a Servant, and they cannot work but twice a week in an Oven, and to fuch Operating in one work, there is to be used near 4

layes of Wood.

The flacks that come from the above-mentioned black Regulus, or which are twice done from the copper, must Regulus. be beaten small as Wallnuts, and smelted through a smelting Oven, then draw the flacks off again from it in the crucible, and out of it you will have a red Regulus.

Of this red Regulus, one must take 40 centners for a Imelting Oven (as above is fignified) and may imelt of it 30 to 31 centners of red Copper, and of this the centner contains two and a half, to 3 loths of Silver, which cannot all be brought out, therefore it must be forced out with an bammer. But if it be made to fell for Bells, then there must be smelted of this 40 centners, or 33 centners to 35 centners of red Copper, and to this one needs but one Oven, 2 to 2, and half the proportion of wood, and 'tis counted by the Smelters for two Works for a Week, as upon the black (oppers.

But the flacks which (of this 20 centners of Regulns) are to be done off out of the fmelting Oven (and happily 6, 7 centners to 7 centners and an half) they are to be beaten afunder and finelted through a finelting Oven, and one may draw off the flacks in the Crucible, and make of a Cobolt Regulus, or Copper-stone, 40 centners upon a smel gulus. Re-

CHAP. ting Oven, and smelt it off from 32 to 34 centners of XXII Liebeter or speizy or unclean Copper, of which a cent-

spizy Cop per. 8.

Stampt Copper, Now when all is smelted off, then take that which remains upon the brim of the driving harth, also that which is about the crucible, and some good slacks, and beat them small with the stamp, upon which the wat r doth run, and then the good copper will fall on the ground, and that is to be gathered and washed and then settled: and, if it be at hand put 12 to 14 centners upon the smelting Oven. Likewise happily 5 or 6 centners of leady-Copper which remain dupon the barth; and if the copper enters in it, and will not out again, then put to it 18 centners of black Regulus: and smelt again 20 centners of stampt Copper (which Copper is to contain 12 to 13 loths) and this same, being thus assayed, one may set it upon the driving harth, and drive it off with the poor and rich lead.

What comes off at last from the stamps in the casting and settlings, is also to be taken up, for 4 centners of this will yield a centner of copper, and such is to be smelted

with the flacks.

CHAP. XXII.

Seven more Instructions for the Hungarian way of separating, and bow the first work or Instrick is to be performed.

O the first Instrick (by which you must understand the first Schiebt, work or operation which a Master with his Servant can smelt in 8 or 9 hours) they do take 30 centners of rich or good Copper and fresh lead, which comes from Crac-

caw,

cam, of which a centner contains near one loth of Sil-Chap. ver) 110 centners: in all 140 centners of Copper and XXII lead: out of which work will come 40 pieces, this being put out of the former Crucible into a copper pan, there will come upon one piece of rich and good Copper, three quarters of a centner; of fresh lead, two and three quarters of a centner: And every Smelter must ob. ferve, That the Addition of every piece come only to one piece, and that the piece may be cast equal, that to the whole work may not come more or less pieces than were weighed to it before (as above is fignified) the flacks are afterwards to be drawn clean off, out of the foremost Crucible, and smelted again in the Oven, and out of this will come flack-lead, and the centner will contain one loth.

But the above-said 40 pieces are to be affay'd so that section. alwayes five pieces be fet upon the Affay-Oven, and the lead which flows out of it (being in a hole) is afterwards to be cast into little copper pans, and the Centner of the same lead (according as the copper is rich) will commonly contain 2, to 2 loths and a half of Silver; and that which remains upon the Affay-Oven is called Keinstocks Keinstocks. (which are pieces yet undry'd or unroafted, and what falleth down from the Affay-Oven, and between the roast-Oven are called Thornels, of which Thornels they do weigh 80 or near 100 pounds.

These Thornels are thus to be made to profit; Take 20 Centners of them from the Affay-Oven, and 20 Thornells. centners from the roaft-Oven, and 40 centners of hard lead, and Litarge, of each fort half; (in the whole 8 Centners) out of this there will come from the Work 20 pieces: and there will come upon one piece 2 Centuers of Thornels, and 2 centners of hard lead and Litarge, for it must be thus distributed upon the pieces, and the flacks upon the foremost Crucible must be drawn off

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Inlay upon richCopper.

CHAP. clear, these are to be smelted apart, and out thereof will

XXII come the flacks of lead.

Afterwards 5 pieces of these 20 pieces of Thornels The first In are alwayes to be let upon an Affay-Oven, and affay the lead of it, of which a centner will contain near 2 loths of Silver, and the Keinstocks will remain above, and what falleth down betwixt the Oven is (called, as is faid, Thornels) and they do weigh near 8 pounds, as above is

mentioned.

To the second Inlay, by which you must understand The fecond the fecond Work) the Additions are to be made thus, they do take rich or good broken Copper, 20 centners and 20 centners of Thornels from the separating and roast Oven, one with another, and 20 centners of Litarge, (in the whole 60 centners) out of this comes 40 pieces, fo there is to each piece half a centner of good Copper, and half a centner of Thornels, and half a centner of Litarge, and these are to be set (as before) always 5 pieces upon a separating Oven, and assay'd, and the Lead of it is to be cast into little copper pans, and the centner will contain 3 and a quarter, to 3 loths and a half of Silver, and the Keinstocks will remain in the separating Oven, and the Thornels fall down: Now, this is not used in the common work, but only when rich Copper is to be taken to

The Third the work, or the store doth increase.

To the third Work you must understand the third measure, which is called Rich putting in: the Additions are to be made thus, Take 20 Centners of rich and good Copper, and of the Thornels of Lead, 120 centners (in the whole 150. centners) then smelt all through the Oven, and draw the flacks clean off, and of these will come 40 pieces, and of one piece will come three quarters of a Centner of Copper, and three Centners of Lead, and these 40 pieces are to be assayed, and every time set 5 pieces on a separating Oven, and the Centner of this lead lead will contain near 3, and three and a half loths, and CHAP. of this there will also come Keinstocks and Thornels like XXIII. as of the second Work.

But to this third Work or Inlay, To one piece is to be taken a quarter of a Centner more of lead than to the first; the reason is, because to the first there hath been added Crackam lead, which hath contained Silver: secondly, because it is Copper: and thirdly, That so the rich works in the lead (which in the working are become Coppery) may also be included.

CHAP. XXIII.

How Litarge Pieces are to be made.

First, their addition is upon a Shich, to 15 centners of rich copper add 15 Centners of Thornels from the Assay-Oven, 60 Centners of Litarge, and 37 centners and a half of slacks or fresh Lead,

(in the whole 127 centners and an half: This stuff may be smelted in the Oven by aMaster and his servant in 8 hours, and the slacks being clean drawn off, and then being cast into a pan, it makes 30 pieces; and in one piece, will be half a centner of rich Copper, and half a centner of Thornels from the Assay Oven, 2 centners of Litarge, one centner and a quarter of slacks, or fresh Lead.

These mention'd 30 pieces of Litarge are to be assayed, and alwayes 5 pieces to be set upon the Assay-Oven, Lithurge and out of this willcome the lead which is called Litarge-lead, and one Centner will contain 2, to 2 and a dram of Silver, and there will come also out of the Assay-Oven Keinstocks, and Thornels, as in the second Assaywork.

Another

CHAP.

Another Addition upon Litarge pieces is this, They take 15 centners of copper, 15 centners of Thornels (from the Affay Oven) 90 centners of Litarge, 15 centners of flacks or fresh lead (the whole 135 centners) and out of this will come 30 pieces, and to one piece will come half a centner of rich Copper, and half a centner of Thornels from the Affay-Oven, and three Centners of Litarge, and half a Centner of flacks or fresh lead.

The before-mentioned 30 Litarge pieces are to be affayed, and set 5 pieces at once upon an Assay Oven, and the Centner of lead which comes of it will contain two to two loths and a quarter of a loth of Silver: of this also there is Keinstocks and Thornels, as formerly hath

been mentioned.

When all the before-written affayed rich and poor The last 10- lead are brought together, they make this account upon it (whereby they may know to make an Inlay, (that is a quantity of it) fo that a centner in the same Inlay of rich Copper and lead in the affay'd lead may contain 5 loths and a quarter of a loth of Silver, and this Inlay is to be made thus. Take 26 centners and a half of rich copper, and 115 centners and a half of rich and poor lead (that they may come upon the before-mentioned reckoning) fo that a centner may contain 5 and a quarter, or at most 5 loths and an half of Silver; what is done above, is with dammage, and the ready copper will become too rich: In short, 141 centners and three quarters of a centner, are also to be smelted through an Oven, and the flacks drawn clean off upon the foremost Crucible, and a Master and servant to make this shich or work into 42 pieces, so there will be to one piece 5 eight parts of a centner of the rich Copper, and of all the forts of rich and poor lead, 2 and three quarters of a centner.

These now mentioned 42 pieces they assay upon an Assay-Oven, but no more at once than 5 pieces of

rich

rich lead, that one centner with the other may contain CHAP. 5 loths and a quarter of Silver, and there will remain XXIV. also upon the Oven Keinstocks and Thornels, which are fallen down, such Thornels which come of rich lead they separate, for they are the best, and are to be used again, and to be laid among the Litarge-pieces: Upon this poor Contenty Copper Assaying, meditate with diligence, for 'tis a profitable Instruction.

CHAP. XXIV.

How Silver is to be separated from spizy and unclean black Coppers.

HEN the freigy and very unclean Silver Contenty coppers are to be separated from other good coppers, then they use the prepared coppers, which are deft of themselves, though they are brickle and unfmooth, and are not to be used to all Works: to avoid this, prepare to affay such degenerate black coppers as follows: Take fuch black Coppers, and drefs them like a black Licheter Copper with help of the lead, by these means they will become clean and deft, and brought thus into compals, so that often. times of three contners hardly remains one, yet nothing of the Silver gone off, but what hath been before in the three raw centners, and this is to be found together, and then separate this prepared copper, with good copper, or by it felf (as is usual) and in Hungary they use this care about the poor Coppers, though not very unclean, which in their feparating is often try'd, and the coppers becomes rich by it.

But that you may fee how the copper Ovens are Aaaa formed,

CHAP. formed, and how to affay upon them, this following XXIV. Sculpture will shew.

Sculpture XXXII.



Deciphered.

1. The separating Oven as it stands fram'd.

2. The Supporters to it made of Copper, as they are to stand under the Oven.

3. The cast pieces as they are to stand in the Oven.

4. The Walls of the Oven (or the four sides of it) and the fire in it, and how the Oven is brac'd with iron

5. The stamp'd Pieces, and coals on the top of the Oyen.

6. The

- 6. The copper or iron little pans, with a man putting the CHAP. melted stuff into them.
- 7. The Keinstocks.

 8. The Crane or draught by which the assayed pieces are to be lifted out of the affay-Oven, or otherwise dispofed of.
- 9. Instruments, viz. Ladle, Picker, Fork and Hook. 10. The troughs or place to cool the Instruments in water.

CHAP. XXV.

Instructions for driving Lead and Copper from Silver.

F you have enough of that rich Lead, of which a centner contains 5 loths and a quarter of Silver, then prepare the driving harth, formed with a Vault like a great Bakers Oven, and lute it with all diligence, and lay 100 Centners of this

lead upon it, and fix centners of the richest copper, which is to be pick'd out of the harth of the feige Oven, of which the Centner contains 10 to 13 lotbs of Silver, (which is call'd the stamp'd Copper,) drive the work, but not quite off, and if it make lead flacks, then quench it and retain the same lead flacks, so in this will be near 50 marks of Hungarian Silver.

But there must be two driving-harths one near the Two drive other, and while you drive off the one work, the other harths. must be prepared with diligence for the other, and then put upon it fix centners of the richest Copper, and an hundred Centners of rich Lead, which contains 5 loths and a quarter of Silver, and drive off the work (as aforesaid) and when the Silver will almost go to it, then

add the faid lead flacks in which the 50 marks of Silver are CHAP. are, and let the work go quite off, thus you have 100 XXVI. marks of Silver to 15 loths of fine. But such works are used to drive them off in 4 or five weeks, that commonly one week with another, is reckoned to make 125 marks of Silver, and its needful to such a driving off, to have 4 layes of wood, and you must not feed the fire upon such driving harths with long split.mood, but (because the Oven hath a singular V ault) it must be fed with good dry faggot-wood, and let the Bellows go true upon the work.

CHAP. XXVI.

Of driving the Keinstocks and Thornels.

EINSTOCKS are prepared upon the faid Assay-oven; and if it be of rich or poor Lead, or Thornels or Litarge pieces, put them together in a driving oven, and let there be four such driving ovens, and in every one 4 Roms or lanes: up-

on these you are to set all sorts of Keinstocks, near 120 centners, then make a fire of dry split wood before and behind the Rows of Litarge, and dry the Keinstocks about 12 or 14 hours, and that which runs first out into the Litarge rows (which will be but little) this pour out, and it is fresh Lead, and what remains of the Thornels will fall down in the rows, then they are to be melted to thornels, like those which are slowen out under the melting Oven.

Item, fuch Keinstocks which remain above those Ovens, are not to be boiled in the great speize Ovens (like the raw black Coppers) but must be beaten and knocked that the sbiffer and other uncleanness of them may be re-

moved

moved, and then put them upon the boyling barth, and CHAP. drive the copper to be pure, and when the flacks are clean XXVI. drawn off, then split the plates or cakes one after another, this is ready and deft copper, and so the remains that are in a centner of such ready copper will be almost a loth of Silver, and one doth take to a shich 4 harths to contain near 18 centners; there are to be two such harths or copper-ovens in the separating houses or sheds, section.

The flacks which are to be drawn off from the harths gulius, are to be melted again through a melt Oven, and a Regulus made of them, which is called a copper Regulus, which I judge to be like the Copper, made at Swatk, fet them in a dry Oven and dry them off, from this the thornels will fall down into the rows, these must be melted into thornels, (as above is mentioned) for such copper Regulus must not be wrought by it self, for they are speizy, therefore you must mingle them among the Keinstocks, which are to be dryed, and you may make pure copper of them.

Thus you have fufficient Directions how Coppers may be affayed and separated.

But concerning the reckoning which (alwayes in such things) is necessary to be made known, I will not recite here, for every ones Practice will teach them, and the keeping of the Book is the surest Rule for it. The next Sculpture is thus

Deciphered.

1. A drying Oven.

2. An Oven foon made according to the Hungarian way.

3. A common and ready Harth for drying.

4. Keinstocks, as they are to be picked and beaten by a

5. Harths for the Hungarian speizing or working-Bbbb 6. Copper CHAP. 6. Copper Cake, quench'd in a Cistern of Water by a XXVI. man, 6. 6. 6.
7. A Pipe and Tub that lets water into the Cistern.

Sculpture XXXIII.



CHAP. XXVII.

A fingular way of melting in the Affaying work.

HEN flint or Copper Oars are intended Section: for Copper, then the Oars are to be roafted well and stick'd through; and then to make it Copper it must be burnt and roafted again.

In fuch work one may furely know the Content of the raw stone, and also by the Content of the Stone (which is flick'd through the little Proof)

how much Copper and Silver is in it.

When the stone for making of Copper is perfectly prepared and burned; then take of this roafted Common proof (among some other) and prove it by 2 or 3 proofs upon Copper, and then the Copper upon Silver, and when the Copper-stone in the roast is of unequal content, it is not well mingled, yet you will find in the content, a very fmall difference; yea fometimes none at all, and then see whether the content of Copper (of the roaft) doth agree with the content before, which is found in the through burnt stone.

Therefore try whether you have all the Silver in the roast which was in the Copper - Stone, if there be a diffe- copperroast rence to 3 or 4 loths in a Centner against the other, then take the middle of it, and make your Additions thus; In cale you have found in a prepared roaft (through the little proof) that two centuers contains three quarters of a centner of Copper, and a centner of this Copper contains twenty loths of filver. Then weigh of Addition of that which is melted 2 centners of the roaft, and fet parts. them alunder, one beap after another, and of eve-

CHAP, ry beap two centners of roast, and to every part XXVII. weigh its due of Lead, that may alwayes come upon a loth of Silver, (which is in the Copper 18 loths of lead) or if it be good, 17 pound: and are to be weighed to the roaft-beap which is weighed off, and because two centners of the roaft do contain three quarters of a Centner of copper, (and must be melted through, to-one piece) then after the common proof, three quarters of a centner of Copper will contain 15 loths of Silver; then weigh to it 15 times 17 pounds of lead, so upon every fresh piece will come two centners 35 pounds of lead, and one fresh piece will weigh 3 centners 7 pounds.

But tis to be observed (in making the Addition of the lead) that you must know what the lead contains, viz. whether the centner had I or 2 doths of Silver. Then upon the same Silver which the lead contains upon every loth must be counted 17 pound of lead; for the Affay-work must contain but 7 lotbs, if they contain more, tis a fign the Keinstocks is too rich, and the Silver comes not all out of the Copper (as is before mentioned) therefore if one hath lead which contains filver, fuch cannot be taken to the rich Coppers, for the fresh pieces are too great and receive too much lead, and the Copper will go through the Affay-Oven with the lead to

But if one have copper-stone or poor copper which may Addition of yield to 10 or 12 loths, to this it may be used; especially if it becomes good, then the Addition must be thus: If you find by the Proof, That 2 centners of the roaftflone contains three quarters of a centner, and one centner of the Copper 12 loths of Silver: then in 3 quarters of Copper, or in two centners of roaft from there will be nine loths of Silver; to this add the due of lead, upon every loth of Silver, 17 pound; and because one hath not other lead than what the centner contains in 2 loths of Silver, .

then

then there will come upon the 9 loths of filver, in the cop- CHAP. per, and of the filver in the lead to one piece, 2 centners XXVII. and I pound of the two loths of lead:but to a fresh piece you must not take all such weak lead, or which doth contain filver, but mingle it with the fresh lead that the filver may come out cleaner, yet for want of fresh lead, somtimes fuch weak lead is taken as necessity requires.

Upon the common melting Furnaces, the Additions Hard our are made in stead of the fresh lead : with hard lead or Litarge, and substract the waste, what might go off in the frelb, and in stead of the 100 pound fresh lead you must take 125 pound bard lead and Litarge; yet the Litarge and hard lead must be refreshed with fresh lead, else, at the last when the hard lead is too weak, there will be damage: This may be used also in this labour and melting, if one have Litarge and bard lead that (according as above is mentioned) to add to the 2 centners of roalt the competent weight of bard lead and Litarge, and let it go through the Oven, and then the fresh pieces are cast

But possibly some person may say, It could not well Spar-stones, be done for the spar-stones take; yet it must again be confidered, Though the spar-stones may be leady yet they will be very poor in filver, and therefore they are not fpoiled, though they be leady and mingled with them, and fo bring them among the Copper-stones, in the roasts, which will afford but little profit, therefore 'twill be more profitable to melt them.

Further observe, If one would melt the stone, and beat the hard lead and Litarge, care must be taken that one doth put in the bard lead and Litarge when the Stone is in the Oven; and then the lead needs not stand to long on the barth among the copper and flacks, and thereby burn: but it were better to refresh the Litarge and hard lead fully (after the Goslarish manner) whereby you

Cccc

CHAP. may make (with one labour in one day and night) 100 XXVII. Centner of fresh lead which else is lost, but when the Additions are to be made with it after it hath been refresh'd, then there goes nothing more off in the little by-Oven, only that it will flow and work through amongst the Copper, and fuch refreshing of the bard lead and Litarge may be done (if one thinks it not too great a labour)

that the work might go the better.

Section. 8. How to make the

When the Melter thinks fit to shut the Melt-Oven, then he must make the Crucible in the barth a little nar. row and deep like a fresh Oven, and near that Oven anfrest pieces. other little Oven, in which the wind may drive, and wherin he may also warm the added lead; and when he begins to fet it, and hath two centners of the weighed roaft upon the Oven, then he must put in some weak slacks, by which he may see when the two centners of roast are throughly done when those flacks do come, then he stops the hole of the Oven, and draweth off the flacks and stones from the Copper: and then take out of the by-Oyen the hot lead, and the Copper in the crucible, with a warm ladle to reach into the crucible, and take out a ladleful or two, that it may come among one another, and then he must cast into the pan the first fresh pieces, and when it is cast then weigh it, by which you may eafily fee whether the defired copper be come: and when the first two centners of the roast are melted throughly, and the weak flacks do come and the Eye or hole of the Oven is stopp'd, then the Melter must set up another beap of two centners of the weighed roaft, but whilft he casts the fresh pieces, the Melter must take out again the gathered Copper which flows out upon the barth, and warm another weight of lead in the little by-oven, that the work may go speedily on, and not be hindred.

When these two centners of roast are set in the second time

time, then the Melter must put in again some of the CHAP. weak stacks, and when they come, then he must stop it XXVII. (as before) and draw off the stacks, and must take the lead out of the little by-oven, and cast the fresh piece, thus he may melt continually as long as he hath Copperstone to put in.

Such fresh pieces when there are enough, cast into the melting-oven, and they are to be melted off, while other fresh pieces are melting and making.

This melting-work is (in my judgment upon such The profit Copper-stones which yield copper) very profitable in of this associated comparison to the other: because you have the Silver quickly out of the copper, with the same Expence as is spent upon the black Copper making, and used with profit, better than when they must first be melted in the copper, and afterwards with great Expence to be wrought, and the Silver to be assayed out of it. Upon which every one who useth to melt may further consider.

This also I think fit to mention for the Instruction of the common copper-Melters, so that all who care for it may be diligent in it: for this is not only a supposition, but proved in the great work.

What and how the Thornels (and other things which come by melting) may be melted and made to profit (as before is shewn:) the form of the Melting-Oven and of the little by-ovens will be seen in the Sculpture following, which is thus

Deciphered.

1. The Fresh Oven.

2. The little By-Oven for lead.

3. The fresh piece, with a man lifting it.

4. The Separation of roasted and weighed lead, brought by a man in a Wheel-barrow and laid in heaps:

5.The

14.

The Third Book.

CHAP. 5. The Vault for the Smoak and Dust.

XXVII. 6. The Tunnels to convey away the Smoak.

7. The fresh Oven without fire in the Furnace, or forewall.

Sculpture XXXIV.



CHAP. XXVII.

How Copper is to be made Brass.

O the Brass burning as it is observed in (auffingen in Hessen, and as before in the Copper dif-City of Goslar and in Ilsenberg on the CONNITYS. Haiz, they use Goslarish Lapis Calaminaris which is sometimes gathered out of the Smelt-Ovens, where (in imelting

the lead oars into 10 or 12 pieces) it ofttimes lyes about a hand thick; but the Lapis Calaminaris at Galmay mountains, and other mountainous places, (as those near the River Ach in Schwaben or Swevia, in the County of Tyrol in Austria, and elsewhere) breaketh yellovv and gray, and is to be added to the Copper to make them of a yellow Colour, and which is called Brass, but the Goslars Lapis Calaminaris must be roasted or burnt and ground small upon a Mullet made on purpose, and then they prepare it as followeth.

They take one part of it, and tvvo parts of small To propare ground Coal well quench'd, and well mingled; dry them Lapis Calawith one another, then pour a bowl-full of water upon the Lapis Calaminaris that it may every where fuck it in, let it stand an hour and moisten together, but some use Vrine instead of water, and add a little Allum; this gives the brass a fair colour in the first fire: then they have a crooked Instrument and draw all well together 3 or 4 times, then mingle it with a proportion of Salt, and draw it again with the Instrument twice or thrice, thus the Lapis Calaminaris is prepared: but they make alwayes fo much Calaminaris together at once, as will be needful for two Oyens.

Dddd

When

When they make Brass they make round Ovens in . XXVIII. the ground, fo that the wind may force the fire through The Ovens the holes below in the Oven, and in one of these Ovens

they fet 8 pots or pipkins at once, and let them be warm and hot, and when they are fo, take them out quickly, and put the Calaminaris in them, also they have a shovel made on purpose, that therewith they may take up and know how to distribute near 46 pounds in such eight Then they lay in every pot upon the Lapis Calaminaris 8 pounds of small broken Copper pieces, and fet-in the pots again, and let them stand 9 hours in a great heat, and in this 9 hours are to be taken one heap and a half of Coals, and when fuch Coals are burnt out, then stir the stuff in the pot with an iron, and see how 'tis flow'n, and let it stand in the fluss, and graduation an hour more, then lift the pots out of the Oven, and pour them (if you will have a piece of Brass) all in one hole, and while the stuff is warm, break them, yet so that they may remain and lye close together.

Thus the Brass receives in the breaking a fair yellow colour, but if you make Kettles of it, and other work, then cast the stone into great pots and large pieces purposely for it, which stones are called Britanish Stones, or Lapis Calaminaris, (because they come thence) from which they cut afterwards some Ingots; and from them draw wyers, and beat out what they please for other uses.

Sometimes the Brass - burner sets in the Brass once more, especially if they will have the colour higher, but tis not with profit to be done, for the expence is more than the gain.

Further, 'tis to be known, That the Brass receives in tion of Cop- fuch burning a heaviness, for if you put in these eight pis Calami- pots 46 pounds of Copper, so the Brass will receive in 9 hours an increase of 26 pounds of Brass, so one poureth out again 90 pounds of Brass, this comes from one

5:

Brittain

Gones.

Oven in the week, as to 14 fires) to 3 Centners 34 Chappounds of Brass increase: And others say, That the XXVIII. Goslarish Calaminaris brings more increase than the mountanous Calaminaris, but it makes the Brass in the breaking gray, therefore in the glowing you must take care, that the stuff may not run in the work; and it must only be made glowing with the stames of wood.

This I was willing to mention in short, how Copper is to be burnt to Brass, for their sakes who know nothing of it: But how the Kettles are to be beaten, and the myer to be drawn and extended by water, is to be seen at Ilsenberg, in their works, and in many other places.

How the Brass Ovens, the Pots, Shovels and lifting Tongs are to be framed, and the Britanish stone disposed of, the Sculpture following shews, thus

Deciphered.

1. The Oven in which Brass is to be burnt: the shape of it in the inside, and how the pots and crucibles are to be placed in it.

2. The little brais Ovens are to be placed in the other.

3. How the Pots and crucibles are to be formed.
4. The shovel to take up the beaten Lapis Calaminaris ftone, which is to be mixt with Copper for the making

of Brais.

5. The tongs by which the Pots are to be set in, and ta-

hen out.

6. The holes in the Oven.

7. The pieces of the Britanish stone or Lapis Calaminaris unbeaten.

8. The place for the workman that sets in the Pots.

Sculpture.

CHAP.

Sculpture XXXV.



Thus I conclude the Third BOOK concerning Copper Oars, and its Labour, with other necessary Instructions appertaining to it; and the Reader may consider further upon them: as also of other things which he may have occasion to use.

The END of the Third Book.

OF

Lead OARS, TIN,

ANTIMONY, QUICKSILVER, IRON, STEEL, and the LOADSTONE.

BOOK IV.

CHAP. I.

Of Lead Oars.

HIS Book shews how to prove Lead Sections Oar for Lead, and how the common The Purpose or unseparable light Lead Oars are to be strike Book, smelted in the great smelting Work: next, how to prove an Oar for Antimony and for Spelter, and how to bring

the Spelter out again: Also to try Tin-stones for Tin, and Quick silver Oar for Quick silver: Also of Iron stone and Steel stone, for Iron and Steel, with some Instruments for Tin sope works, and trying of Tin stone in the little Oven: and also of the wonderful properties of the Magnet or Loadstone.

Now, concerning Lead oars they are usually to be well Lead known known among the other Metal oars, for they are mostly from other metals, grey, beavy, bright of colour like the Lead it self, and from Bright oar. its brightness is called bright oar; and such tright colored Lead oars are the richest, and contain above half lead: Oar. then there is white lead oar like a Sand-stone and red lead Red Lead Eeee oar. Oar.

CHAP. oar, like a reddish clay, these Two, viz. the white and II. red are heavy, but not so rich in lead as the bright : also Section. yellow lead oar mixt with grey, which is called, the Lead Tellow lead ram : These and such like Oars are counted the smoothflowing and deft oars: and the heavyer they are, the more

they yield in lead.

But the lead oars which are poor, and taken from flinty, Flinty Lead blendy or mount ainous places, are either visibly or invisibly insperg'd or sprinkled with brightness (like the Lead oar at Gollar,) and are very heavy: yet commonly no visible brightness in them, they are somewhat hard and unflowing, yet they do partly separate and purify in beating and washing, but partly they do stick fast in the water, that one with the other remain unseparated.

CHAP. II.

How to prove defty-lead Oars for Lead.

The mixtures for it.

Unsepara-ble lead

ROVING of Lead oars do require different observations (as in other oars, therefore the pure-soft and flowing-lead oars, you must prove thus, first grind the oar small, and weigh of it two centners, and put it in a crucible, with twice

fo much fluss which is made of Copper oars) with a little Sandiver, and mingle it with a little filed Iron, after this put also on the top of the Crucible a half square finger high of common Salt, press it down a little and cover the Crucible, and lute the joynings with a thin Clay, that no coals fall into the crucible, for that will do hurt, especially in the Lead-Proof, by reason the fluss will boil up in the Crucible, and the lead will not come together in one grain, but in the flacks, like grains.

When

When your Crucibles is thus prepared with the CHAP proof, then let it in a little Oven, prepared for the proof II. of the Copper Oars, put fire in it, and when the Cruci- Section. ble is glowing, blow very hard with a hand-Bellows, that How to difthe proof may have a strong heat, so that it need not Gracibles stand long: then take out the Crucible, and let it be cold, and Ovens. then beat it alunder, and you will find below a grain of Lead, so much as the 2 centner-proof-weights will yield; then draw up the Proof weights, and you will fee how many centners of the bright or deft-lead Oar will vield a centner of lead.

But to this proof must be added filed Iron, that the Antimony which is in the raw lead-Oar may touch the Ironing to be Iron rather than the lead, for if it had no Iron to con-melting of fume, it would begin on the weak Lead, therefore in many places, in the great fire, old fron, or Iron scales, slacks and finders are to be added to the melting, whereby more Lead is produced: it hath also this service in melting that some Lead yields foul and unclean vvork, which by the Addition of the Iron becomes clean, for the Antimony or remaining Sulphur vvill give it felf (in the melting in the Lead-Kilns) to the Iron, and will come away that so the lead may be pure.

But some Assayers pretend to set the Grain-lead upon a Test, which in proving is found below in the crucible, and let it drive, so it will become clean: which is falle, for the Lead being a vveak-volatile Metal, eafily confumes it felf in the fire : therefore I judge that when the proof hath once suffered the fire, the Lead vvill become good and clean, unless the grain of the Proof be not clean, and that there doth hang on the fame Lead, ravy glimmer or stone, which is a fign that the Proof hath not received its due heat, which ought to be observ'd by the Assayer) and then he must make the proof once more.

CHAP.

CHAP.

CHAP. III.

How to prove an undefty, Lead-Oar for Lead. .

UT the right lead Oars (which have with them fome flint, or other harsh ftuff) they prove thus: Beat the lead Oar into pieces, as small as grains of bemp, and weigh of them 2 centners, and fet them in an Assay test in a proof Oven, and roast them, but make it not too hot at first, that it may not run together like Sinders (and do just

as is above mentioned with the Copper-proof) then grind the roast-oar very small, mingle it with the fluss (covered with falt) and you need no filed Iron to this, for it hath two contrary Sulpburs which consume one another, fo that the lead will remain fure, then boyl the proof in the little oven before the bellows (as before) thus the lead will be right in the proof.

CHAP. IV.

How to prove poor separable Oar by boyling it, and trying it by smelting.

> ANY times also Silver containing Lead glimmer do break in the Oven (being insperged with stony-oar) but when you have a separableOar, let it separate it self from the glimmer in the water, viz. when the Oars are beaten that they may be

drawn in washing and cleansing to a pure Oar: of these

I must mention something for the good of the Mine- CHAP. workers, what difference is to be observed in the beat- IV. ing, because oftentimes by Negligence comes dammage;

but first of the try-proof in the little work.

Take a common proof of the light oars, beat it small section. and mingle it well, weigh of it by the Proof-weight 20 centuers, more or less, and draw it into a Tub to a clean Oar, and gently separate this from the light, and weigh how many centners of clean oar, the wash'd common oar will yield; and then you may eafily reckon how many centners of common oar will yield a centner of good oar; and this pure oar may come to be so by the beating, sifting or washing it, (and do waste and prove, as above) but the good clean and bright oar is proved upon lead; thus you have the content of the Lead.

Now concerning the beating in the great work, the lead Oar you know is a heavy Oar, yet 'tis subtile and easy to be beaten into dust, which swims upon the water, and goeth forth; especially, if the same be in a glimmery or flinty, or borny stone (which Quarryes or bornflones do afford) to which add the glimmer in beating, and make it dust, and this subtile dust (which is the best of the oar) doth oft times yield a blew, dust which will lay it felf on the great walls or ftones in the wash-

ing, and comes to no profit.

But, some use the Beaters or Workers (which build A burtful Beating. the Beat-works) to prepare thus the wet-works, viz. That the hindmost stamping Pestel which beates the light or rocky Oar from behind, and beats against the lamins or plates; understand it in this manner, That the bind. most Pestel may fall first, then the middle one, and at last, the first next the Plates.

This beating is not profitable because it causeth great dammage, by realon that the beaten stuff or rocky oars let themselves before the Plates, so that the graind oar Ffff cannot

V. Section. Difference in Beating.

CHAP. cannot well come through, but beats it felf into a small or fubtil dust, and goes away in the beaten or wash'd fuff, therefore many Washers esteem the dry-beat Works better, where one may work over the Seeve, and have the great and small Oars asunder, and also make more forts than with the wet work, which is found that if the wet-beaten work is built and prepared thus, the poor or rocky Oars will be beaten back from the plates, viz. that the Pettle nearest the plates will fall first, then the middle one, and at last, that which is behind, thereby the plates will remain clear, and the holes will not be stop'd, but the water will carry the pure Oar through without hindrance, whereby not only more Oar will be preferv'd, but also the Oar may be made great or small, and so to greater profit: and having found this in the work, I would not leave it unmentioned being fo fit for every Mine-worker and Assayer to know.

CHAP. V.

How to try common Lead-Oars for Lead, in a little Oven.

IKE as the Copper Oars (mentioned in the Third Book) are to be try'd in a little Oven, to may it be done with the Lead Oars, especially if they are very clean, right and good, let them be thus beaten raw, as small as half an Ha-

gel nut, then let them upon a little Oven, but it were better 3 or 4 pounds of fuch small beaten oar might be laid first upon a Test, and gently roasted, and then beaten and roafted again, that its great wildness may come off, and so the lead will easily separate from the flacks without other Additions. CHAP.

colod auto of the CHAP. VI. m. , wall drive it same

How the inseparable and light Lead Oars are to be assayed in a little Oven.

> ONCERNING the light-common-Lead-Oars, which do not separate in the water, they must be beaten in like manner as is spoken of the separable; only they must be roasted somewhat better, and when they are thus prepared, then

melt them through the little oven, but when the lead is to the little not come altogether, then beat the flacks very small again, over and take the clean lead from it, as you separate the stone; Now when the Lead oar is flinty (if one be diligent) then weigh the *lead* which is cleanly feparated, and make your account how many centners of Oar may yield a centner of Lead; but if the lead oar be very coppery, 'tis to be roafted, whereby in the proof melting the Copper will come among the lead, therefore it must be separated upon a very flat harth, and you must cause the lead (as above in the Copper proof direction) to run off with a gentle fire, and fo the lead will become clean, and the Copper will remain fetled, and this makes clean work (as you are taught before.) But the little oven for proving the lead oars must be prepared (like to the Copper Oars and flints) that you may bring out the flacks and lead very clean, as such practise will shew.

But in the Assay Crucibles the proof must be thus: 12Crucibles Take the light lead oar, grind it small, weigh two Centners of it with thy Proof-weight, let it upon a proof Test in the oven, let it roaft till it stink no more of Sulphur, then grind it fmall, put it in a little Crucible with four

Cent-

CHAP. centners of the fluss (which is used to the deft lead Oar) VII. put in it also melted Sandiver, and cover it with Salt, lute it with clay, and let it boyl in the little Oven before the Bellows, blow more strongly to this proof than to the clean bright proof, and thus you have the Content

right.

You must also know, That every lead Oar may be proved unroasted; thus, Grind it small, weigh two centners, use the fins to it (according to Instruction given) only with the Sandiver, take among it raw Argol, mingle it together, cover it with Salt, and the crucible with a covering: Lute the joynings with clay, and fet it in one of the little Ovens, blow strong to it like to a Copper proof (as above) thus you will find the Content of the Lead,

CHAP, a VII.

How to make a Lead-Proof on a Table or in a Stove.

HE Lead oar to this proof must be very clean and good, take and roast it a little, then make a flus of two parts of good clean Salt-Petre, and one part of fmall ground Coals mingled together, put two parts of this fluss, and one part of

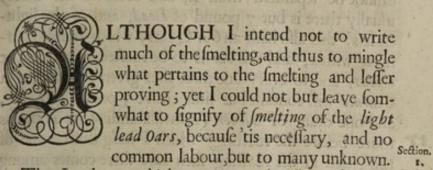
the roast Lead oar also well mingled into a Crucible, cast a little glowing coal in it, then it will begin to burn, and the Lead which is in it will flow together, and although this is an uncertain proof (not to be trufted to) yet thereby one may learn to know the property and nature of Minerals. CHAP.

begunind it littell, put it in a little brineible with four

the state of the color of the

CHAP. VIII.

How to make Lead Oars (though they will not separate in the water) to be profitable.



Section.

Rocky lead

The Lead-oars which are poor, and will not separate our, lead in the Water, are flinty Glimmer, or such as come from unseparable Oars, and yet to be made to profit (if one have a pretty quantity of them) but not by the common smelt-work or arch'd oven, for there the wild and sulphury slacks of the oars consume the Lead very easily, the sail that almost no Lead, or not half so much as in the little devour the proof is found or can be made, but only after the useful Lead. melting at Goslar, with which the light contenty lead oars of the same place are to be smelted in a great quantity, and by no other ways, as by me and many others have been tryed.

But that you may have a fure Instruction for this work, and how such volatile oars may be help'd, I shall therefore describe the whole Gostarish Method, which they

use in preparing their ovens, &c.

First, I will signify what manner of Lead-Ovens there are at Goslar, and what they contain, that one may the better find out what doth follow.

The Lead Oars at Goslar are commonly black Oars, Goslarish also a white-gray flint with insperged Copper flint, and Lead Oar.

Gggg

are

CHAP. are very shining, which Glimmer is not to be seen in the VIII. Oar, but apparently in the melting and flacks, a Centner of the best of that Goslarish oar (if there appear not Glimmer) doth not contain above 16 pounds of Lead, but of the common Oar (mingled among the flint which cannot be separated from it, and breaketh the most) usually there is but 7 pound of Lead, and of the lighteft less: this also hath an Oar Quarry which flands intermixt with it, and this Oar is to be roafted in very great Ovens, and to every one three fires given; and then a Centuer will contain but little above 5 pound of Lead, and one dram of Silver (notwithstanding it contains more before the roasting) which I judg dorh come of this, that in the roafting fuch oars there comes among the others, light and good; and therefore the Content is more equal, and these 5 pounds of Lead, and one dram of Silver are for the most part melted out in the Smel-

ting.

Secondly, In the same place must be no more than ovens upon two Smelt Ovens to one fpring (though the Melters think (if it might be fo for the Waterfalls-sake) that it were better that every Smelt oven should have his own spring and wheel, because every one might order his Bellows most advantagiously, which must be with great might and with heaps (as will be shewn) to force the Oar through the oven: yet it is at all times fet through the fmelt Oven nearer the Wheel, than through the other, and so where is more set, there is more Lead made, and with more profit of the Coals.

They make fuch Smelt ovens inward, within a wall of two bricks and a half deep, and two bricks wide, and the Walls above it, two ells and a half high, of Sbifferstones which are not thick, that one may, when he will, break out the Oven for the Lapis calaminaris, which

grows in it (as hereafter you may hear) for the Shiffer

Smelt 5 Ovens.

or flackstone in the same place will very well indure the CHAP. fire, and they do lay the foundation of the fame two VIII. ells deep under it, crossways; that it may go out against section. the bellows, yet fome foundations extend or reach to the wheel-room, but I do not approve of it, for if they become moift thereby, or draw moiftness to it felf, then it is hurt in melting, therefore it matters not a little that the smelt Ovens be right in their wideness and hight, as also that the Foundations be in their right places, that no water may come in, not too deep nor too moift, for if the water go on the Foundations, then the stuff in the Lead will not leparate nor work well; also that the forms may lay right according to every kind and condition of the Oar, neither too fharp nor too flat, which should be fitted that the Bellows may blow in the midft of the stuff in the oven, just near the forewall; The fmelt Ovens at Gollar have very great Bellows, of fix ox hides to one pair, to force the oar through in great quantities, therefore the Bellows must be strong.

Concerning the Crucible in the oven, it must be Two Crucis made thus, Lay upon the Foundation a great stone, best for the which is called the Crucible-stone, upon this they make a harth of Clay, mingled with little flacks, and upon it, another harth of Clay, and when itis dry they wash the Crucible which is half in the Oven, and half out the middle standing right under the Wall) with burnt Oars of a thumbs thickness, and when 'tis dry and well warm'd, that it will glow very well, and become firm in the Crncible like feel, then the smelt oven is prepared till the clofing : but fuch a Crucible must be to the smelt oven five quarters of an ell deep, and without the oven, it must so bend it self that the Lead may come to stand before the oven in the Crucible, and not in the oven.

When all this is done, then they put a veffel with The Clofing Coals in the warm Crucible, and upon the Coals three the work in

Vessels the Ovens,

CHAP. Vessels full with light coal dust, which they make thus: VIII. They make on the Wheel on the end of it a Beater or Mallet, and as the wheel goes round about, then the Mallet falls down twice upon little hard coals, which the fervant of the Melter, when he hath time doth put under with a Shovel, albeit it is a flow work, yet they make fo much dust with it as may serve two ovens, for they are not willing to lay fo great a burden upon the Wheel, but they beat no Clay with it (as they use in the dust in other Smeltings) then they moisten their Coal_dust, and force and beat them with some heavy thing, into the Crucible in the oven, (commonly with an iron Beetle) that it may not come upon one another, and also before the oven, where they make it a little higher, that the flacks may not floyv out, and leave a hole open belovy on the oven, under the forewall, (which is called an Eye) that one may almost reach his hand into the Oyen.

Of hindling the Fire.

After the preparation and closing of the oven, they put on the Top of it glowing and other Coals, and after that a dray or two full of their flacks, then coals again, upon it the burnt oar, and so continually coals and oars till the Oven be full to the top, also they lay before it live coals, but not many, only that the dust may remain warm near the fore-vyall, where the flacks flow out: Novv when the oven is let full, they flay till the fire burn in the Oven, and then they begin to melt, and make the Oven vvet, vvith vveak flacks, as in other meltings: neither have they Iron-stones, but copper which is to lye pretty far in the oven, for the Iron gratty flacks will deyour the Iron stones quite in tvvice vvorking, which they do not so easily to the Copper: yet in time they do confume also, so that they must be renevved once in a quarter of a year.

Their time to melt is 23 hours, in this they set into one Oven 66 to 70 Centner of roast oar, and the oar vvill

flow

flovy like vvater, and vvorks it self very fresh, and there CHAP. is nothing else to be taken to it, but only the burnt VIII. Oar.

Now, when the Melter lifts off the uppermost flacks, (which is very heavy and thick) the rest under it will stand very clear, and then with a great iron Ladle he pours them out, which will run like lead, so fresh as they are, and the slacks look like a melted slack-stone. But the lead creeps through the light dust in the Oven, and hides it self under it near 23 hours, and therefore the wild Sulphurish slacks cannot reach it, nor the long during heat consume or devour it.

When the Melter hath observ'd his time, then he opening the opens the Funnel below, and takes out the light dust together with the slacks which are settled in it, and whilst the Melter is drawing the dust out of the Oven, a servant must gently pour water, that the Melter may endure the heat, and when all the dust is drawn out, then the Melter with his fork stirs the Lead in the Oven below, so that all the Lead may come together, then he casts the Lead into the harth standing by the Oven, and it must be kept warm continually.

Out of this he draws it into Cakes or sows of Lead of the (according to the old Fryberish Method, and brings out Sakes of of the 60 or 70 Centner of melted Oar (in such a time Lead. well melted) near three centner of Lead, of which one centner contains 4 loths of Silver, and the rest of the Lead and Silver will remain in the slacks; and though there be almost as much yet remaining, it is a Wonder that so much should be produced out of a poor contenty stub; born Oar.

But if you would melt other Oars besides this (after the Goslarish Method) you must be careful the Oar may vvork it self fresh; for if it do not, then you must help it, for the light dust cannot suffer the very soft slacks, also Hhhhh CHAP, when the light lead Oar contains pretty much Silver VIII. and little Lead, then at all times, according to the condition of the Oars, there may be added hard Lead, that

the Silver may have a refuge into the lead. Section.

I must fignify, that in the melt Oven of the Goslarish Lead oars, they lay on all four walls of the Oven a gray with a yellow mingled matter, every Row or Lay as thick as a straw bredth) which they call Galmay, used Galmay, or in the brass-melting (and adding as you have heard in the end of the Third Book:) and this matter must be put out of the melt Oven after 8 or 9 Rows or Lays are made, else the Oven will be too narrow, so that no

more can be melted in it with profit.

Thus much I was willing to mention of Lead oar and Lead, that every Mine and Smelter, who will imploy himself in it, may know how every one may be help'd; for 'tis a weak tender Metal, and may in Smelting quickly be hurt: And, 'tis manifest, if this way of Smelting of poor light oars of Goslar had not been invented (by which they make their Lead) neither the City, nor the Mine-work could have been thus long useful, having continued these 700 years, and by the help of the Lord may longer continue. The following Sculpture

The Goftar Mine 700 nnance.

Lapis Cala-

14.

minarts.

Deciphered.

1. The The Walls of the Furnace.

2. The Lines on them, shews the Gradations of the Metal descending.

3. The man that manageth the metal in the furnace.

4. The back of the Furnace with the coals and pieces of metal flaming.

5. The grand Test.

6. The Oven for that Test. 7. The pieces from the Test.

8. The man that beats the Oar.

9. The

Of Lead Oars.

9. The pieces of Oar and Cinders.
10. A heap of Charcoal.
11. The water troughs to mash the Oar in.
12. The Pipes by which the foul water is cast out.
13. The Instruments for the Furnaces and Tests.

Sculpture XXXVI.



CHAP.

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CHAP. VIII.

CHAP.

CHAP. IX.

Of melting Oars with Moll or Turf.

ers and Smelters have pretended that all forts of Oars might be melted with Sods or Turff (as the Saxons call it) I could not omit in this part, but give the Reader my Judgment. And because the

Oars are not all of one fort, but partly harsh and hardy, and partly mild saft and flowing, and that the Turf yields very heavy and much Asbes, which in the Melt oven comes to be a slack (almost like a Glass) I judg it must not be used at all to the weak oars, to which this separating Work is unprofitable, for through their many heavy Asbes the meak flowing oars are hindered, and the Oven thereby stopped, and though you use half coals with it, yet it would not turn to profit. But what are barsh-bot-graty Oars (especially roasted lead oars by help of Coals) may be melted, and it will be serviceable, for they will work themselves more separable and dest: so that one need not much other addition (as aforesaid.)

But if one would melt such barsh Oars with Turf only, I fear the Oven will be stopped many times, by which the work will be much hindred; therefore I conclude it better to melt with Coals, than with Moll, Sod or

Turf.

The property of the Molls.

CHAP. X.

How to prove Spelter or Wizmet Oar, which some call Bizmuth.

> PELTER Oar is a white heavy Oar, and section. yields among other Oars the most flowing Metal, which needs no fingular Pains to melt it down: But there are two forts Two forts of of melting it, in the Wind, and before feller Melthe Bellows; as will follow: for, if you

will prove this oar, how much Spelter it may contain, then grind it small, and weigh a centner of it, and two centners of the fluss (before spoken of, made of Argol and Saltpeter) mingle it, and put it in a Crucible, cove. red wit Salt, and cover it, Lute it with (Jay, and boyl it up in a little Oven before the bellows, like (to a flowing Lead proof) thus you will have the Spelter below in the Crucible like a lead Regulus; draw it up after thy proof weight, and you will find how much Spelter a centuer of Oar yields: but, till of late, we had not the vvay to melt fo much out of the Oar, as hath been found in the proof, and the difference is alike, for we finde almost the half part more in the little proof, when the Spelter is melted out of it: But, as it hath been mentioned in The Differthe Tin-flacks (which by a strong fire will melt the Content. remaining Tin) so it is possible to do with the Spelter.

But to melt the Spelter out of the Oars tyvo methods are used: one by the wind, the other by Bellows: the To melt on the wind, vveakest fort of Spelter Oars are to be melted on the wind, which is to be done thus; Take of the Oar, and Beat it to little pieces, about the bignels of Walnuts, and put it in little iron Pans (let in order) that they may

fpread

CHAP. spread abroad, and fet them in the field in the winde, and make a fire of dry wood, so that the wind may bring the flame into the pans upon the Oar; thus the Spelter will flow quickly out of the Oar into the pans, and when 'tis almost flown out, stir the Oar about, that what the flame hath not touch'd yet, may be melted all out.

Section.

This is the true proof for the Spelter oar (and the right melting) because after this, can nothing more be melted out of it; then lift the pans off the fire, and put out the oar, and make the spelter clean, let it be cold, and put fresh oar into the pans, and melt continually; this spelter so melted is the best and cleanest, and some centners may be made at a melting, which melting is clearly to be seen in the following Sculpture.

The other way of Melting it, is thus, make the Oar To melt in clean and beat it small, and prepare a little Oven, a good fran wide below, and four spans high, and above two spans square, then place a weak Bellows (like a little Smiths Bellows) behind, and in this melt the spelter Oars or flicks with wood and foft Coals; and before it be all flacks draw it out of the Oven into a trough of wood, made on purpole, and in this stir the glowing Oar to and fro, and so the spelter will flow together, then feparate it and make it clean; what remains at last of the dross (by either way of Melting) makes a blew colour in great quantity, and may be used for glass to give it a blew, tis here and there fold to the Glass-bouses.

ning I in) lo it is politible to do worth the

are used: one by the noud, the other by bellows: the vverkelt fort of Spelter Oars are to be melted on the

print vylaich is to be done thus; Take of the Oar, and prupus of it to little pieces, about the bigness of Walants, and

partit in little from Page (fer in order) that they may



Deciphered.

- The little Iron Pans for Spelter or Wismet Oar.
 The fire of vyood for them.
 Melted Spelter that is to be made clean in the iron Pan, and the work man that tends it.
 4. He that draw; the Oar out of the Mine.

CHAP.

CHAP. XI. XII.

CHAP, XI.

Of Tin.

Section.
1.
Tin ftone or
Zwitter.

WITTER or Tin. stone whereof Tin is made, is heavy Oar, yet the Metal which it produceth is the lightest of all other Metals; the Zwitter is to be known by its brown colour, which inclines a little to yellow, yet the rich Zwit-

ters are black and of fine growth, and so smooth as if they were polished, and very rich in Tin, yet sometimes the Zwitters are found in another form like Iron stone, or a pointed woolfer an Oar (which the old Miners have not known) therefore 'tis needful to prove the Zwitter with diligence whether it be Tin-stone or not, and whether it yields much or little, that the Mine-workers may the better know what to do.

But the Tin-stone, as well in the little proof as in the great work, must not only be burnt, but also purified clean before the melting, otherwise it yields not so much Tin, as when cleanly prepared.

Yet, 'tis to be known that every Tin-Mine-work hath a fingular manner to prepare the Zwitter or Tin-fone, which is to be admired.

CHAP. XII. and shirt of T.

How to prove Tin-stone for Tin- and I

The way of Proving it.

LTHOUGH the proying of the Tinftone how much properly doth contain a centner, be an uncertain proof, yet by it thus much may be learnt, that one may know whether the Tin-stone be good or light, likewise what happily may be made of Tin, and to know its true content, CHAP. and the most common way to be used therein is as here- XII. after followeth.

First, when you have taken a common proof of the Zwitter, or well-beaten Tin-stone, then grind it small, and weigh of it with thy proof-weight what you think fit, and dravv that which is vveighed off into the flick or dross, and weigh that too; then set it in an Assay-oven upon a test, and roast it in a pretty heat, and when it is cold again, grind it, wash that which is light in a wooden trough, and weigh the clean flick again, and observe how much goes off from the flick in the roafting and shifting, and do this two, three or four times, till the stone is very clean, and that nothing more goes off from

it; thus'tis prepared to the proving.

Of this prepared Tin-stone weigh two Centners, and In the mingle among it small ground Pitch, and take a glowing Coals. bazelor Lime tree coal, or any other that doth not spring or break in the fire, but remains whole, cool it in the fand, and cut in it a Channel, and at the further end of the Chanel, make a little hole, into which put the mingled Tin-stone above, upon the broad place of the Channels, and lay upon the same Coals, other Coals, just as broad as the first, for which you must also have a hole below and above, that the Bellows may blow between, and lute the Coals on both fides, that they may remain together; and when 'tis thus prepared, lay it together with a cool temperate fire, so that the Tin-stone may come above and in the little hole (in which the Tin is to flow) lay glowing coals upon it, and blow it with the Bellows, so that the blowing may just move upon the coals in which the Tin-stone is, so the Tin will slow out of it with a fresh flame, then lift the Coals out of it, and let it cool, and weigh how much Tin the two Centners of the prepared Tin-stone hath given, then you may make Kkkk your

With the

CHAP account how many Centners of the common Zwitter XIII. yields a Centner of Tin, this I judge the furest proof.

Then one may weigh off the prepared Tin-stone, and with the fluss (made of Salt-peter and Argol mingled, and put into a Crucible and covered with Salt) boyl it in a little Oven (like to the Copper Oars) with the Bellows to give the Proof a strong and suddain heat : for the Tin will burn eafily in a strong fire, and so you will find how much Tin the Tin-stone doth contain.

Upon a fud-den Heat.

But the Tin-Melters have a fingular proof upon the bucking, and wash'd unburnt Tin-stone, namely, to cause a shovel to be very glowing hot upon which they put the Tin-stone that remains upon it, and springeth not off, and doth colour it felf, this they account a good Tin-stone, but if there be much false Oar among it, they may fee it, and I judge it more needful to prove the Tin this way, because you may know whether it be good or bad, and vvhat may be made out of it, but for those who have not long converted with it, or well understand it, 'tis better to use the first proof.

CHAP. XIII.

How to try Tin-stone in the little Ovens.

HEN the Tin - Stone is cleansed and burnt, then weigh an half, or vvhole pound or two of it: and fet it through the little Ovens (as before is taught of the Copper and Lead Proof) and melt it with the Bellows, without any other Addition, whereby you may fully fee how much Tin-Stone it yields: but observe, if you will set the Tinstone in the little Oven, or will melt it, 'tis to be put in

wet

wet, and no small or smooth Coals used to it, for the CHAP. Tin cannot fuffer the heat, like Copper and other Me-XIV.

CHAP. XIV.

Of beating and preparing the Zwitter.

ECAUSE in preparing the Zwitter, commonly fo much Tin-stone cannot be made and washed from it, as in the little proof, which I do impute to the useful and long observed beating, because the Pestels fall not (as I have mentioned above in the Lead-work) I judge the other beating (though not tryed and prepared upon the Zwitterwork) not to be unferviceable for the dreffing it; but by it more Tin-stone is obtained, and it stands with Keal ion, because thereby the Lead-oar may be profitable to the Zwitter or Tin-oar which I leave to every ones con-

fideration and pleafure. There comes often many profitable works to light by To melt old trying, which otherwise would have been lost; as lately gathered the Melting the old Tin-flacks which have lain long useless; also upon a new Method, that you need not melt them as before, through the Zwitter Oven, but over a common Melt Oven, which is used to raw Works, and may always add fresh, making it not only much but also good Tin.

But because commonly the Melters make not out of one Vessel of Tinstone, so much Tin as out of the other, that is not as I judge in burning and preparing; but the fault is in their way of Melting, else it were not possible to melt fuch Tin out of the flacks, as now is proposed.

in the

CHAP. I must further instruct the Reader, That I am of this XIV. mind in preparing and melting the Tin stone, because tis fure, That out of the common Zwitter so much Tin The log in cannot be made in the great proof, with the usual beating and melting, as is to be found in the little proof because in beating and melting, there may be loss, (as above is mentioned) therefore it follows, That to this preparing and melting fome better ways may be invented, in my

ludgment futable to this way.

For the Tin in melting cannot fuffer fo much, and is burning it. more volatile in the fire than Lead, and good clean Tinfrome goes off as well in beating, burning and washing as the Lead oar: and I judge it more profitable and fit to be tryed, that the Tin-stone be left in grains, and then well burned, but not made half fo clean, as to the now usual melting; and when it is melted over the light dust with strong blowing (after the Goslarish Method) under which the Tin may hide it felf, and remain fure, for the flacks and great heat: and I doubt not but by this way, out of 60 Zwitters may be made more Tin than in the com. mon way of melting, confidering the light Contents of the Gollarish Lead oars (are as is above written) which doth not separate in the water nor are made clean: but of the Lead which is in it, (as it is faid) one Centner commonly contains but five pound of Lead, by reafon of the light Content, and the many flints with the Oar, which will not let it waste away, and in no other Melting can Lead be melted out of it, as by the admirable vvay of Melting in this place is discovered; vvhereby I judge this trying vvould not be fruitless, if it vvere truly tryed, yet I leave it to every ones confideration. But if the Goslarish Method should not beused to this, then I know that through their Melt-ovens it can no vvays be done.

Goflarish Melting.

CHAP. XV.

An Instruction for Tin Stone Work.

HERE are many forts of Tin-stone Working: some being rich and some poor; in the Stone, and in the washing there is much hurt by the great waters which the Tin-workers use, by which fo much of the Tin-ftone as is flowing

and fubtil runs avvay, fo that for two, three or more Miles the Tin-stone is found under the Water : which in my Judgment may be the more profitable, because a full Mine-Tub of the Wash-work yields commonly one Loth of clean Tin-stone, and may be set over the Seeve work and washed, so as a Wash-man may do as Seeve-Werk much in one day, as two Boys can bring.

But such cleansing must be in a Tub of water with a hole in the bottom, that the flicks may fall through upon a plain harth, and yet the Tub be always full of water, and in this the Tin-stone is to be driven over the plain harth made clean and prefery'd.

By this Work, if in one day 400 Mine-Tubs were filled and made clean (to which there needs but four persons) there might in a Weeks time almost half a Centner of Tin-stone be made clean and gathered, and this were to better profit than the other usual way; but I leave it to every one's pleasure.

CHAP.

CHAP. XVI. XVII.

CHAP. XVI.

To prove Tin Additions.

Scalion.

OU must take clean Tin, wherein is no Addition, cast it into a round Ball in a frame (made on purpole) cut the Ingot clean off, and take the Tin you would prove against it, and cast also of it a round Ball like the other, and cut the

Ingot also clean off, weigh the Balls against one another, as the pure Tin, and if they weigh alike, then they are of one fort of Tin, but if one Ball be heavier than the other, there is Addition either in the Melting, or put to it Tin the best. afterwards; but the lighter the Tin is, it is the better : but to know justly the Addition, you must have a particular weight made on purpole; and when the Addition is found, then such proof must be weighted against the clean wrought Tin, and the Tin Vessels made for the Tin, upon divers Mine-works, will have a difference on the weight (as is mentioned of the Coppers) and the Proofs will not agree.

CHAP. XVII.

How to prove Antimony.

NTIMONY is a fine beavy Our bright like Lead, yet spigy, and in Germany and Bobemia it is found in great quantity, yet fome better than other: and now. because it is used in some matters, I will Thew the best way how to prove it: viz.

Beat

Beat two or three pounds of the Oar small, put it in a CHAP. pot with a hole at bottom, cover it, and fet it on ano- XVIII ther pot, Lute the joynings, and let them between Tile- XIX. Stones in the fire, that the lovver part may be cool, and that the fire may not touch it, let the upper part stand in a glowing heat, so the Oar will flow easily, and also the Antimony from it through the hole, then cool it, and take out the Antimony, fo you will fee how much Antimony those pounds of oar will produce, and accordingly you may order your felf.

CHAP. XVIII.

obam od vern god Of Quick-filver.

UICKSILVER is a fine red and brown Oar, like Gold Oar, partly deft and partly insperged in the Mine. To prove this Oar it cannot be done in an ordinary fire (as the other Oars are, Quick sliver nor melted out of it) but as a spirit must

be driven off in a strong distillation, for its Metal is in the fire volatile like a spirit.

CHAP. XIX.

How to prove Quick-filver-Oar for Quick-filver.



OR the accomplishing whereof, the best way is to take half a pound of it, or fomewhat lefs, beat it as fmall as half a Nut, and put it into a Retort or other well luted Instrument, and drive the spirit into another Instrument laid before it

CHAP, in water or other moistness, thus the vapours or spirit will prefently resolve it self in the coldness or wetness into Quick filver: But if one hath no Retorts, he may use a well luted glass Bottle, and set upon the Bottle a Helmet (which hangs over) in which water is to be put, and the joynings every where well luted, that no firit may go out, then let the Retorts on the Bottle in a little Oven, and make first a gentle fire with wood, then stronger, thus the Quick filver will drive it felf from the Oar in the coldness or wetness, for the Quick silver loves coldness and moistness, and avoideth the heat as its Enemy: Now when you have found Quick filver in the proof, weigh it, and then you may fee how much the Oar was which was let in, whereby your reckoning may be made accordingly.

> But concerning melting of Quick filver in the great Work, do thus, beat the Oar small as a little nut, put it into Juggs (made on purpole) in each about four pound: then prepare a flat harth of moistned Coal-A-(bes, on which fet round Tests, three square fingers deep after one another, and turn upon it the Jugs fill'd with Oar, stop it well with the moistned dust, about the Tests and Jugs: then make a wood fire upon it, and the Quick filver will avoid the heat, and feek the cold which

it finds in the Test below.

This Labour in the great Work is to be feen in Germany, and in many places upon the Mine-works.

Pags.

CI

CHAP.

CHAP, XX.

XX. XXI.

Of Iron and Steel-stone, bow to know and prove them.

RON-STONE is brown, and its colour is fo that commonly it looks like roasted Iron; but the best and richeft Iron-stone its colour is blewish, like to a dug Iron, and some of these Ironstones are Magnetish, and draw the Iron apparently, which proceeds from their hidden beat, as shall hereafter be discoursed of.

CHAP. XXI.

How to prove whether the Iron, stone be rich in Iron.

O this by the Loadstone; therefore if you section. will try the Iron-stone, roast it (though "the Load. fome take it unroasted) grind it small, stone. and take a good Loadstone, turn or draw it about with it, and the good will hang all on the Magnet, stroak it off with an Hare's foot, and lift the Iron-stone up again with the Magnet as much as it can bear, and if at last any remains that will not be drawn up, that stone is drossy and not good: Thus you may see whether a Mine hath Iron, or whether the Iron-stone in it be rich or poor in Iron, for the Magnet (as is faid) lifteth up no other

Mmmm

Metal but Iron and Steel.

The

CHAP. XXI.

The Steel-stone and Iron-stone are alike, though not in colour, some look like yellow sparr, this the Magnet will not lift up raw: nor some Iron stone at all; but if By the Steel you roast the Steel stone, it colours it self, and is like the colour of the rich Iron frone, and then the Magnet will lift it very eafily, and fooner than the Ironstone: and then the Iron may be made (with a long and strong heat, and with hard Coals in a Secret glow) without dammage to good Steel, and the common Steel by Smith-working will turn into Iron again.

When fuch proof is found by the Magnet that the Ironstone is good and rich, then the Hammer-smiths (with their Additions) use further to prove and try it, in the

great fire.

The Iron stone being of an hot Nature, will not flow or melt with a fmall fire, as Gold and Silver will, but it must be a great and strong fire, and when 'tis forced to flow out of the Iron Ovens, many Instruments may be cast, and its hot Sulpbur will flow from it: also upon melting of it, somwhat of its substance will come out, and though it be refreshed in the fire with fresh Ironstone, yet fo much of its substance will go from it as it hath lost in the first melting. But when the Iron stone is to be melted in the high Ovens, or in the running work (with a true Addition as every Ironstone requires) then let it

most deft for to work. Thus much of the Ironstone, how to prove what it yields in the little work: But how the Iron may be boyled into Crocum Martis, as also to get Vitriol out of the roafted Iron (of which the Philosophers write much) and how the Iron is to be wrought after feveral Manners and Methods, and hardned: But all this belongs not to proving of Metals, and so it falls not un-

force it felf, yet the twice melted Iron is best for use, and

der

Iron.ftone,

der my Instructions, but the Reader is left to find out CHAP.

CHAP. XXII.

Of Magnets.

OADSTONES or Magnets being mentioned in BOOK II. CAP. II. and in this IV. BOOK, I will discourse something of its Nature and wonderful Properties, because there is none amongst all fewels which doth so naturally thew its Virtues as this fewel or Magnet, and therefore I will let the Reader understand what Serapion an old Philo-Sopber writes of it in his Book De Simplicibus & Mineralibus, where he fayeth thus, Take the Magnet, lay it in an earthen Veffel, and add much of Calx viva, lute the Vessel well about with Plaster, and make a great fire under it, and let it stand in the beat till the fire goes through the earthen Vessel that it may well glow; then set the earthen Vessel with the matter to burn in a Potter's Oven, till the overluting be consumed on the Test, then take the Loadstone out of the Vessel, and mingle it again with Calx viva three or four times, and let it burn as before, and when 'tis taken out of the Oven the fourth time, then hold the Magnet in such a place that neither the Wind, Water nor Dew may come to it, nor any other Moistness, till it be cool, then beat it small and add yellow Sulphur, in like weight; Thus the Magnet is prepared, and if one do drop Water only upon it, a great fire will spring out of the Magnet, which would burn all that it toucheth. CHAP. This was Serapion's Opinion, against which I have XXII. nothing to say, whence the Magnet doth so vehement. It love the Iron, and the Iron the Magnet, as though they were both of one Nature, and created one for the other; the Magnet being very desirous of Iron, and draws it to it self with its whole Power, and the Iron presently shews it self by springing to it, and so remains hanging on it.

The Magnet is also called the Sail stone, for the Sailors look upon it as their Chief Instructor in their way upon the Water, far and near; namely, after they have touch'd the little tonge or Needle in the Compass with

the Loadstone.

sun I.

Also the Magnet is used to the Compass Needle, in the Mine-work, and to direct their Glass and Andits; and also in the samous and worthy Art of * Separation: and also with common Miners, the Sun-Compass is very useful; so for Brevity sake, I will conclude this Fourth Book: and desire the Reader, for this time, to be contented with the Instructions I have here given.

about with Platter, and make a great free un-

* Mark Schiden.

The END of the Fourth BOOK.

till it he cool then beat it had and and yellow Sul-

if one do drop Water only upon it, a given fire will fring out of the Magnet, which would burn all that it tout beth.

The Fifth Book.

tion to all Juch (and others who are Lovers of the

Of Vitriol.

SALT-PETRE,

VITRIOL, ALLUM and Salt Springs.

BOOK V.

CHAP. I.

of Salt-Petre.

N this Book Salt-Petre Earth is described, and its Properties, and how to be The Purpose known, and how to make Lees of it, of this Book. and of the Washings and Boilings of it, and the Purifying of the Raw Parts of it, and how the Salt is separated from the Earth, and cleansed with particular Instructions how the weak Salt-Petre Lee is to be made richer and boil'd to greater profit.

Allo how to prove the Flints for Vitriol, and Allum-Oar for Allum, and of Wells or Springs of Salt.

Now, because Salt-Petre is much used for several uses (as may be seen in the Four foregoing Books) especially for the distilling of Aqua Fort. I thought it a necessary knowledge for every one who shall use the former works, that he may himself purify the Salt-Petre, and cleanse it from the Earth of common Salt.

Therefore, I shall, in this Book, give a large and true How to book Nnnn Instruction falt Peter.

Section.

CHAP. Instruction to all such (and others who are Lovers of the Products of Nature) and tell them of what Species Salt-Petre is, and of what 'tis made, also how to boil it, so CHAP. that every one for his own Use may prepare it him-

Salt-Petre is a Stone-Salt, which hath in it self a fullen cold fire, therefore for many things ferviceable, especially for separations (of which I have written in my Books before) and of great use for making Gun-Pouder from which it cannot well be spared) but 'tis to be made out of many Sorts of Earth, as hereafter follows.

CHAP. II.

Of what Earth Salt-Petre is best to be made.

HE best Earth which is richest in Salt-Petre, and hath not much Salt, is the Earth out of old long-lain Sheep-stalls, which are very dry and not wet:

The other Earth which yields good Salt-Petre is the Calx or Clay of very

old Walls, in a Town or City: where the Earth it self is Salt-Petrish, having not stood too wet, nor alwayes dry, but sometimes moistned, and then again shined ipon by the Sun:

Next to this is the Earth which comes of broken Old Cellers Chalk-Walls in ruin'd Houses, built upon vaulted, Cellars, and lain there some years, because the Vapours out of the Cellar through the Vault may draw it in , as also from the daily moistness from above, and so the Salt-Petre is generated: and this Earth may be dig'd to a good depth, for it lies mixt from above down to the Vault, which man /

which (by the before-mentioned way) may be proved CHAP. how deep the Earth shall be taken for the use.

Also Earth which is old (and hath lain long in unplastered Houses, Cellars or Vaults) is good ; but if Unplastered it lies not above a Span or half an Ell deep, it is not good to take up, therefore it must be try'd; only take Notice, that in those places where you intend to boil Salt-Petre, must be also of salt-Petre, or of a Saltish

Nature, that they may be workt together.

Now, those places in general which lay in good fat and claies Countreys, and the Earth of unplastered Horf-stables, or old sheep-bouses (where the Sun hath power over it) as also the Earth of Bremers and of Dyers-houses, and of all Alumish places, and the Ashes of Sope-boylers and Tanners, and all other Asbes (whereof Lee is made) are very useful, only this latter Earth, do's yield much salt: which is some hinderance in boyling.

СНАР. Ш.

How Salt-petre is to be proved.

ALT-PETRE and all other faltish Earth you must prove thus, Put it in a little Tub with water upon it, which may cover it a square hand, let it stand two or three hours, then let it run off, and retain the Lees.

Then take a little Ballance made on purpose, pretty quick in motion, that it may draw a half pound of the proof weight, then have two Scales of Brass or Copper, fet in each weigh scale one, and in one of them a lentner of the Proof weight, and in the other Scale drop with the point of a Knife or a Spoon one drop of this Lees

CHAP. Lees and after that another, until you have weigh'd a Centner of the Lees, then with Pincers take the Lees and the little Scale, which must have room for a Centner of Lees in it) from the Ballance, and fet it upon a foot made on purpose over a little warmth, or upon a piece of Iron-plate or Lamin, and hold a large Candle under it, and the Lee will begin to boil in the little scale, and let it boil till all moifture is boil'd in, and the remains becomes yellow-white, and hardish, then lift it off, and put it in the Ballance again, lay as much of the proofweight against it as it weighs, so you may see how much Salt-Petre a Centner of this Lee will yield; only observe. Section. If you make your proof too hot, then the Salt petre will be of a black-brown, and fo spoil'd, then make it anew. that the Proof may be right.

But that you may know whether it be Salt. Petre or Vitriol, take with a knife, out of the little Scale, some of the rest of the matter, and lay it upon glowing Coals, and when it melts and burns, and is sharp upon the tongue and cold, then it is Salt Petre, but if it be Salt and no Salt-Petre, then it sparkles upon the Coals, and will flow, and is upon the Tongue like a common salt.

By such proof (perform'd with diligence) it doth many times prevent that no unprofitable or faltish Earth is brought in or made to Lees, or boys'd off (as I will shew in my following Instructions.)

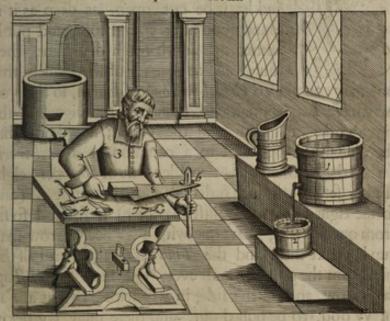
After the Proof is made, observe diligently when the Salt-Peter doth burn, whether it leaves behind much feces or dregs like Asbes, which will not burn, and this is Salt. For, if it be found thus, though the Earth be pretty rich in the Proof, yet it is not to be accounted so good, as if the proof were poorer, and burned clear off upon the Coals, therefore the Salt by it is not so good, but it must alwayes be separated from the proof, for it

weakens the strong Lees, and hinders much in many CHAP. things, as Experience sheweth.

But if you have not the Oportunity with the Ballance and Weights, or understand them not, then make a Another
little Scale of Brass of a hand-breadth, and put off the
Lee which is made in it, and set it upon a few hot
Coals, let it boil in, as is above declared, so you may
see whether the Lee which is made of the Earth be rich
of Salt-petre or not, which is a nearer way also to have
the Proof, yet he that knows it by Ballance and meight
is surest of his Reckoning.

How the Salt-Petre Lee is to be proved, the Sculpture following shews.

Sculpture XXXVIII.



Deciphered.

1. The Tub in which the Lee is to be made, out of which Salt-Petre is to be extracted, and the Can or Vessel to put water into that Tub.

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2. The

CHAP. 2. The lesser Tub into which the Vessel doth run.

IV. 3.7 The Master with his Ballance, by which he proves the goodness of the Lees or Suds.

5. The Lamin.

6. The Candle.

7. Pincers.

CHAP. IV.

How the Lees or Suds shall be made out of the abovementioned Earths.

Lee Tubs.

F you will make a Lee of Salt-Petre Earth, then boyl it, if you have a great quantity, and let it be cut open, as deep as it is found good after your Proof, and put it among one another in a dry place, then cause Tubs to be made, of the bigness that

one may contain 10 Wheel-barrows of Earth, so that you may have Lees enough, according to the bigness of the boyl-work, or greatness of the Kettle; now know that there usually appertains to a common great boyl-work, (when the Kettle weighs two Centners of Copper) eight Tubs, set them in such order, that on every side 4. (and so the eight one over against the other) must stand so far from one another, that one with a Wheel-barrow may run betwixt them, and the Tubs must stand an half Ell high from the ground, and every one shall have a Tap-bole below, and on the side, in which may be put a Tap of Wood, to be pulled out, and there must lay below under the Tubs a Channel in which the Lee may run together into Tubs or Sinks, placed in the ground, so as the ground may be higher than the tops of the Tubs.

Of the reeds When the Tubbs are set, then lay in every one a bot-

the bottom above two fingers high, and upon the fame lay CHAP. a bottom made to it on purpose of Sticks or Reeds (which grows by Rivers or Ditches (bound together a quarter of an Ell thick) but if fuch stuff cannot be had, then put upon the bottom full of boles, some chopt Straw, a span long, and upon the same Straw, lay small little Boards, that it may remain together, thus the Tubs are prepared, then run the Earth with a Wheel-Barrow into it, and when you can have old long-layen Tanners or Soap-boylers Asbes, from old holes, put two or three Wheel-barrows full of them below in the bottom, then put the other Earth (which you have proved and brought in also upon it) and so do untill the Tub be full to a span breadth, then lay it upon an hurdle or frame of Reeds, and tye it fast, and let water be poured upon it (so much that it may remain standing a good square hand above the Earth) but if one could have a convenience of letting the Water upon it with a Channel, it were better) and do this fo long, until the Water may remain a good fquare hand above the Earth, and that it may be poured upon the Reeds or Hurdle, that no hole may be caused in the Earth, but remain even; then let the Water stand upon the Earth near 8 hours, then let the Lee run gently off below through the Tap-hole, till it doth run middy, then pour the first Lee again upon the Earth, and so do till it runs clear, then run the Lees quite off, and retain it, and this Lees is called the Weak-Lees.

Then pour upon the once extracted Earth, common of weak Water again, and let it draw out the other Water, which the first Water hath left in the Earth, and this that then comes the second time, is the after-Water, and is called watering out, and such Water one may use instead of fresh Water, upon new Earth, and that which runs from it is called ramLees (which is strong enough to boyl) and a Centner made of this common Earth, doth usually contain 3 to

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CHAP. 4 pound of Salt-Petre, or above, then put the extracted IV. Earth out of the Tubs and renew it again constantly, that one may have Lees enough to boyl day and night, and

need not delay boyling for want of Lees.

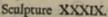
Also there must be set above near the Kettle, a Tub. out of which may run so much Lees into the Kettle, as is boyled, that the Kettle may remain continually boyling, and always full; then boyl this one day and night, until a Centner of Lee may be taken out of the Kettle, and may contain in the like Proof a quarter of a Centner, or 25 pounds of salt-Petre, which may be done in two daies, and one our the other Parch (which you have proved and breathgin

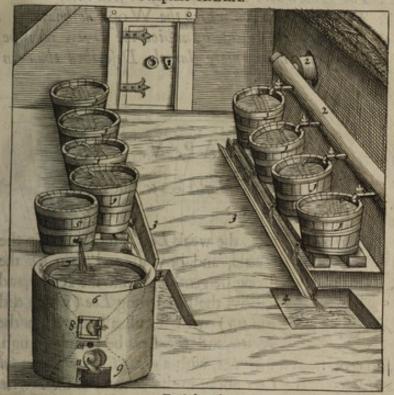
Then take two Tubs more, prepared with bottoms full of holes (and the sticks or red bottoms as aforesaid) only above the stuff must be laid again a bottom full of holes, and put straw upon it, and then Ashes of good Wood (of the best Elm) mingle it together, and moisten it with good warm Lees, before it be put into the Tubs, then being prepared, put it into the Tubs, an Ell high above the straw, but if you can have the Ashes for a small price, 'twere better to put them together in it, and then pour upon them the boyled Lees (containing 25 pound) boyling hot water, let it run gently off, and it will first come muddy, therefore put in more till it run clear.

When all the Lees is gone through both Ashes, which Strong Lees is done that the Asbes may take the fatness of the Lees, and become fit for washing, and so retain of that which runs first off a part, and put upon the extracted Ashes, common hot raw Lees, and let the Ashes be watered out with the same Lees which goes the second time through the Afhes, and is calledstrong Lees, then water it out the third time with hot Lees (and this is called weak Lees) after this the Ashesmay be watered out with common Lees, untill the

strength comes out of it.

By the following Sculpture you are taught how the Tubs CHAP. are to be set, and the Lees made and boyld from it. IV.





Deciphered.

1. The eight Tubs into which the Petre-Earth is to be put.

2. The Pipe with a Brass Cock, by which the Water is let into the eight Tubs.

3. The Channel by which the Lees falls from each Tub, and so into the Receiver.

4. The Sink or great Receiver of the Lees.

5. The ninth Tub, from which the Lees runs into the Kettle.

6. The Oven wherein the Kettle stands.

7. The Kettle on the top of the Oven.

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8. The

CHAP. 8. The Iron Door by which the Wood is to be put into V. the Oven under the Kettle.

9. The Wind-hole in the bottom of the Oven.
10. The Hole where the Oven may be seen into.

11. The Iron Grate on which the Wood doth lay.

12. The form of the Door by which the Oven may be lookt into (being more largely Described than in Fig. 10.)

CHAP. V.

How to Boyl Lees or Suds.

AKE the weak Lees, and put it in the Kettle, and boyl it, and then let the strong be gently put into the Kettle, and so boyl the first strong Lee (which did run off) with it, till all comes in the Kettle, and the Lees be strong enough,

and you must sometimes, with a great Copper-Spoon full of boles, stir the Lees about in the bottom of the Kettle, (for when the Lee yeilds Salt it will fall on the bottom of the Kettle) then list it out with the great Ladle, and always take the scum from it, then prove the strong Lee by droping one, two or three drops upon a cold Iron, and when the drops stand upon it like Butter (that is, when they flow not off, when you turn the Iron) then the Lees is strong enough, or set the Lees in a little Copper Vessel, upon cold water, till it becomes cold, then the raw Salt-Petre will show it self, whereby you may see alwayes whether the Lee be strong enough, which may be seen also upon the great Spoon, wherewith you scum it, for if the Lees draw it self into a Body like an Oyl, the proofs

proofs are right, now when the Lee is thus prepared, then CHAP. a hundred pound of it will contain in the proof, very near VI. feventy pound of Salt-Petre.

CHAP. VI.

How to prepare Lees for the crude and raw Salt-Petre.

HEN the Lee is prepared (as above) section, put it out of the Kettle, into a very ftrong Tub, of good Wood, let it stand in it till it cool a little and the dirt settles, then the Salt will fasten it self in great Grains on the Wood, and when the that you may hold your finger in it then

Lees is cool, so that you may hold your finger in it, then draw it off through a Tap, which is to stand a span high from the bottom, and put it into great deep Wooden Troughs, or into Copper Kettles, which must stand in the ground, (the colder they stand the better) till the Salt-Petre grows, and in this the raw Salt-Petre will grow almost two singers thick, partly white, partly yellow, and partly very black-brown.

When the Lee hath stood in the growth two daies and two nights, draw off the Lee from the Salt-Petre, and put it the second time over Ashes again with other strong Lee, else it will be too fat and will not grow, but when the Ashes are not good, (so that the Lee cannot grow) then put strong Lee with other Lee, over new good Ashes, and boyl it again to grow (as above:) likewise when the strong Lee in the making is very muddy in the Kettle, and the Salt cannot fall because of the muddiness, if this happen, then only take out the Lee to the growth, and let the remaining Lee, purify through the Ashes.

Now

CHAP. Now bow the Salt is to be taken out, and bow the strong Lee stands growing, this following Sculpture will shew.



Deciphered.

- 1. The long narrow Tubs wherein to cool the Lees.
- 2. The Oven wherein the Kettle is placed.
- 3. The Master that makes and takes out the Petre, and puts it into separating Baskets.
- 3. The separating Baskets.
- 4. The Tub out of which the strong Lee runs into the Kettle.
- 5. The Melters in which the Salt. Petre Improves.
- 6. The four Kettles standing in the Ground wherein the Salt-Petre also improves it self.

7. A

7. A strong Tub into which the Salt-Petre is to be cast CHAP. as it improves. VII.

Mod or string of CHAP. VII.

How to purify and cleanse the raw Salt-Petre.

HEN the Salt-Petre is thus made, and Section. the rest of the Lees drawn off, lift up Raw Saltthe Kettles or Trays, and turn them to one end, that the remaining Lee may run clear off; then take a great Iron Spoon fuch as Bricklayers use, and lift out the Petre with it, out of the Kettles or Trays, put it with a bole below, that the Lees may run clean off.

Some Salt-Petre Boylers, (who fell the raw unpurified Earth-Petre) they pour clean Well-Water upon it, that it may be well washed from the most part of its redness, and become white, what is run off they put again to other strong Lee, and boyl it the next boyling.

But if you will purify the ramsalt Petre right and well from its salt and uncleanness, to become fair and white, do To purify it it thus; When the ram Salt-Petre is a Centner or four, cause the purifying Kettle to be cleanled and dryed, pour in it so much Well-Water, that the Salt-Petre may be dissolved in it, then make a fire under it, let the water be boyling hot, and then put the Salt-Petre gently and eafily in it, and turn it about with the feumming Spoon, that the Salt-Petre may be the sooner and easier diffolved.

But while you are pouring it into the Kettle, let there be but little fire under, that the cleanfing may remain warm, and when the Salt Petre is almost all put into the Qqqq

CHAP, ter and melted, and the cleanfung begin to boyl, then with the scumming-Spoon, put some upon the ground, and when the Salt-Petre hath fet great Grains of Salt, then lift it out, which is better for it.

Section.

To make proofs.

When this is done, and the cleanfing begins to boyl, then it brings up a black soum, take that off, and take a Copper Vessel which holds near 8 Loths of strong Lees, and make it half full of the cleanfing; put it in cold water to cool it fuddenly, so the salt-Petre will begin to (hoot (and this is called a Proof made) then you will fee whether the cleanfing be yet too strong, if it be, there will come a skin over the Proof in the Vessel, and if so, then fill more warm water into the Kettle, and keep it in fuch a strength, that the cleansing in the Kettle may bubble, then make a Proof out of the Vessel, and when the cleanfing shoots in it, and in the midst do remain open (so that it doth not close together) then the Proof is right, but if it grows together, then fill more water, till the Proof remain open, and pour near a pint of Vinegar in the cleanfing into the Kettle, which will bring up a black four, for the cleanfing will purify it felf of it, and when the fcum is thick, take it off, and when the cleanling hath bubled a while longer, pour in it so much good Vinegar as may keep it in continual bubling, and then take the black off, as at first, this you may do the third time, and pour on Vinegar, till the cleanfing be very clean, and do cast up no more black scum; Then take 3 or 4 loths of burnt-Allum, beaten small, and put it in the cleansed water, stir it about, and of this the Salt-Petre useth to yield fine long flacks, and it hurts not the Salt-Petre, then pour the cleanfing in the before mentioned high flender Tub, and cover it, that it be not cold in the Tub; let it stand an hour or two at most, thus the yellow dirt will settle it felf in the bottom, then let the cleanfing run out while tis hot, and pour it into a great wooden Tray, or great Cop-

Copper Kettle, which for coolness had need stand in the CHAP. ground, and cover them warm that the Lees may begin VII. to spring from below, else the Salt-Petre will grow first above and fall down, and so will not yield very long slacks, let it stand three or four days until it grows no more, which you may prove thus; set some of the Lees in the Copper-proof Vessels, if it grow no more in it, then take away the rest of the Lees, and let it clean go off, and then put the Salt-Petre with the Iron Spoon, clean out of it, into a Vessel with a hole below, that the rest of the Lees may run off, and thus you have purified Salt Petre.

The Lees which is drawn off (while it is yet falty) boyl it as the other strong Lee (in making of the Salt or Lee) and from this the ram Salt-Petre will grow very But some use at the cleansing in the Kettle, Calx viva, by which it becoms as white as Milk, and they let it settle in the Tub, which makes the Salt-Petre very fine, but it lettles not so soon or so well in the Tub, and while the cleanfing stands thus strong in the Kettle, you must not make too great a fire, for if it boyl too high, you can hardly quietit, or hinder it from running over, whereby comes great loss, therefore it must be kept bubling with a little flame, and when the Kettle is washed, such water is to be boyled again with the strong Suds or Lees, but the fcum which is to be taken off from the cleanfing must be put upon the Asbes, where more Lee is to be put over Albes, that that which is yet in it may come to profit, and when you boyl much in the Kettle, then lay upon it a bard grey stone, like the colour of Tartar, under which the Kittle uleth to burn, and this is sometimes to be cleanled and separated off, with a flaming fire made under it, to make it fly off, and when the Kettle is empty and clean, then you may boyl it again.

The Earth and Ashes which have been extracted (whereof comes the ram weak Lee,) are to be put in

heaps

Section.

·CHAP. into vanlts or Houses, and in four years it will be sit to use, VII. only when you use it to make Lees, then you must (many weeks before) dig open such Vaults, that the moistness may go off, and the Sun may shine in, and of this good

Lees may be made.

But the old Masters do suppose, that if one could run off the Petre in the Houses under Tylings, it would be fooner good, which is likely, for, because of too much Peter is gemoistness or daily rain upon it, the Salt-Petre is much nerated and spoiled, and will have only a little moistness, of which it is to be generated.

Also some of the old Masters do use among the Earth solutions of in the Lees-Tub, to mingle bits of Firr Wood, a finger long, and these they put among the Earth, with the Lees that hath been made, and fet it in the vaults or Houses, and fuch fatness which is used in the mingling the Salt-Petre doth also generate and multiply, and they say when it lays in a dry place, it may be used again within a year; likewise they pour upon the light poor Earth in Houses. the old decayed colours of Cloth-Makers or Dyers, or any sharp decayed colours of Waters made with Allum, vet not so often, but that such Earth may have a better beginning to a good effect. Next, they bring also Soot out of the Stoves, Furnaces and Chimnies, and mixt with the Earth, likewise the Ashes of such Lees as is made

> help to a melioration, that it may fooner be used. Know this only by the way, That sometimes Earth is found which gives brown thick Lees, which of it felf is too fat to make Salt-Petre of, amongst which you must mingle another Earth more brittle and lean, and with it put some made Lee over it, or elle you will bring no

> in Houses, and in the Nosel or Mouths of Ovens, where much Straw is burnt, which Ingredients do much

Salt-Petre off from it fit to be washed.

How the Salt Peter is cleanfed, and what Infruments

per-

pertain to it, they are almost alike to the XXXIX.and CHAP XL. Sculptures next before, and out of the same to be VIII feen.

CHAP. VIII.

How to cleanse the great Graind and black Salt-Petre Salt.

HE black or greySalt PetreSalt, which is tound (in boyling Salt-petre) below in The wfes of the Kettle and flender-Tub, this may be good Salt for dreffing Victuals, without any danger, only it must first be

cleanled and purified thus: Wash well the Kettle, put in clean Well-Water, make under it a fire, and when it begins to boyl, take the faid Salt, put it gently in, and let it dissolve, stir it continually, and when tis all dissolved, then pour the Lees into a Tub, let it lettle that the Lees may be clear, then wash the Kettle clean again, put the clear Lees or Suds in it, and boyl it till the Salt fall in it, and then lift it out with the great Spoon, put it in a Basket above the Kettle, that the remaining Lees may run again into the Kettle, and lift up such Salt, un. till no more will fall, then dryit, and so it is prepared: But some before they use it, let the Salt glow out, by which it becomes ftronger, and what remains of the Lees in the Kettle, boyl it like the other Suds to a Lees, and put it out, and let the Sait-Petre grow out of it, for this Salt coming out of salt-Petre, cannot be quite without Salt-Petre, but there will be still some among it, which is to be cleanfed off thus.

Take Notice if the Salt have too much salt-Petre, or be very black and unclean, the Salt will not become very "To make it white at once, for when the Lees begins to be strong, then

Rrrr

CHAP. ascends not white, therefore such unclean salt must be dis-IX. solved in the Kettle once more, purified and cleansed, and then it will become very white.

Section.
3.
To purify
the Salt
through Aflots.

There is another way of cleanfing such black and unclean Salt, viz. one may put the dissolved Salt out of the Kettle thus warm, through the Asbes, over which already Lees hath been put, of which the salt Lees, will almost purify and cleanse it self, yet it becomes not all white Salt, but the last remains commonly yellow, therefore it must be cleansed once more; likewise take notice, that when the Salt is to be put over the Asbes, that it must be well watered out, that the red bottom may not be very salty, else it will come in the next strong Lees, and makes it very salt.

And thus you have a true large Instruction of the Salt-Peter boyling, how it is to be usually observed; but it is a tedious and not profitable boyling for this reason, because there is in a Centner of Lees but three or four pounds of Salt Petre, therefore the Water remaining must all be boyled off, which takes much time and expences, and cannot be avoided, but how it may be helped (as I my self have found out and used) I will Demonstrate in the next Chapters.

CHAP. IX.

How to make the raw Lees richer before the boyling.

The manner of doing it.



FTER this way many Salt Peter boylers have fearched, but the true Method (because they have not been guided by the little Proof) they could not find; but thus it is to be done. Take a Tub full of the Lees (of which a Centner

con-

contains four pound of Salt-Petre) pour it upon new CHAP. Earth, let it stand uponit near 12 hours, that it may run off and as much as remains behind of the Lees, so much Water pour upon the Earth, and let it run through to the other, and thus you will receive so much again, as you had of Lees before; now when this is done, then prove the Lees, through the little Proof, to you will find (because of the other pouring over) it will contain 6 pounds, this 6 pounds of Lees, prove again upon fresh Earth, and let it stand 6 hours, and then run it off, and follow it with fo much Water as remains behind upon the Earth; also that the first measure of Lees may come only again and not more, then the Lee will contain nine pounds, this you may once more pour over fresh Earth, and enrich it; but always observe, that the Lees may be neither more or less then it was at the first; and to follow this with Water in this manner, I only mention for the proof fake, that one may be fure of the enriching, for the Lees by this means will contain more Salt-Petre, and yet the Lees will not increase; then to supply the first measure of Lees, pour in some of the weak Lees, so it will become the fooner and more enriched, and of fuch you may then foon come to a Suds.

And though there is much labour and dilligence thus section. to enrich the Lees, yet it comes all again, for one may make in one Week two or three times more Salt-Petre, and it spends no more Wood, only it requires more Veffels to keep the Lees leverally for their enriching.

I will also show hove the Salt-Petre boyling may be ordered to profit, first observe, because there appertains much of Earth to a great Boyl-work, and good Earth is not alvvays to be had, but fometimes, if one cannot prove the Earth, very poor Earth is mingled amongst it, that the expences are spent upon the poor as the good, and thereby no gain to be expected, therefore I judge it

CHAP. more profitable to make the Boyl-mork vvith three or IX. four Tubs, that one may take the best Earth which is to be had out of old Cities, Houses and stables, yet not too deep, by vvhich means such Lees as are of 8 pounds content, may easily be enriched (as above) to 18 or 20 pounds, and not done vvith so much boyling, this they may consider of, especially vvhere Wood is dear.

To water out the Earth. When the Lees is thus enriched, there vvill remain more Salt-Petre in the Earth (for the good Lees cannot take it all out) then upon this Earth pour common water, let it stand some hours and then run it off, so you will receive weak Lees, prove it, and make the enriching thus, as hath been shewed, and so you may be continually at your work.

To enrich Lees of Al-

Now because the Salt-Petre Lees may be enriched out of poor Earth (much more the Allum Lees out of the same Oar and Earth) and may be boyled to better profit, vvill by dilligent searching, be found hove it may

be performed.

Salts of Oars, After this manner I judge one may make Lees on all roafted Oars, and try vvhat Salt they may yield, for I do believe that the roafted Lead Oars are not vvithout fuch a falty matter, which I leave to farther Experience; But how a Salt-Petre Halls, Houses or Sheds, are seen to be on the out-sides, you will see in the following Sculpture, thus

Deciphered.

1. The fore-part of the Salt-Petre House, wherein the Lee Tubs do stand.

2. The back part wherein the Kettle and the Oven do stand, wherein the Salt-Petre is to be boyled.

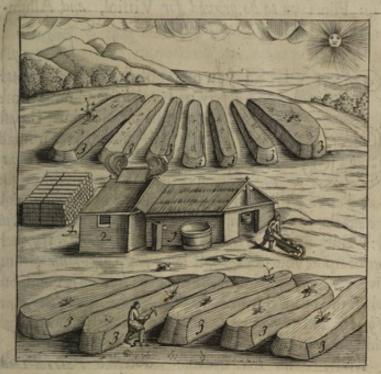
3. The Old Pieces of dig'd Earth, out of which Salt-Petre is to be taken.

4. The Wood used for boyling it.

5.The

5. The Servant that shaves and fits the pieces of Earth, CHAP. for boyling, 5. 5. 5.

Sculpture XLI.



It is also to be observed, That the Salt-Petre Sheds must be built very low, as possible, and covered with Straw, whereby the warmth from the Kettle may go over the Tubs, especially in Winter, (if Earth is to be had for boyling) so that the weak Lees may not freeze.

SIII

CHAP.

CHAP.

CHAP. X.

How Flints are to be proved for Vitriol, and Allum-Oar for Allum.

Section.

1.

To make
Lees of it.

IRST you must observe, that all Flints are Coppery or Vitriolish, and some more rich than others, the proof is thus; Roast the Flint very well, cool it, beat it small and make Lees of it, then weigh a Centner of it, and prove it, (as is said of the

Salt-PetreLees) and what remains in the little scale, weigh against the weight, then you may find how rich the Flint is: But that you may be sure it is Vitriol, try such proof upon your Tongue, if it be sharp and sowr, and gives a redness to clear Iron, then the Vitriol is good, but when the proof doth not so, then make more Lees, and try it in a little pan of Lead, that you may know what kind of species it doth yield.

Many think that because we make Vitriol-Lees out of Roast-Oars and Copper-Stone, therefore we may out of Copper and Silver, &c. which is with good profit to be melted out of them, yet 'tis found, that out of the same Flint, and Copper-Stone, made into Lees, there hath been made much less Copper than when it had been melted before the making them into Lees, by reason the Vitriol Lees which is made of it, hath drawn out the most part of the Copper, and somewhat of the Silver, therefore it is not to be trusted to, nor any account to be made of it.

But the Allum-Earth or Shiffer, if you prove it for Proof upon Allum, it matters not that it be roafted, neither can it be done raw with it, as it comes out of the Vein, but it must

lay

lay a while upon a heap together, to be weathered and CHAP. warm'd init self, that it may fall asunder and break out, X. and then you may make Lees of it, and you will find by the proof of the Allum upon the Tongue, that it

draws it together very Vitriolish.

Further, we may observe, that in the Vitriol-Mines (as at Goslar upon Cuttemburg, and other places) that the Vitriolish Water in Waters which by Art are drawn out of the deepest the Mines are for the most part vitriolish, yet some more than others, and if such Water might be directed in wooden Pipes into the Boyling-Work, and boyl'd for Vitriol, it would yield good prosit; yet when this is done, you must take heed that no sweet-Water (which by Arts is brought into the Mines or other Tiling Water,) may come among it, but such Waters (as above) you may prove, and surther after your pleasure make prosit by them. Also on this wise you may prove all Wells or Springs of Salt (after the beforementioned little proof) and search and know properly how rich they be.

And I was willing to mention these Instructions, for falty-Proofs, that those who are now concerned, may know how the better to manage them.

Thus much, loving Reader, I have writ of proving all forts of Oars and Mettals, and other necessary things fit to be known, for proving and melting them, to the good and profit of all Mine-workers and young Assayers, and for such as are ignorant of these Arts: and this I have done in five Books, most faithfully and dilligently, and also given very large Instructions, by writing and Sculpturing the same; and I desire for this time that every one who loves or inclines to these Sciences, will be content with it, and accept of my good Intentions, for these are not designed for Magisterial Artists.

Now

CHAP. Now in these Books I have not undertaken to X. treat of all Oars fingly, upon preparing and melting them in the great Works, because I could not well discharge my self therein, in respect that it would be a greater Task than my present Services can admit of, yet I will reserve it to a farther Opportunity, and I will also respite my Labour to discover how the Gold and Silver upon the Coyn'd Works are to be ordered, upon diverse certain Contents, and so made to profit, which would require a particular and more large Volumn, confidering that it is a great Work and for many years (with other things pertaining to the Coyn'd-Works) have been as Secrets, and therefore I will also let them be as Secrets for the present.

And although Goldsmiths, common Assayers and Merchants, do suppose when they can reckon some dref. fings of the Crucible, they have the perfect Art, yet they want the most needful and best parts; namely, they have not been with the Coiners, neither have they any true understanding or exercise of it, and therefore in these matters nothing could be done with fruit or profit.

Now concerning the Generation of Oars and Metals, of which the Philosophers and Naturalists have wrote and disputed very much, I leave all of them to others with their Rules and Opinions of the Mine-Workers, by reason that their thoughts and prefumptions, are not only uncertain, but oft-times wide and agree not together; yet I really believe, That God the Almighty Creator hath referved these Mysteries to his Almightyness, and that Gold, Silver and all Metals through his Everlasting Word, the Son of God (from whom Heaven and Earth, and all things which are in them have their Creation and Being) are to this day preserved and multiplied, and that the knowledge of them are come to clear light, and published for his Glory and the good of Mankind; for which

Section.

which glorious Guifts, every one ought with pure Zeal CHAP. to praise and thank God from his Heart, and imploy all X. his dilligence and reason, so that what he may have out of the Mine-Works may be used to the praise of God, and to the prosit, belp and advantage of his Neighbors, whereby God the Almighty will not only bless it, but also richly Multiply the Possessor of it, and cause them to injoy it to the Salvation of their Souls.

Now, may the Lord God, Creator and Preserver of all Creatures, be graciously pleased to open the hidden Treasures of the rich Gold Sope, also of Gold, Silver and all Metallick Veins, for upbolding the Posterity of the Poor Sons of Adam, and by blessings and long continuance, preserve them for his beloved Son, our Lord Jesus Christs sake, and that we may use them with thanks and praise. Amen.

FINIS.

Tttt

The Conclusion. 245 which glorious Guifes, every our loude with pure Zeel CHAR. oto praise and cinek God from his Heart, and imploy all bis dillecarce and realon, to that what he may have out of the Mine I why my y besuled to the praise of Gad, ound to the perfet help and advantage of this Neighbors, while the Alanghy will not only ble it, but also robby trentiply the sofffers of it, and coule themas the joy it to the Saluation of their Soule, to the Him I Now may the Lord God, Crestorand Preserver of all som i Creatures, be graciently pleded to open the hidden and Tree favor of the rich Gold Sone, allow Gold; Sitvermi all Merallick Veine for according the Police vity of the Poor Sons of Adams, and by blefiner and long concernance, profess a thefu for his beloved Song our Lord Joles Christs Sale and that me may we their with thinks and praise. Antenne hal I The state of the s the state of the same of the s

Fleta Minor,

Spagyrick LAWS,

The Second Part.

CONTAINING

ESSAYS

Metallick WORDS:

Alphabetically composed, as a DICTIONARY

Lazarus Erckern.

Illustrated with two Sculptures.

By Sir John Pettus, of Suffolk, Knight.

Scire tuum nihil eft; Nifi te scire, hoe sciet alter.

LONDON,

Printed, for the Author, by Thomas Dawks, his Majesty's British Printer, at the West-end of Thames-street. 1683.

Kind Reader, the Ellays, and therefore referred the Second Potionary, and the Capitals of the Diethe parts of the five Books of Ercken Adam wide Gold Arlanick v. Gold.
Auficalcum v. Wire. Reipt W. Gold. Ægipuns y. Com Æthiopia v. Go Osgly com v. Medfirer, SMa Rs v. Brass. AM CEallick Alabafter, w. All & Blims IV Allays v. Svor Mys mullA Alpha of Regule, Amethift to & Made and with Anumony whereder where By Sir Yola Peter Backsiff & Kall Antartick vs. Gold ... Lord Bread vs. Fecer Scientium nilligibilitone v. Minerals. Antidotes v. Drue Architecture w Calcune. Buxtons Wells to Miner Armoniack w. Mineralin. Aarons Bells of Bell O . The Caldriddies. Braft, Mineral. Arfenick w. Mineral Carrie on St. Leghis Majesty Carrie of American Sec. 1882. Capa longa fills v. Congities

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Affes v. Bone.

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Kind Reader,

TOU are defired to take notice, That all the following words are only transciently used in the Essays, and therefore referr'd to the Capitals of the Dictionary, and the Capitals of the Dictionary are referr'd to some parts of the five Books of Erckern.

Adam vide Gold. Ægipt v. Gold. Ægiptians v. Quick-filver. Æthiopia v. Gold. Æs v. Brass. Ætna v. Bitumen. Affrica, v. Gold. Alabaster, v. Marble, Plaster. All v. Chimistry. Allays v. Mony. Allum v. Minerals. Almonds v. Blanch. Alpha v. Regulus. Amethist v. Metals. Antimony v. Metals, Mine- Borneo flu. v. Gold. rals. Antartick v. Gold; Stone. Antidotes v. Dung. Architecture v. Calcine. Armoniack v. Minerals. Aarons Bells v. Bell. Arfenick v. Mineral. Artick v. Gold, Loadstone. Ashes v. Gold, Pulveration Affes v. Bone.

Alia v. Gold. Atlantick v. Gold. Auricalcum v. Wire. Barly corn v. Measures, Mo-Barme v. Yeast. Bees v. Putrefaction, Regulus. Beergood v. Teft. Beer v. Blink. Black Lead v. Lead: Blood v. Gold. Blood-stone v. Polish. Boards v. Planks. Boar v. Bacon. Botanist v. Colour. Load- Bread v. Feces. Brimstone v. Minerals. Bullock v Ox. Buxtons Wells v. Mines. Calcanthum v. Sublimatum Calaminaris v. Brass, Mineral. Camelion v. Eggs. Camel v. Armoniack. Capa longa fish v. Conglutinate. [A 2] Cedar Cedar v. Gold. Ceruse v. Lead. Chaldeans v. Quick-filver. Chalck-Itone, v. Lead, Lime. China earth, v. Earth. Chiromancy v. Mealures. Cinders v. Coal. Cinnabar v. Minerals, Quick- Electrum v. Metals. filver. Clay v. Loadstone. Cloath v. Filtration. Coaches v. Yellow. Coin v. Mint, Mony Consonants v. Regulus. Constellations v. Loadstone. Copper v. Metal. Corrolion v. Calcine. Counterfeits v. Mony. Christ v. Gold. Crocus v. Verdigreafe. Cubit v. Measures. Cup v. Pipkin. Damp v. Evaporation, Mines. Fermentation v. Yest. David v. Gold. Dew v. Feces. Diamonds v. Metal, pulvera- Flax v. Flux. tion. Discourses v. Regulus. Devils arle v. Mines. Dodmans v. conglutinate. Dogs v. Dung: Dovegang v. Mines. Dram v. Measures. Ducks v. Dung. Dung v. Eggs, Gold.

Remes.

Durdans v. Petrefaction. Dust v. Pulveration. Earthquake v. Boyling, Ebb v. Loadstone. Eden v. Gold. Eels v. Putrefaction. Eldon hole v. Mines: Elbow v. Measures. Ell v. Measures. Elephant v. Armoniack and Dragons Blood. England v. Load-stone, Water-Stones, &c. English Mines, v. Mines. Equinoctial v. Gold. Erckern, Etimology v. Alchimift. Essays v. Assay. Europe v. Gold. Eye v. Needle-Fathom v. Measures. Finger v. Gold. Fish v. Eggs. Flesh v. Gold. Flowing v. Loadstone. Flower v. Fermentation Test. Flies v. Putrifaction. Fort v. Measures. Foam v. Yest. Frankincense v. Xiphion. Froth v. Litarge, Test.

Gallenist, v. Quick silver Geefe, v Dung. Gems, v. Colours, Metals German Mines, v. Mines God, v. Gold, Regulus Goldmiths, v. Gold. Gold, v. Metals God's-good, v. Teft. Gums, v. Tellow Gunpowder v. Boyling, Pul- Leven v. Firmentation veration. Guts v. Bells Guenea v. Gold Hards v. Flocks Havilah v. Golda Heaven 7 Hebrews V. Quickfilver Herrings, v. Asbes Hens v. Eggs. Hides v. Bellows Hisperides, v. Gold Holy Ghost v. Regulus Hony-Comb v. Putrefaction Horle v. Dung. Hungary v. Mines Iclingham v. Earth Idols v. Dung lefus v. Gold Inch v. Meeasures India v. Gold. Industry v. Alchimist link, v. Copperas

Fullers earth, v. Earth Iron v. Metals, Oars. Fusile, v. Fusion. Ising-glass fish v. Conglutinate Ifop, v. Gold Ganges, v. Gold Very Ivory, v. Black. King v. Regulus. Lapis celeftis v. Vitriol Lead v. Metals. Oars. Leather v. Expression. Lees, v. Pulveration. Leimster v. Flocks Lethargy v. Littarg Letters 24 v. Regulus Limbus patrum ? v. Quick-Limbus Intantium & filver. Limpet fish v. Conglutinate Linnen v. Expression Linly woolfy v. Timode Linfeed-Oyl v. Oyls Liquid v. Regulus Litturgy v. Littarge Loadstone v. Gold Lombardy v. Gold Luna v. Quickfilver Magnas Magnus Ev. Loadstone Magnetism el Mediterranean v. Gold. Mendip v. Mines Menstruum v. Extraction Mice v. Putrefaction Mercury v. Quick filoer Miles v. Measure: Quicksilver Mill-stones v. Quarry Mines

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Moon (v. Quick silver.	Plant see Loadstone.
Money v. Coin	Pliers see Pincers.
Mortar v. Earth.	Plawing fee Boyling A sol toom?
Moles v. Gold.	Plimouth fee Calcina sol sysos
	Poland fee Miner. 30 esono Sono
Mutes v. Regulus	Policy fee Polifb. Annual Policy fee Policy fee
Nails and water days	Pools Hole see Putrefaction
Navigation v. Loadstone	Pound fee Weight all yaged?
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Obedience see Regulus	Putte see Polish.
Officers v. Alchimift. Mint.	Quenching fee Steel.
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Orpiment fee Minerals.	Reason see Ground
Ox fee Dragons blood.	Rebeckah fee Gold. of bobbog
Oysters see conglutinate.	Red Lead fee Lead. sol ship
Palm see Measures.	Religion see Gold. Refurrection see Calcine, Gold,
Palmistry see Measures	Refurrection see Calcine, Gold,
Paper see Filtration	Pulveration, Dust, Asber, Quick silver.
Paradice fee Gold.	Quick filver.
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Water -	Sa-

Sables fee Sands Sublimation fee Fixation Sand lee Earth, Ruffer Sugar fee Dulcification Saphire fee Metals Sulphur fee Flegm Minerals Sandiver fee Minerals. Tabacco pipe fee Coal Scarlet see Gold. Talck see Minerals, Plaster. Scurf see Scales. Teasle tree see Petrefaction. Scruple see Measures. Terrella see Loadstone. Screen see Rattar. Terra Sigillata, Lemnia, Ar-Seeve see Rattar. minia fee Earth. Sentences see Regulus. Testis v. Test. Separation fee Cement. Thane fee Athanor. Thank Shafts fee Mines. Thumb see Measures. Sheppy Island see Copperas. Thummim fee Alchimift. Tide-Well fee Boyling. Sillables fee Regulus. Tin see Metals. Silver fee Metals. NIETO FL 2 Tongs see Pincers. Sinoper see Armoniack. Touch-stone see Marble Skin see Gold. Smerna-foap fee Bacon, Needle. Snails see conglutinate, Putre. Travelling see Money. faction. Tree of Life, of good and ill fee Alchimist, Gamabes. Sodom see Bitumen. Truth fee Ballance. Sods fee Turf. Snakes fee Egg. Variation fee Load-stone Solomon fee Gold. Venice fee Mines. Soul fee Loadstone. Venus lee Quick-filver. Vermilion lee Quick-filver. Span see Measures. Speckled fee Miffy. Virgula Divina fee Xanthus. Vitriol fee Flegman ool stally Spittle see Flegm. Visuvius see Bitumen. Spring fee Salt. Vitriol fee Minerals. Stanneries fee Tin. Union see Cement. Sterling money fee Money. Steer fee Ox. Vowel see Regulus. Stibium fee Minerals. Vows fee Regulus. Stills little fee Limbeck. Urine fee Alchimift. Stones see Petrefaction. Wales see Mines. Water 52Water see Gold.
Wax see Plaster.
Weapon salve see Bacon.
Weather see Load-stone.
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Wheat see Measures.
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Wooll see Flocks.
Wood see Gold, Petrefaction.
Work see Needle.
Words see Regulus.
World see Vein.
Yard see Measures.
Yest see Fermentation.
Zambre see Gold.
Zaclar see Gold.

HE Reader is defired to amend or connive at the Omissions of the folio's of the first 80 pages, and to alter these words, p. 8. 1. 24. r. Tentare. p. 16. 1.15. r. Ceneres. p. 20, 1.25. r. or woolen. p. 29. 1.15. r. koinos. p. 41. 1. 13. r. Warner. p. 42. 1. 11. r. Moving. p. 60. 1.15. r. Lamins. p. 64. 1.31. r. Maritime. p. 74. 1. 27. r. Thumb. p. 92. 1, 20. dele And r. It. p. 97. 1. 4. r. draining. p. 110. 1. 7. r. Herbert. p. 120. 1. 11. dele un. r. Drest. p. 121. 1. 10. r. Coasts. p. 128. 1.11. r. Emerald 1. 21. r. Lazuli: Some other there are by want of points, or vewels or Consonants, or misplacing of Capital Words, wherein I hope the Reader will pardon the Printer, considering my Circumstances.

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ESSAYS

Metallick WORDS

Alphabetically disposed, as a DICTIONARY or INDEX to the whole.

Note, T. fignifies the Tentonical or Upper German Language. L. The Latine.

A. The Anglican or English: The rest are written at large, being but seldom used.

AL



AL

LCHIMIE. T. Alkumy, L. Alchimia, but by Plautus is writ Orchimia, which may well have relation to our word Ore or Oar. The Lord Verulam tells us, Tis an Art of Distilling or Drawing Quintessences out of Metals by Fire, separating the pure from the impure, setting at liberty such Bodies of Metals as are bound and imprisoned, and bringing to perfection such as are unripe, and this is the chief subject of this Book; now in his Lordships mentioning Fire, in this Definition, it seems only to relate to Culinary Fires: But I apprehend this Art looks higher, even to the use of Celestial Fires; from the Sun and Stars, and their influential Heats, gain'd by Contractions, Resections, &c. which are or may be used in this Art, as will be shewn.

ALCHIMIST, T. Alchumist. L. Alchimista (from the Greek Alkamos, or Hebrew Alkum) is one that is used or skill'd in the Art of Alchimy or Chimistry, and therefore in

A. he is commonly call'd Alchimist or Chimift, Melter, Prover, Affayer or Extracter of Quintessences; and such an one was our Author. But before we fix our Title or Epithite to the Master of this Science, it is sit to shew the progresses of it; at the first step to it, he is called, a Miner, or he that finds out and digs (or causes to be dig'd) the Metallick Oar out of such Mines. The fecond is the Wasber, or he that washeth the Oars from their useles Excrements of adherences. The third is the Stamper, that knows how to beat or stampthem by mills or otherwise into fuch Particles as that they may be fitted for fmelting Ovens (which are the great melting Works, but called Smelting for distinction from the lesser.) The fourth, is the Smelter of the great Quantities in those great Ovens or Furnaces. The Fifth, is the Finer that smelts them over again, and separates the met. tals in the great Works. The fixth is the Refiner, that melts them again so often as he thinks fit, till he hath brought the separated Metals to their several perfections and intireness. The feventh, is the Prover or Affayer, who by Tests, Crucibles, Weights and other Experiments is able to judge of all Oars, either as they come from their Veins, or made into melted, fined or refined Metals; and fuch an Assayer was our Author in all these seven Gradations, and therefore intituled the far renowned Lagarus Erckern, Berkmeister, or Chief Prover, (which we call, Assayer) of the Mines of the Emperor of Germany, and the depending Principalities of that Empire.

In what Emperors time he lived, I cannot learn, but his five Books were printed and published at Antwerp, Anno. 1629. from which many of the yonger Chimists of this Age have derived their skill, by Copies surreptitiously gain'd from my first Translation, about 14 years since, which occasions my

printing of it now, being made more perfect.

His Name, Lazarus, is in Imitation of the old Romans, Germans and Belgicks, who assumed Names suting to their temper, or some observable Actions: the word Lazarus signifies in Sacred Writ one that was beloved of our Saviour,

also one that was raised from the Earth; and, in the Parable, fignifies a good poor man in Abraham's Bosom, and accordingly in the conclusion of his fifth Book, he shews his Zeal for God's Glory, and his true Belief in Jefus Chrift, affifting him in his deep Knowledg of Metallick Science, and he might well expect, by his Humility of mind to be lodg'd in Abraham's Bo= fom (who we find was well verst in Metals:) and the Rosy Crucius (of whom Majerus and Spagnetus do give a full account, being a fort of Metaphifical Chimists, who do make it a chief Principle of that Science, to be strict in their Devotion towards God, and just towards men, without which they believe they cannot attain to any Perfection in this Science: also Paracelsus (that great Chimist) goes so far as to make the two Trees of Life, and of Good and Evil, and the Urim and Thummin, (and many other things written by Moses) to be only mystically related to this Science; but to pass by this.

His other Name is Erckern (Erskerns being but a mistake in the first Translator, for in the Original it is Erckern) now Erk in T. is Oar, and Kern in T. is gramm, or grain; so that to kern is to grammate (which is to reduce Metals into certain proportions of the purest part which they call grains:) also kern signifies to pulverize any thing, and so may be applyed to Metals, whereby it may intend also that magisterial pouder of Projection (of which I shall speak more:) or else it may very well come from the Latin word Cernere, which we English to discern, the Latine often using c for k; and so we do in our Language, so kern or cern, may justly signify to see, know or judg.

Now joyning all together, I may represent him as an humble minded industrious man, that knows how to judge of all Oars, and how to manage the Products of them, for the

Glory of God, and good of mankind.

By which we may see how Goodness and Industry do improve the Fortunes and Esteems of such men, and that the exact Knowledge of this Noble Science, and Art of Proving or Assaying Metals, do raise them to be owned, and dignissed,

even by Emperors, Kings, Princes and States; and their very Names renouned to Posterity, as may be seen in Histories.

Now, I have shewn the seven Gradations to a Chimist, fo I must tell you that he looks on himself in an higher degree and justly defined, according to the Lord Virulam, for he, not only knows all these seven Gradations, but also knows how to Extract Quintessences or several marvelous Works out of all, and if he would stop there (as Erckern doth) it were well for him, but it feems he cannot be content, unless he attains to the high Elixir or Pouder of Projection or Philosophers-Stone, which is believed by some of them to have a power of Transmuting or turning all other Metals into Gold; but by woful Experience of some mens credulity, instead of turning every thing into Gold, they have turned all their Gold into nothing (Verulam.) But our · Author (though it may well be supposed, that he knew much more than he writ) goes no farther in his Books, than what is fafe and fit to be known and publish't; i. e. only concerning Fining and Refining of Metals, neither stooping too low to the meaner Gradations, nor ascending too high to the Metapbifical Speculations, but leaves those subjects to other Writers.

Now, as for the word Alchimist, it is the same thing with Chimist, but usually taken in an imperfect or ill Sense (like Ben. Johnson's Alchimist) that is, one that can or pretends to counterseit Metals: so that to sum up the chief Terms; an Assayer judgeth of the purity of Metals, and the Chimist improves this purity to Spirits, Quintessences, Virtues, &c. But the Alchimist, Counterseits and Adulterates them, by making them appear to be pure, which realy are not pure, but mixt with other sophistications, (Verulam.) Of this latter our Author is not Guilty; so as he stands for a renown'd Assay-Master, a good Chimist, and one that understood, but was not a Sophisticating Alchimist, nor a Lapidarian Philosopher,

or Metaphisical Projector. See Assaying.

Alkali or Alcali, reckoned by Doctor Wilkins amongst

Stones

Stones, but here and in other parts of the V.Books, call'd Sale Alkali, which is a Salt made of the Herb Kali or Salicornia; vulgarly call'd Glasswort: The herb is hot and dry, and therefore such Salts of that Quality are called alcalous, and this Salt is often used by our Author, as having a nature to discoagulate Metals, by opening their Bodies. (l. 1. c. 32. f. 4.)

ALIMBECK, See Limbeck.

ALLAY, T. Linderen. L. Mitigare. A to leffen or allay.

See Money and Coin.

ALLUM, T. Alaum. L. Alumen, from Lumen, in respect of its transparency and nearness to Christal, and is accounted among the brighter stones; of this Mineral there are several sorts from several Mines, and Allum works erected in England, and they are also in many parts of Europe, some more acid and sharp in taste than others, by which their goodness is chiefly distinguished: and this Mineral is of great use to Chi-

mists, Dyers and other Artists. 1.2. c. 4. s. 5.

AMEL, or to Enamel, T. Eyn-brennen, and is call'd the metallick Calx or Lime, compounded of two parts, viz. one of Lead and one of Tin, and being well calcin'd in an Oven of Reverberation makes the Amel, and in the making 'tis so delicatly ting'd with variety of colours, (the Art being grown to so much perfection in this age) that all sorts of Features, Images, Landskips, & c. are so lively represented to the eye in a condensed work of the same, that they are as delightful and more durable than those which are done with oyl or gums, 1.2. c.4. s. 1. see Nealing.

AMONIACK, see Armoniak.

ANTIMONY, T. Speiz and Speiz-glass (which is properly Glass made of Antimony) L. Stibium, and it is also called by some Mineralists Red Lion, Wolf and Proteus (in respect of its various qualities). It is a heavy, bright Oar, like Lead, but more speizy and porous, and less ponderous, and some give it the name of white stone or imperfect Metal (because they say, it is the beginner or producer of Silver or Lead)

and the extracts made out of it, are of fingular Virtues of which his late Highness Prince Ruperts red drops were chimically made, and given with good success for most Diseases, 1.

4. C. 17. AQUA FORTIS, (which for brevity is printed Fort.) T. Scheid-masser, called by Lat. Chimists Aqua separatoria, and is a composition of Nitre and Vitriol, &c. and this liquor is used for dissolving and separating Gold and Silver, and hath many other excellent properties, as may be collected from the 5 Books. 1.2. c. 16. to c.34.

AQUA regis, is a water made of Aqua fort. and other compositions, and is of a more strong and corrosive nature than aqua fort, and it is observable the aqua fort, is a specifick for filver, and this aqua regis for gold, for it will touch only

gold and not filver. 1.2.c. 28.

Aqua argentea, see Quick silver, and metals. Aqua Vitrioli, see Vitriol, and minerals.

Aqua dulcis, see common water. Aqua fontis, see Spring water.

ARGOL, T. Weinstein, L. Tartarum, and in English Tartar or the Lees of Wine, which sticks to the sides of wine-Vessels, hard and dry like a crust, and therefore sometimes called Argol-stone from its compacted hardness, and this is of great use in metallick Operations, L. 1. c.10. f.17. and other pla-See Feces. ces. I. I.

ARITHMATICK, T. Recbenkunft, L. Arithmatica, the Art of Numbring, or Reckoning, according to the T. and this Art of all others is the most affifting to the Metallick Science, in judging of the goodness of Metals, after Fining and Refining them. 1. 1. 6. 1.

See Armoniack ARMENICK.

ARMONIACK, T. gives it the Latine Name, Bolus Armeni, and we Bole Armoniack, and I find these words of kin, both in their Orthography and Pronuntiation, viz. Amoniack Armenick and Armoniack. The first Pliny tell us, 1. 24.

1. 24. isa Gum which he calls Gumma Ameniaci, of a glutinous nature (like other Gums) and so may be used for Metallick Veffels. The second viz. Armenich ; I find the word Sal always joyned with it, and fo called Sal Armenicus, and this Salt was antiently accounted a natural Salt, but that being now unknown to us, we use the Armenicus, which is made of the Urine of Elephants or Camels (as 'tis faid) boyled to a Lixivium or Salt, and called Sal Armenius or Armeniacus, and this is of great use for purifying and refining of Metals. To the third Armoniacus the word Bole is added, I suppose for distinction fake : Pliny, c. 35. mentions a Stone, which he calls Lapis Armeni, of which he counts several forts, but the best of those he faith, are of a blew colour, and calls it verd de Aqure (being of great price and esteem with Painters, but the common Armoniack he calls Synoper (and we Synople) from a City of that name, where it was plentiful, and tis probable this is the fame which we call Bole Armoniack, being of a reddish colour, and this is oft used by our Author, and for distinction the word Gum is put to the first, Salt to the other, and Bolus to this: which I write to prevent Errors in Medicines or Metallick Experiments. l. 2. c. 20.

ARSNICK, T. Arsenick, L. Auripigmentum, We, Orpine or Orpinent, and commonly Rats-Bain (being used to kill Rats) of Arsnick there are two forts, yellow and red, (which some, by mistake, esteem to be red oker) Pliny, l. 34. saith, it is of the same substance with Sandarack, and inclines to that Colour, the best of which, saith he, resembleth Gold, and

therefore I suppose called yellow Orpiment.

There is also a white or Christalline Arsnick, which is compounded of salt and the yellow Orpiment, so becomes transparent like Christal, and from thence is made the white Rats-bane, and it may be observed this white, consists of two parts, viz. a crusty or external part, and a Christaline or internal part, and this makes metal brickle, the other solid, and of

the Regulus of this mineral a good metal may be made, L. I.c. nous nature (size other Guras) and fo

14. J. 1. See Sulphur.

ASHES, T. Asben, L. Ciner, A. Asbes, and these are made so by the power of Fire, from metals, minerals, stones, bones, earth and wood; which puts me in mind of those trees which plentifully grows in England, call'd Ashes, T. Eschen or Affchen-Baum, quod optimos cerneres efficiant (Minstam) but the L. calls it Fraxinus, and of this Asben-wood I have seen the great effects of it at Tarmouth and Laistoff in suffolk, for with this wood and no other they dry their Herrings, (which is a profitable commodity to them) and it feems that the Salt and drying Vapours of that Wood, do cure (for fo is their term) their Herrings of all malignities: and doubtless that wood is most proper where it is to be used for dissolving metals, and the ashes of it rather than any other for metallick uses (except Bone albes) and especially for Salt-Petre which is the Subject of the 5th Book. l. 2. c. 20. f. 5. See Duft, Bone-Afhes, Pulveration, &c.

ASSAYER, T. Probirer, L. Probator. A. Affayer or Tryer. To ASSAY, T. Probiren. L. Probare. Which we call also to Assay, Prove or Try Metals, all intending the fame thing, though different in Dialect; but there is another Word of the like fignification, which is written with an E. as Essayer and to Essay, &c. both are rendred, by Dictionarys

to Try, L. Tentare, Probare

Now I think fome have committed an Error herein, and ought to have made a more clear distinction, for I take Assay ing to have relation only to things of Weight, as Metals, &c. from the word As or Assis, (which signifies a pound Weight, or 12 Ounces, or the whole of any substance which may be divided into parts) and especially applicable to the greatest or smallest Coins that are made of any Metal, which many times were, and still are of Copper or Brass, which the L. call Æs. and thereupon I suppose it is sometimes writ Essaying (without a diphthong) and so confounded these two words in their applications, and to confirm my just distinction of them.

We read in the stat. of H. 6. c. 12. that the Kings Officer of the Mint, who, (as the Statute faith) is indifferently appointed between the Master of the Mint and the Merchant (which brings Silver thither to be minted) is called the King's Assayer, and not Essayer, and in the Records Assaissator not Essaissator, (See Goldman's Diet.) And some latin Records renders it metallorum prebendorum Prefectus, and the Italians, Assagiatore, and the Belgick calls Affay, Examen Probitatis moneta, applying the word wholy to Metals, but Essay they define it specimen artis, or Exemplum quasita artis. (See Binworts Biglotton,) 'tis true the French make the two words indifferent : yet further to support this distinction in our English Language, the ever to be admired Lord Virulam calls his excellent Observations on Men and things, Essayes and not Assayes, and so Dr. Don (a Critick in our Language, and in general Learning) calls his quaint Discourses on some Pieces of Divinity Essayes and not Assayes, and therefore to prevent the misapplication of those two Words (with submission to those of this present age, who write themselves Essayers and not Assayers of Metals) I take leave in these Discourses to apply the word Assayer and Assaying to Metals, and metallick substances, and the word Essayer and Essaying to Accidences, and other ingenuous Undertakings, and not to metallick substances, having such Authorities, as I have cited to countenance me, 1.2: c. 2.

ATHANOR, T. Heinzen thurne, L. Fornax, which we also call Kiln or Oven, and indeed is only a Furnace of several shapes, so this is called Athanor from its distinct shape from others Furnaces or Ovens being like a Thurn, which in Tent. is a Tower; but from whence the word Athanor to which the name of this kind of Furnace is given, I cannot sind, unless it be from the Greek word Athanatos which signifies immortal) and so the spirits of the Metals which are drawn from thence into lesser Ovens, and so into Recipients, do thereby perfect Quick-silver which may be said to be of an immortal nature.

Or else from the Saxon word Thane, which fignifies No.

ble, as also a Servant: and thence called Athaner or Athaner, because it hath those two properties, as being the most noble of all Furnaces for Metals: and also the most serviceable in the operations of refining Metals, l. 2. c. 7. see ovens.

BA B F

ACON (fignifying here the Fat of Hogs or Swine) the Original of which word I cannot trace, with any satisfaction to my self, either from the T. Speck or L. Lardum, nor from a Boar, T. Eber, which is pretty near L. Aper) nor from Sow, T. Saw, L. Sus and Scrofa, nor from swine, T. Schwene, L. Porcus, but refer you to Skinner's Dictionary. And though this is oft mentioned by Erckern for greazing of Instruments, yet in respect of the Salt in it, I conceive it were better to use the fat of a Boar (especially when any Metal is concern'd) because I know it is as effectual in curing of wounds at distance, as the so admired unquentum Armarium, commonly called the Weapon falve; and fince it hath fuch a kindness to Metals, I know not how it may not be better used than Venetian or Smerna Soap, for improving Gold, Silver, Tin, &c. and so in stead of Gold-soap call'd Golden Bacon. l. 2. c. 4. l. 4. c. 15. l. 5. c. 10.

BALLANCE, or a pair of scales, T. en wagmit Zwyen schustum: but the L. call it Bilanx, babens duas lances, or two little Vessels to contain the things to be tryed, and also statera, because it demonstrates the state of the thing in question, and the tongue of this Ballance is in the T. Wigzunglain, L. Lingua, and Examen, because by standing in an equipossure or not, it doth as it were speak or tell you the difference or certainty of the

Weights,

Weights, in question, and the Latine hath another word for it, viz. Trutina, from the Greek Trutane, which not only signifies a Ballance, but a dilligent examining, or good advice and judgment, and from this Trutina we borrow the word Truth, and as the natural tongue of men speaks the truth of the Heart, so this artificial tongue speaks the truth of the Ballance and Weights, and this Ballance is very necessary to the performance of this metallick science. 1. 1. c. 35, 36, 37.

BEAM, the word is applyed to the beam of an House, and the beam in the eye, the beam of a plough, a Weaver's beam, but though we use the same word for many things in English, yet they all differ in other Languages by distinct words: but this is called T. schnalwag, and in Latin the same

with Ballance. See Ballance.

BELL, T. Schelle, i.e. fonitus, that which yields a found, and it either comes from Belle an adverb fignifying that which is pleafing to the ear, or from tunable Instruments that were used in Tempore Belli, and though by the Italians they are called Campane, upon pretence of their original, from Campania a noble region in Italy, yet we find in Exod. 28. that there were golden Bells upon Aarons Vest, which all the Versions into Latin call Tintinnabulum auri (of which the Interpreters give little account) and certainly they had little or no found; but the metal of our bells have no gold in them, but what is calually mixt with other metals, for they are compounded of Copper, Tin and Brass, and a little Silver: sometimes the Artists or maker of these are called Bell-founders T. Glockengieffer from Gloken which we call Clock, by changing G to C) and the art of mixing, making aud calting them (in respect of their diversity of founds) is of as transcending a nature as any one art or science, for the proportions of Ingredients are according to the great skill and Judgment of the Founders adequated to their various ules.

Antiently, and still, solemn Prayers are used at the casting them, and sormerly they were with great Ceremony baptized,

presuming that many spirits did attend them: and I remember an old fexton did affirm, That by the found of a Paffing-Bell, for one dying and dead, he could tell how many hours or days after, some other of his Parish should dy: But whether this prognosticating quality be in them, I shall not dispute, but we are certain, that the Harmony of a Consort of them, are very pleafing to mufical ears; and 'tis observable, that this Art is only from Metals. 1. 1. c. 18. And not only this of Bells, but most of the choice Instruments of Musick were and still are either in the whole or in parts composed of Metals; Such as are wholly of Metals, are Trumpets, Sag-bots, Cimballs (foft and triumphal) Organ Pipes, &c. fuch as are in part, viz. the strings of the Harp (which we now call the Irish Harp (being strung with wire) in distinction of the Welsh Harp strung with Guts-(trings) also the strings of the Harpsicon, and Poliphant (which I have often heard with great pleafure, but now out of use) also the Tabaret, and the Cittern, though now of small esteem, yet was devised by Amphion, Pliny I. 7. p. 187. and many others, amongst which I must not forget the Monochord or Tuba marina, whose Entrals are curiously composed of Metals, although the string, which stirs up the reverberating Spirits of the Metal, is composed of Guts. Now as Petrus Bongus hath writ a Book de sacris numeris, and fonston de sacris Arbori. bus (with Sculptures) I wish some would write De sacris Instrumentis Musica, with their Sculptures, especially of those wherein metals are imployed, for doubtless the subject would afford excellent variety.

But besides this musical part of Metals, the word Bell is also applyed to a Glass with a round bottom and long neck, which the Chimists call a matrass glass, or long Bell, Sculpture I.

BELLOWS, T. Blaszbalgh, and to blow Geblasz. L. Follis & follescere: of these there are three sorts mentioned in Erckern, 1. the Philosophical Bellows, 2 The great Bellows (which requires eight Ox-hides) and 3. the common Bellows, which Smiths also use, and others for common sires, as you often find in the Sculptures

Sculptures, and all these in imitation of the nature of a Com Beast, which in drawing in and forcing out her breath, is said to Bellow.

BLANCH, T. Blanck, Weiss and Bluk, all fignifying white, or a white Silver or Tin, when it is melted, for the meer Oar of Tinis of a ruddy colour, and white when melted; and this by the Translator of Weckerus, is called Blenck; which word I like, (though I find it not in any Dictionary) for I had a Mannor in Suffolk, called by the name of Blenches, and it appeared so in my Antient Court Rolls, for that the Soyl of the Mannor, consisted of a white Clay and Chalky temper, and the next Village is Wisset, which consisted also of the like Soil: Blench and Wiess both signifying white, so that Blench and Blanch have the same signification of white, and so the word is used for the whitening, blenching or blanching of Silver; the word is also used to Almonds, viz. when the superficies or dull part is taken from them by boyling Water, they are then called blencht or blancht Almonds. See Bone Ashes.

BISMUTH, is a Crude Oar or kind of Silver Marchafite, and of a white, hard and brittle Body, and I conceive is the same which Erckern calls also Wismut, or Wismuth Oar and Spelter, 1. 4. c. 10. and sometimes called TinGlass. See

BITUMEN, is accounted both among Gums and Pixes, and also among Sulphurs, but that which Erckern speaks of, intends Brimstone, which the T. calls Schwebel, L. Sulphur, and this is either Natural, from the Lake called Asphaltis, (where once Sodom and Gomorrah stood, also from the vomiting of the Hill Ætna and Visuvins) or Artisticial made by Fire. See Minerals.

BLACK, See Colours.

their Alphabets.

BLEND, or Blent, T. Ablinderne, L. Miscere, A. to Mingle, that is, when Metals are blended or mingled in lumps. 1.4. c. 2. &c. And this word is much used in the North parts of England, for mixt or mingled matter, which some call Hots-Potch.

[F] BLEW.

BLEW, See Colours.

BLINK, T. Blinkin or Blicken, L. Micare and Nictare, A. to Shine, it is commonly used to those that are blear Ey'd, or often twinkle with their Eyes: it is also applyed to dead and sharp Beer, and to the brouss or loppage of Trees, given to Deer (see skinner) but in our Author only applyed to bright Oars, or melted Metals, l. 1. c, 23. &c. & l. 2. c.24. viz. blink Gold and blink Silver, that is bright or clear Gold or Silver.

BLOUD, T. Blut, L. Sanguis, apply'd to the Bloud of Oxen, &c. and is often mentioned as a good mixture, for Instruments and Cements for Metalick uses. See 1. 2. c. 20. and Ox.

BOYLING, T. Seiden and Kochen. L. Coquens, 1.5. c. 7. f. 1. we have many words for this, tending to the same sence, and yet with some Gradations, as when any liquid matter begins to stir with the heat of the Fire, we call it simporing, it may be from fimpo, a Pot wherein the old Roman and Gretian Priests were wont to drink their cheering Liquor, and therfore the word simporing is used for smiling, and when it stirs more, tis called feething (which differs little from the T. Seiden) when it stirs to bubble, it is called Boyling, from bulla and bullire; but antiently Boyling was called Plaming, from L. Plandere, to rejoyce, because the fire had the full effect of the heated liquor, and therefore the Pfalmist saith, Plandent Flumina vola, let the Floods clap their Hands: i. e. let them plaw or rejoyce in their plawing or boyling waves, but I do not find my fense of the word plaming confirmed in any Dictionary, as I can now peruse; but this I shall affirm for the Sence and Antiquity of the Word, That there is a Marsh in South-Walsham in Norfolk, belonging to the now Duke of that County, which with other Marshes were gain'd from the Sea, in the time of the old Romans (as 'tis generally faid) to which my Grandfather and my felf were Tenants for near an 100 years, and in thele Marshes there was one parcel called by the name of Plawing-Well Marsh, within 3 miles of Tarmouth, and about a mile from the Sea, and the Marsh is so called, and stiled in Writings, from a Well or place in it of about two yards broad, and about 18 Inches deep, only in the middle of it is a little hole, the bottom of which I could not then fathom by any Pole or Instrument that I could get, and from that hole the water constantly bubbles, boils up and playes, which was the word used in the Lease, and in other Records sufficient to justify the Antiqui-

ty of the word.

Now having spoken what I can of the word, give me leave to speak of the water, which keeps at one scantling, neither swelling higher nor decreafing; but if it decrease at any time, it foretels a dearth) so that the motions of it cannot be attributed to the neighboring Motions of the Sea (which are regular, lunary or ventilary) nor any other cause that I could find; unless it be from a constant motion of Cattle (grazing in these and the neighboring marshes, which being only thin & graffy coverings of the waters, those beafts by quaffation and constant compressure of such flexible grounds, may easily cause this Ebolition or planing) I confess, I am the more content with this reason, because we daily see, that a little Compresfure in a large yelfel of liquids will make it rife and run over, and we often find in folid Bodies, Compressure will have great effects at distance, as in the year 1648. When the Committeehouse at Norwich was blown up, by the firing of 40 barrels of Powder, it caused by compressure such a motion in the Earth, that at Thorp Market (15 miles from Norwich (near (romer) Mr. Allen who dwelt there in good repute) told me, that as he was fitting in his Parlor there, he was very fensible of the quaking of the Earth, which upon Information of what had past the day before at Norwich, and comparing the punctual time, he found the shaking was caused by that Gun-ponder, and I, being then in the Country, foon after went into the City, where I observ'd, that all the lower windows of the City-bouses were shattered by the Air and Earth, but the upper windows (that had only the more tender motion of the Air to offend them)

them) had little hurt, and this was general, except in Churches whose Windows were all shatter'd, having no floors to defend

them against the motion of Earth and Air.

I was pleased with these outward accidental causes, but soon after I saw a Spring on one side of the highest Hills in Darby-sbire within the Peak-Forest, and 30 miles from the Sea) that eb'd and slowed four times in the space of an hour, call'd Tides Well, and for this I will not pretend to give a Reason, being so far from the Sea, or any probable outward cause.

BOLUS, see Armoniack. It fignisses a certain proportion; from whence we might have the word Boul or Bole, which is used by Miners to measure out their dig'd Oars, both for the

King, Proprietor or themselves, or for other uses.

BONE (Ashes) T. Bein (Ashen) Lat. Os & Ciner. A. eAshes, and from ciners, cinders: so as the Latines have no proper word for it, but Ciner the Cinders, or ashes of Ossium, or bones in the plural. Now the Latines have the like word Os signifying a month, distinguished in their Genitive cases, one making Os, ossis, the other Os oris, one signifying spiration, from the Greek, the other Os oris, one signifying spiration, from the Greek, the other duration, and they may well be coupled, for the nourishment which goes into the month gives nutriture to the Bones, and is the Original of its duration (of which I have writ more fully in my Fodine Regales) and our Author gives several Directions what Bones are fittest to be used (to the making of Tesis and Crucibles for dissolving Mettals) either of Beasts or Fishes, of which you may see his Opinion in several places, l. 1. c. 5, 6, 7, &c. See Ashes, Incineration, Pulverisation.

Now Pliny N.H. 1.11. c. 37. tells us that the bones of Affes have a more musical nature in them (being made into Pipes) than any other bones, so that it may be worth the Trial for Bell-Founders, who make their Furnaces and Tests of Bone-Asbes) to try if tests made of bones of those dull Asses, in stead of other bones, can make their Bells of a more active

found.

The ordinary Bone-Ashes made of Beasts is a considerable Trade about London, not only for Goldsmiths,&c. but for our Mines in England, for whilst the Leasees of our Society did work the Mines of Consumlock and Talibont in Cardigan shire in Wales (two old Roman Mines, as I have shewn else where) every year there were at least 800 Tun sent from hence thither by Sea; by which may be guessed what is, or might be, spent in the other 28 Mine Counties in England and Wales, if our Mines were duly set on work, but they being neglected, we send great quantities to other Nations, for the same use; for which the Merchants pay outward 6 s, 8 d, for every thousand Bones, and we pay for their bringing them into us 1 l. 5 s. for every Barrel of their Ashes, which we might burn and employ for ours.

BORAX, T. Borras. L. Borax, and Christocolla, which Pliny calls the Ordure or Dung of Gold, yet Gold-smiths and Silver-Smiths use it for their chiefest sodering of Gold or Silver, and joyning one metal with the other, and indeed bringing all metals to perfection, besides it hath medicinal proper-

ties, l. 2. c. 4. J. 2. and in many other places.

Pliny reckons it among Minerals, and describes it to be a green Earth, but of four sorts, the best from Copper Mines, the second from Silver, the third from Gold, and the fourth and worst from Lead, he tells us also of an Artificial Borax which he saith comes from a putrified Vein of metals: there is also another kind made by Art of Roch Alum and Bole Armoniack, and other Ingredients, which is used also by Goldsmiths: But the right Borax hath another quality, for it being mixt with Arsnick, it takes off the poisonous quality of the Arsnick, whereby it may be safely put to metals as a dissolvent.

BOTTELLS, T. Krugs. See Instruments and their Crui-

Ses, Jugs, Pots, &c.

BOTTOM, T. Boden, l. 1. c. 33. L. Fundus. A. Foundation, or the lowermost part of any thing: the word is also used for a bottom of thread, T. Vin. Glenen or a clem of thread

thred. L. Glomus, which is only the Foundation on which the

thred is wound, and so call'd the bottom.

BRAN, T. Kleyen & Gruesch. L. Aplanda & Furfur, because it makes a double theft, by taking away it self, and also much of the good flower with it : however this Bran is very useful, by its mixtion with such stuff as is used for glasing and strengthning the outward and inward parts of such earthen Pats or Vessels as are made for Metals, by making the matter stick the more close and firm, and is it self destroyed like many innocent men, to make way for others, 1.2. c. 20.s.6.

BRASS, T. Ertz. L. Æs: and it is a great Error that most Writers run into, by promiscuously giving the title Æs for both Brass and Copper, as if they were the same Metals: whereas Æs or Brass is not a proper Metal, but compounded of a Metal, viz. (uprum or Copper, and Lapis Calaminaris, or f admie, which is a mineral, and from the mixture of these two, Brass is made, as may be seen in Erckern, lib. 3. c 28. which in T is called Galmay. Now there is of this Calamin two forts, Natural, as in the third Book; and Artificial, I. 4. c. 8. 1. 7. made of the dregs of Metals, but the natural, he faith, comes from Britain, and indeed we have mountains of it, especially in Glocester-shire, Sommerset-shire, and Notinghamsbire: but we let the Calaminaris go for Ballast into forein parts, in very great quantities, before it be wrought, fo as the best Brass beyond Seas is made of our stone rather than their own, which deserves a further confideration: and I remember about 30 years fince, one Demetrius a German, did fet up a Brass-work in Surry, and with the Expence of 6000 pound (as he told me) made it compleat and to good profit: but the forein Merchants joyning with some of ours, found wayes to bring him into suits; and meeting with no incouragement, he was at last necessitated to submit the work, to his own ruin, and unspeakable prejudice to the Kingdom, in loofing to beneficial an Art, having here both the best copper and Calamine of any part of Europe. See stones and copper. 101 100 Now

nature

Now whereas Pliny, Cap. 33. speaks of about 18 several Mines of Brass, we must not understand it as a specifick Metal: though the word Æs is vulgarly applyed to both, but those Mines were either Copper mines, capable of being made Brass; or so many several sorts of Lapis Cadmia or Calamin, from the composition of all which with Copper, Brass was made more or less both in Quantity and Quality: and this Art of composing it, is faid, by him, to be first invented by Cadmus a Grecian, contemporary with Josbua, in whose time the word Brass is first mentioned in the Sacred Story, Exod. 25.3. And it is observable, That though in the composition of Brass, there is more of the stone than of Copper, and that Copper is a Metal, and that other a Stone, yet it takes a new name of Brass, and not its own, or of the Metal, Copper: and being thus made Brafs, it is an Imitator of Gold, both in Colour and in many Virtues, and in such esteem, that the Roman Treasurers were call'd Tribuni Ærarij, rather than Aurarii: and Camerarius fays, that the Ægyptians (long before the Komans) had so great Veneration of Brass that they made Images of it, and laid them in the graves of their Kings, to preserve their Bodies from Putrefaction, and to men of leffer quality they nailed their dead bodies with many brass nails.

Also Virgil, Horace and Homer are all full of their Encomiums on Brass, and therefore it may well have the honour of a seventh Metal, though compounded of a Mineral. Now as the common Brass is of a Goldish colour, so Pliny, l. 34. c. 11. tells us, of a white brass, (which is no other (as I conceive) than Brass Tind-over, and called Laten, or Auricalcum. see Latten,

BRICK, A. Brick.T. Gabachen-stein or (a stone made by Art) L. Later, a side, because 'tis used both to outside and inside of Buildings; as antient as the Ægytians who forc'd the Israelites tomakeit: the Makers of it is called, T. Bachen-strein-lin. L. Laterculus. 15. c. 7:s. 1.

BRICKLE, T. Zee bruch-lech, L. Fragilis, and this we vulgarly call brittle, but doubtless it come from Brick, the

nature of which is fragile or more easy to be broken in pieces, and so made into Pouder, which both whole and in Pouder (as those from Tile) are used by Assayers. 1. 1. c. 32. f. 3. 1.2. c. 44. s. 2. & c.

BRIMSTONE, see Bitumen, Sulpbur. l.1. c.16. s.1.

thence Bitumenous, Sulphureous.

BRITTAIN, See Mines and Mineral Countrys. 1. 3. c. 28. f. 5.

BROOM, T. Bassem, L. scopa, A. Besom and Broom; but I conceive this word is from the Plant, which we call Broom, (T. Ginster, L. Genista) of a flexible nature, and so used to sweep Rooms.

BROWN, T. Braun, L. Fuscus. See Colours.

BRUSH, T. Buerst (and yet to brush, they say Ketbern)
L. Scopula and verricula, vestes purgare scopulis, sculpture 7.
BUBLING, Ein Wasser blason, from T. Blass a Bladder, being but a more durable bubble, L. bulla. l. 2. c. 35. s. 7.

BUCK, Bucking, and up-Bucking, and to Buck, used often in the 2, 3, 4 & 5 Books, in the T. is Lawgen, L. Lixivare from Lixivium or Lee, (see Lee of Ashes) but the Italians call it Bucato or Washing, from whence our word Buck, or properly -Buc (to distinguish it from the Male of a Doe) is called also Buck, which may have its name too from Bucceto, from his frequent mingency, piffing or making Water oftner than Females, and this word Bucking is applyed often to those that are Washers of the filth out of Linen or Cloaths, which the common people use to do with a piece of broad and thick Wood, which they call a Clapper or Bat-staff; but for more Expedition, the Fullers have invented Mills, with several Stamps for their Cloths, which by the force of water do raise and let fall their Stamps, by which the Fullers-Earth with the Water do make our Cloaths fit for use; but whether the Metallists did teach them that Art, I shall not enquire, only the Metalists which we converse with here, have two ways of Bucking or Wash. ing their Oars, from the dirt or Earth about them; one by a Mill, which they call a Smelting-mill, by which with the force of Water, certain Stamps or Hammers do beat and wash the Oars, and those Workers are called *Smelters* at the Mill, and after that, there are other lesser Buckings in Mortars and Tubs, to prepare the Metal (more free from Rubbish) for the Melters; See Smelting Melting, and Menstruum.

BURNING of Metals, i. e. reducing them to Ashes or

Pouder for use. 1.2. c.2. See Ashes, Calcination, Roasting, &c.

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CAKES, T. Schiben, or pieces of Metal, melted into the form of Cakes. 1.3. c. 26. By this word Cake, we must not understand such Cakes as in Latine are called Placenta, from placere, to please the Pallat, by their several pleasant Ingredients; but here it relates only to the form of it, sometimes round and Convex, but mostly Flat, like pieces of Plate, and therefore the Resiners (for distinction) do call Lead, cast into a solid body, Sows and Pigs; Tin, Blocks; and Iron, Barrs; but Silver, Gold and Copper so cast, they call Cakes; and Copper sometimes Rose-Cakes, or Cupri Rosa; and though they be not Edibles (or bear the name of Placenta) yet without Mony, which is derived from those metal'd Cakes, we could not have such things as are placentions or pleasing to us.

To CALCINE, Calcinate, Calcinize and Calcination, T. Calcineren, L. Calcinare, both Languages making it a compound of two Words, Calx for Lime, and Ciner, Asses, which in a metallick sence, is to reduce Metals, by Fire to a friable or brickle temper, like Lime; therefore Lime is called

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onely in Latine, Calx, and we from the word call our Lime .. stone, Chalk, which being burnt, we call Lime, and this burning we call flacking (according to the Teut.) and before it is burnt, Unflackt, unburnt, or uncalcin'd Lime; and being burnt or flack't, called also Calx viva (which is oft mentioned by our Author) and A. Quick-Lime, or that which hath by Fire, asit were) an additional Life, for metals feem to be dead in their Oars, but by this Calcination revived, to hint to us the advantages of our Resurrection, by the general constagration. true, there are other ways of calcination, especially of Metals; viz. by corrosion, Immersion, Amalgamation, Cementations, Fumigations and Illinations. (See Salmon.) yet none of these can be performed without Fire: but to return to the common Lime, as it is fitted for the use of Architecture, it is mingled with Water and Sand, and then called Mortar, and according as the Lime and Sand are in goodness, so the Stru-Etures by it are made more durable, and therefore it is thought, That we had all our Sand for our Mortar (with which our antient Churches were built) out of Italy; and the Fort of Plymouth (built by his present Majesty) recompensed my Journy thither, the Graff of which is hewn out of Marble, and the Mortar also made of (alcined Marble, and their Sand, which makes that Mortar as compact as the Marble it felf, but what kind of Sand or what Proportions, I did not then enquire. Now there are two words in L. which pass under the same Orthography, viz. Calx for Lime, and Calx for the Heel of a man, (or end of a thing) fo as I may conceive that our Metallick and Artificial word Calx for Lime, is borrowed of the Natural word Gala for Heel, because the calcining of Metals, do as it were determine its Life for a better, because those Metals which lay dully in the Earth, before their Calcination are by Calcining and Refining made more active and paffable throughout the World.

CALAMINARIS, See Brafs, and Sculpt. 35.

CA WORDS Metallick CA

CALIFY, T. Warme, Werme, L. Calefaccre, A. to make warm.

CALX, See Calcine.

CAPUT MORTIS, (for brevity Mort.) is the matter or sediment of Metals (or of other things used in Chimical Dissolutions) which remain at the bottom of a Furnace or Stillatory, thick and dry, chiefly from Metals and Minerals; viz. when all their Spirituous parts are drawn off, the remain-

der is call'd Caput Mort. or Feces. See Feces.

CARRAT (signifying a weight) is a French and Italian Word, much used by our Author in his second Book; and it seems to come from the Arabian, Kirat: (see Holioak.) but Cotgrave saith, That Goldsmiths and Minters esteem it at a third part of an Ounce, and among fewellers and precious Stone-cutters, but the 19 part of an Ounce; so as eight of them are but one Sterling, and a Sterling is the 24th part of an Ounce, and 3 Grains of Assize, or 4 Grains of Diamond weight make a Carrat.

Torriano's Addition to Florio, calls it Carrato, fignifying, faith he, a weight or degree in Metals, Diamonds, Rubies, &c. and doth not determine it : but Mr. Howel in his ingenious Tetraglotton (sect. 40.) proportions it to the 24 part of an ounce, and Mr. Webster in his History of Metals speaks more clearly, and faith, the Carrat or Charrat is a term given (by the Officers of the Mint, and Wardens of Goldsmiths) to a certain composition of Weights, that are only used for Af-Jaying, and computing the standard of Gold, and are of two Contents, namely, either the 24 part of an ounce, Troyweight, and is compounded thus; of the pound carrats 2 d. weight, and 12 grains, Troy, make a Carrat grain, and 4 fuch carrat grains make one carat, which is half an ounce, or 10 d. weight Troy, and 24 of fuch carats make a pound or 12 ounces Troy, the other way of Computation is of an ounce carat, five Troy grains make one carat grain, and four of such grains make one carat, and 24 fuch carats make one ounce Troy, and

for affaying he recommends the ounce carat, as more eafy for alculation, than the pound carot, which is made more perspicuous

by our Author. 1. 2. c. 15. See Mony, Gold-weights.

CASE, T. Gebauelz, or a little houle, L. Capsula, A. Case, 'tis of various fignification, as, a Gramatical, Legal, Formal, and fometimes put for an ill chance or hard case. See Sculpture 1, 5, 12, 13.

CATSILVER, T. Kat-zon silver, because it hath a grev

sparkling colour like a Cats-eye.

CEMENT, cementing and Cementation, T. Cementerne. L. Comentum, not from Cado, to beat (as Minshaw would have it) but Camentum, is quasi mens caeli, i. e. the mind of Heaven, to unite things separated, especially, when they confift of one species, and it may well be observed in the viciflitute of the things in the World, that the whole Labour 0 of Man and Nature, seems to be almost nothing else, but to separate what is united, and to unite things that are separated. and this not only feen in our operations upon Metals, but in the actions of humane Affairs: yet, to pass them by, this Cementation of Metals is properly a gradual imbodying or uniting of Metals first separated, and this by a gentle fire, as in Lib. 1, 2, and 3 Books, wherein there are several magisterial Directions: and in other Cases'tis properly called a Conglutination, or glewing together. See Conglutinate.

CENTNER, T. Center & Centner. L. centum. At the Mines it fignifies an bundred and ten pounds weight, but at the Mint, just an hundred pound : Whereby the Mi. ner may get 10 l. towards his charges: See lib.1 cap. 9. but in lib. 1. cap. 37. and in many parts of the five Books, it is confidered only as a small Assay-weight for trying how much a little Part of an bundred weight do hold of Gold, Silver, &c. whereby (as ex ungue Leonis, the whole Proportion of the Lion may be known from its claw: fo by the small Assay weight, the goodness of the whole piece may also be estimated, be it a centner or balf a centner,&c. and this shews the skill of an Af-Sayer in the skilful use of Arithmetick. CE-

CINABAR, T.Zenober, O. (. m f 2. f. s.) Bergen

CERUSE. T. Bleywiesse, L. Cerussa. A. White Lead, the best is made of Lead, calcined with the vapors of Vinegar;

but the common way is by Urine.

CHRISTAL, T. Keistal, L. Christalus and Christalum, there is Natural and Artificial, the Natural is Aqua qua frigore in glaciem concressit; that is, congealed or petrefied Ice. Diodorus Sic. and Boetius are of a contrary Opinion, and fay, It is the purest Earth, dissolved by Water, and for want of Water, congeald to the Christal-Stone: 'tis found about the Alps and in many parts of Germany, Hungary, France, &c. And Captain Ant. Langston, my good Friend, who had travelled about 300 Miles into the Continent of Virginia, did affure me, that he saw there several Mountains of clear and shining Christal; he died about a year fince, and was a very Credible person whilst he lived. Now the Artificial Christals, are made by Chimistry, and is a peculiar part of that Science, called Christalization; that is, making things like Christals: viz. Christal of Silver, Tin, Antimony, &c. See Petrefaction and Stone.

CHIMISTRY, see Alchimy and Alchimist: But I have something more to say to them, for I find that the Chimist hath another Name, and is called Spagirus; and Chymistry, Ars Spagerica; signifying, to sine and resine Metals, and therefore I have thought sit to put the words Spagerica Leges, as the Title to this whole Treatise, instead of Leges Chymica, this latter being more commonly used than the other: nor do I wave the word Alchimy or Alchimist, because it is sometimes taken in an ill Sense, for in the best and truest Sence, by the addition of ALL (which word in all Languages signifies Omnia) so as by addition of All, we are to understand, That Chymistry doth comprehend All Sciences and Mechanick Arts and Trades, even from the Coblers Astralobe, for nothing can be performed without some Metalick Instrument.

CINABAR, T. Zenober, or (l. 1. c. 2. f. 5.) Bergennouer,

L. Cinnabaris, which in English we call natural Vermillion, for of this Cinnabar, there are two forts : Natural, which is an hard, red and heavy Stone, found in Mines: or Artificial, which is better coloured (made of calcin'd Sulphur and Quick-filver, which we now use with Metals) but it is vulgarly called Ruddle or marken Stone, and Sinople or Red Lead; the first also of these two is natural, and the other artificial, but I conceive our Author intends none of these latter, but the former, or one of them. Pliny, N. H. l. 33. hath a large Discourse of this Ginabar, and makes it the same with Minium, of a rich and fresh Scarlet Colour, and faith, there are whole Mines of it in some parts of Spain; and concludes with his Opinion, That it is the Rust of Silver and Lead, but it hath not the less Esteem with the best Painters or Limners, no more then hath Verdigrise, though it be the Rust of Copper: there is great quantity of this Cinabar in the Mines of America, and some few Veins of it, in the English Copper-Mines. See Gold and Quick-filver.

CLAR, so the T. word is writ (l. 1. c. 5. s. 1. and e. 7. s. 1. and c. 21.) the French call it clair, and A. clear: Now though this word bears the same sence in all, yet because, by a certain composition, it doth clear the Metals and Instruments to which it is applyed (for distinction sake) I think sit, according to the T. to call it Clar, as a substantive, rather then clear, which for the most part is used as an adjective. viz. clear Drink, &c.

clay, T. Laim and Thon. 1. 2. c. 20. s. 1. &c. But the L. calls Clay (which is of a flat and clammy Earth) Argilla and Terra Figulina, because Potters (by whom it is used) do reduce it to certain Figures; in A. it is commonly called Potters-Earth, or Clay for making of Potts, Dishes, &c. and although Erckern applyes the word chiefly to Potters-Earth, clay or Loam, yet there are many other clays or Earths which have particular Names, according to their natures and colours; as Fullers-Earth, or Clay of a Russet colour, also Blew, Green and reddish clay, but that which is for common use is solid and firm, and for the most part of a russet or blewish Hue or colour: and

and though it be said by Minsham; That Potters Clay is called Argilla, from Argor a City in Greece, where Potters (as he saith) did first exercise that Art (which Pliny ascribes to Corabus an Athenian, one in the Province of Argolis, and the other in Africa, but both in Greece:) so it seems the Art was there, before it was in Egypt in Africa: however, according to the Sacred Story, the Art of making Pots of Clay was antient, as we may read in Exod. 16. 13. and of Bricks. Exod. 5. 8. and in Job 4. 19. the Honses in his time were called Honses of Clay, and Clay was of such E. steem with Jesus Christ, That he made it an Instrumental cure in the Blind Man. Jo. 9. 6.

Now to pass these, In Devonshire, and other places, I have seen good cottages made only with clay, without any wood, except little Window-cases, doors and roofs; and in Suffolk and Norfolk the outside of most cottages and out-houses (to great edifices) are of clay daub'd on Splenters, and the infides also plastered with clay, and a little Lime, yet are ye-

ry durable.

At Woodford, near London (about 20 years fince) I faw a fair House of Brick, built on the top of that hill, and had no lime or other mortar within or without it, but found clay mixt with fand, which continues strong to this day, as I am informed: and in 1674. (my House in suffolk (standing on an Hill, upon a clay Soil) I digg'd about 30 foot in length, and 10 foot deep, under part of it, with intent to make a cellar, designing to pin or support the sides with Brick: But finding the clay to be very firm (being mattocked and not spaded) and never before digg'd (as might be judg'd, because under the clay was found good gravel, and beds of flat Oyfter-(bells) I saved the charge by continuing the clay in stead of the brick, and I hear it doth hold firm to this day, as if it had been done with Brick: and doubtless, according as the clay is in goodness, so Furnaces, Ovens, Tests, Crucibles, &c. will the better indure the beat of Fire and Metals: care being taken that they

be well dryed, after they are made, and before they be exposed to the fire, and then by degrees, and not fuddenly burnt. See

Brick, Earth, Loadstone.

COAGULATE, T. Rensel, L. Coagulatio, See conglutinate. COAL, T. Koll stein, L. Carbo, of these we have Va. rieties, viz. Wood-coal (of feveral forts mentioned by our Author) used chiefly for Metals, Sea Coal (dig'd out of coal-Mines, near the Sea at Tinmouth, by Newcastle, and Pitcoal (in Mines remote from the Sea) near coventry in Warmick-(bire, and in Stafford-sbire and Sbropsbire, &c. but these are not useful to Metals: 'tis true, many have attempted to Chark or make Cinders of them to be used for Metals, when Wood is scarce, but I have not yet heard of any certain success therein (though I wish it:) there is another coal which is artificial, which we call charcoal, and I conceive the proper Latine word for it is Anthrax, and the burner of it Anthratins, but most Dictionaries douse carbo and carbones for all forts of Coals, by adding Adjectives, as Carbones Fossiles, &c. but Charcoal being a new Invention (comparative to the other) it is fit to have a newer word then Carbo, and these Charcoals of Wood, are most useful for Metals: Now in making those of Wood, the Art is so much improved, that I have seen an Arrow with its Feathers exactly burnt into a Charcoal, without diminution of the shape or the Feather, only the Feather made black for white, and some of this Wood Charcoal, I have seen at the Iron-Mills in Worcestersbire, so uncombustible, that they have come running out of the Furnace, and floated on the top of the Metal, whole and intire, and this (as they told me) was the Charcoal of the Withy - Tree, being a more light and foft Wood than any that grows in those parts: I carried away some of them, and cut them into fine Pencils, and used them for Drawing, on blew Paper (especially being first boyl'd in Butter) and the white Pencils proper to them, I made of Tabacco-Pipe Earth in Rouls dry'd by the Sun, and not at the Fire, and sometimes I heightned the lights with Ceruse (composed of Lead, COfee (eruse.)

CO WORDS Metallick CO

COBOLT, T. Cobolt. Sometimes accounted for the Copper-stone, and reckoned by Dr. Salmon, among the natural Recrements of mettals; and I do not find it by any other name, then as it is so described by Erckern. l. 1. c. 2. s. 11.

& L. 2. c. 21. &c.

COIN, T. Gemuntsz, the Latine hath several Words for it, viz. Moneta, Nummus, Pecunia, &c. and Aurum, Argentum, Cuprum, Æs; and antiently Coriata (when Leather Coin was currant and in esteem) but the proper word for it, (and for Minshaw) is Cusus, thence Cudere to Coin: Now Moneta is a relative Word to Monere, advising to take heed how to use Mony, only to honest ends, after it is once Coin'd: Nummus to Numeratus or Quantity: Pecumia to Pecus or Sheep, which were and still are commutative as Money it felf, but it may be properly from the Greek Word Kainos, Comunis, because when it once had its Stamp or Cude upon it, then it was passable, currant and Common, and some would have it from the form of the Coin, confifting of Angles (as much of the French and Spanish Mony do) and some fay, That from Angular Coins, the Corners or Angles of Structures are called Coins, because with fuch Mony the Architects were paid their Wages. Now, I conceive that I may add my Supposition also, That the Word Coin, may be the abstract of Coynobeline or Cunobeline, one of the Kings of the old Britans, and who is faid to be the first that did coin Mony, at Malden in Essex (Cambden) where it is probable that their Mines (in our Records) fince decayed or neglected, did supply him with Metal, for that purpose; however, in our later Ages, the Word Coin is still applyed to Metals, formed into Currant Mony made of Metals.

CONDENSE, T. Dick-Maken, A. making Thick. L. Con-

densatio.

CONGEAL, ver Breizon, L. Coagulatio. See Conglutinate. CONGLUTINATE. T. Lime, (from whence we have the word lime, for a Dog and Bitch in copulation) L. con[K] glutinare.

glutinare. A. to glew and join together: now these words cement, coagulate, condense, congeal and conglutinate are often, but improperly, applyed to one sense, especially about metals; for cementing is, as I have shewn in Cement; coagulation, from coagulo, to curdle, i.e. where metals are joyned or curdled together by fire; condensation, when metals are made more bard, or thickned; congelation, when they are by Fire turned into a Christaline, Glittering and Icy form, from gelare, to turn into Ice; which kind of Christal is often feen in refining of metals; and conglutination from Glutinare, when they are joyned by a glewish temper, and is more properly applicable to vessels made of Glutinous matter, for the better holding of Metals in the Fire, yet all these Words still signify the making of things thicker or harder, than they were before : Now as to conglutination, I cannot here but call to mind what I saw at Exmouth in Devonshire, where upon little Rocks appearing somewhat above the Sands (at a low Water) there were Oysters sticking fast to them (which at an high Water were all covered by the Sea) so as we were forc't to beat them off with a Chizeland Hammer, and these they call'd Rock Oysters, the Shells being almost as firm as the Rock it self; I confess I look't upon it as a wonderful Secret in Nature, That the Oy. ster could fix it felf fo firmly, having no outward parts to do it, and this in 12 hours time; for at the next Low-Water those very Rocks (where at the former Ebb we had left no Oysters on them) they were filled again with other Oysters, and therefore it must be some glutinous matter, which they cast forth upon the Rocks, and so brood upon it to a condensation; and I the rather believe this, because Shell-Snails, which we call Dodmans, have an excellent white Cement, always lying in the little end of the Cone of their Shells, with which they often glew themselves so fast to Walls, that they cannot get loose, but dye in their Shells: and fo do's the Limpet (another Shell-Fish on the same (oast) cleave it self so hard to the Rocks, that nothing but a chizel can divide them from the Rocks; now cer-

certainly, if that part of the Oyster-shell which is so glemed, were mixt with so much of the Rock, on which it is fixt, there might be made a very binding Glew or cement, for Metallick Veffels; but there is another fort of Shell-Fish, upon that coast also, which I cannot but mention, because I do not find it amongst those that write of shell-Fishes, and it is called in that County, the Long-Fish, or capa Longa, the longest are not above 12 Inches and about an Inch in breadth, opening at each end, and contains in it a white-Worm (for I cannot call it otherwise) which is a very nourishing Food, and being pickled up, are sent as acceptablePresents, to those that make their Gusts their delights; these are caught in this manner : at a Low Water, that is, when the Sands are clear of Water, those Fishes do shew themselves above the Sands, about 3 Inches, fo as 8 or 9 Inches remain in the fands, and then those who make it their Trade toget them, presently go against the wind very softly (as in catching of Moles) and with an Iron Engine (somewhat like a Spade) strike under them, and so are caught; but if they go with the wind, the Fish presently retires into the Sand, without possibility of being caught for that Tyde, and though after their Escapes, I have feen them digg'd for, yet they vanish beyond the strength or agillity of labour to catch them.

Now, these having no outward thing discernable to affist them in so quick a Motion, I conceive it must be by some glutinous matter, (such as we see do attend snails in their motion, but the snails cannot contract it again, because it usually lies on some dry substance) but the glutinous matter of these capa longa's, being fixt in their Repositories (much under the superficies of the sand, and so extended by them like a spiders thred) may with much more agility than a spider rise or fall as they please in a moment, there being a liquidity from their Repositories to make their motions of ascention or descention more agile and passable: Now from Creatures of this constitutions, certainly many excellent Gements may be made, as may be judged by the Fish, which Pliny lib. 32. cap. 7. calls

Itebthiocalla, and we Ising-glass Fish, which besides other virtues, the skin and other parts of it (as he tells us, and now we know by Experience) do make an excellent Cement (especially if it be mingled with aqua vita) either for earthen Ware or Metals: enduring both sire and mater.

COLOUR, T. Farb. L. Color. A. Colour. (fignifying Beauty or Pulchritude) of which there are two forts: natural and artificial; wherewith the Limners and Painters, in Imitation of the Beauty of Nature, shews us the Beauty of their Art; yet they cannot perform their Works without the help and mixture of other Substances; as Oyls, Gums, &c. but their best and most proper Colours are from Metals; Whereof feven are accounted the chief, produced from the seven chief Metals which are influenced from the feven Planets, and these 7 colours are used in painting, by two forts of eminent Artists in that Science, viz. those who use them with Gum (call'd the Art of Miniature or drawing in little) and those which use them with Oyl (called Limners or Painters, or drawing in great and little) for I meddle not with those who work with Pastils or in Frisco, or Dyers, or Tincturists, so the first of these in an Alphabetical Order is Black; otherwise White and Black are accounted the Principes Colorum, &. Mensura Reliquorum (Alsted.) And all of them produced from Metals and Minerals: the Seven are thefe;

I. BLACK, T. Schwartz (l. 1. p.6.) from whence we have our word swarth or swarthy, inclining to black) L. Niger. Plutarch calls it color umbrosus. A. Black, and these Blacks are natural in Stones, Coals, &c. but the best Artificial ones are made by the retortions of Lamps, placed under Plates of Gold, Silver, Copper, Lead, Tin or Iron, and are easily distinguish't, in their nigerities or blackness; and this shews, that black hathsome superiority over white, because when white things, as Ivory, &c. are burnt, they turn to a black: but as to our purpose: it is Observable, That all these Blacks

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Blacks are still heightned and improved for use, by the three eminent Minerals, viz. Vitriol, Allum and Copperas.

II. BLEW, T. Blan and Himmel Blan (in English heavenly Blew) the Latines renders it to us mostly by Participles or Adjectives, as Lividus, Adluens, Ceruleus, Cyaneus, Cumatilis, Cælestis Color; that is, a Colour having those properties or resemblances: the French calls it Blen and Azur, and we Blem and Azure, we from them, or they from us; which latter is the more likely, because we have more Mines of Copper, from whence it is produced, than they: now besides this Azure Blem, there is Blew Bise, Ultramarine, Smalt, Flory, Inde-Bandias, Litmus, Orchal, Blew Vitriol, Verdigrease, produced from Mines and Minerals.

III. BROWN (or Russet) T. Braun, the Latines, which would bring this into the septinary of colours, call it color nations and Pulligo (Holioke) otherwise the common name is Fuscus, from the darkness of its colour, being (as it were) an attendent on Black, and of this brown colour (which is the proper colour of Tin and Copper Oar) there is Umber, spanish-Brown, Terrra d'colonia, Turnsil, Bole Armoniack, and other products of Metals and Minerals, which Painters and other do use for it.

IV. GREEN, T. Gruen, L. Veridis Recens, and many other words relating to the diversity of Greens, but those which are used for Painting (from Metals and Minerals) are Green Bise, Virditer, Verdigrease (which though it be used for Blew) yet being steept in Vinegar (as I have oft tryed) it doth produce a delightful transparent Green: also copperas, Vitriol and Allum do much improve this colour.

V. RED, T. Rot, L. Ruber, Rufus, &c. to supply which for Painting (there is Lake, which is another delicate transparent red purple colour) also red Lead, Vermillion, Cinnabar, Minium (of different Names, yet little differing in colour)

also Cinople, Rosset, and several other Reds from Metals and Minerals.

VI. WHITE, T. Weitz and Blanck, Blun L. Albus and Candidus, to represent this, the Painters use Littarge of Silver, Ceruse, white Lead, Spanish White, &c. raised from the Calcination of Metals.

VII. YELLOW, T. Gelb, L. Gilvus,

Flavus, Fulvus, Luteus, Croceus; to represent this, they use Littarge of Gold (and a liquid matter which counterfeits Gold, fuch as is used about Coaches, &c.) they have also yellow Orpiment, Sandarach, Masticot, yellow Oker, &c.

Now of these colours, those which are produced from Metals and Minerals (as I have shewn) are too piercing for Paintings with Gum, and therefore not lasting, but with Oyl they are safe and very durable, even to a thousand years or

more, especially in the curious Art of Anealing.

Now concerning colours in general, here is the difference between the Botanick Science and the Metallick, because in one the colour of Plants are feen, in their admirable variety, without the use of Art; but the colours of Metals are not seen, but by the help of Art; only it may be supposed, that every Vein of Metal hath some pretions Stones to attend it, whereby we may be informed of what colour that Metal is most apt to yeild by Art: as Saphires, white and yellow, Diamonds, Rubyes, Emeralds, Amathifts, &c. which are daily found (especially in hotter climates) there are also other colours, mentioned by Erckern, as grey Lazure, red Sulpbur, Purple, Orange, &c. but whoever will make a more exact review, will find that the most pleasing, useful and durable colours, are from the Metals themselves, or their Extracts and Flowers, seen in their Original representatives, viz. Gems and pretions Stones.

CO-OPERATE. T. mit eyn ander werk. L. Co-operate, to work together, that is, when Metals do work together before separation, and is also generally applyed to any joynt

action.

COPELLS. See Utenfils.

COPPER, T. Cupfer, L. Cuprum (1.3.) A. Copper, and is accounted the thirdMetal in esteem next Gold; and, as is pretended comes from the Isle of Cyprus, from whence it had its Name Cuprum; we need notgo to far for it, having many Mines of that Metal, both in England and Wales, especially those at Kefwick in Cumberland, , which occasioned a great Suit between Queen Elifabeth and the Earl of Northumberland, concerning her Right to them, upon the account of Royal Mines : which Case is reported by Plouden, with the Opinion of the Judges on the Queens fide, wherby the Society for the Mines Royal, have had and still have the care over them, but for want of Fuel and skilful Miners, they are of no use at present: This Metal is of three forts, the Red or Reddish is the proper Natural Copper: Tellow Copper, which, for distinction, is properly called Brass, is an Imitator of Gold: the White is when Copper is tinged with Silver, so as it imitates Silver. See Brass.

Stone which is cast up very plentifully between Rochester and the Isle of Shepy (which being not far) I went purposely to the Copperas-Works, farmed of Mr. Hamard (Lord of the Soyl) by one Mr. Johnson a Londoner, who in few years got above 20000 l. by it, as appeared by what he lest to his two Daughters, when he died: I went also to other places, but did not find that the Stones are so plentiful and good in any other place of England: it is of a dark Sea-Green, but being melted its colour is heightned, and glitters like to Chrystal, and serves for many uses about Metals, and almost in all Trades where colours are concerned, and is one of the chief Ingredients for

good Ink, as I found it in anold Abbot's Book:

Vitrioli quarta mediata sit uncia gummi
Uncia sit Galli his jungas octo Falerni; (which I take to be Sherry)
His bene contritis comixtis omnibus illis
Facit bonum Atramentum.

And

And therefore this Copperas or one fort of Vitriol (in distinction of the white (called Dans Vitriol, because from Danemark) and the perfect blew Vitriol (called Roman, coming out of Italy) is called Atramentum Sutorium, because Shomakers-black is made with it. See Colours, Black and Vitriol.

COPPER-stone, T. Ruffer stein (lib. 3.) is no other than folid Oar of Copper, as it is in the mine, and not touch'd by other Imbracers, or, as it is made at the first smelting into Cakes or stones, and so the word Stone is commonly applyed

to it by Erckern. See Oars and Stones.

CRISTAL, See Christal. CROCUS, is the T. and L. for Saffron (lib. 2. and 4.) but in Metallicks, it is meant a pouder made of Iron or Antimony, of a Saffron colour, and when it is made of Iron it is called Crocus Martis, or of copper, Crocus Veneris, because it is the pouder of those Metals of Iron and Copper, which are Dedicated to the Planets Mars and Venus, and sometimes is made of mixt Metals, and then called Crocus Metallorum, and are often mentioned by our Author.

CREIZER (l. 2. c.2.) T. Kreutzer from Kreutx, or a little Cross stampt upon it, and is so small a piece, that it is accounted but the 92 part of an Hungarian Gilder, which is about 30 pence of our Silver: but H. Vanghan in his Book of Coinage, makes fix forts besides the Hungarian. See VVeight.

CRUCIBLE, T. Tiegel, I find no proper Latine Word for it, but it may go under the word Phiala for a Cruise or a Pot, and this Crucible is a diminutive of Cruife, or Pot less than a Cruife, but of different shapes: and this is used for diffolying of small pieces of Metal for Assaying, as others are for other uses called Cruifes. See Pots.

CULB, T. Krug, which is a common name for all Cubical Pots, but we call it (ulb, from the particular form of it, I duppose, because it inclines to a Cubical shape. See Sculpture.



EAD, T. Todt, Todter (from whence we have our word Tclod or Clod) and Gesterben, L. Mortuus,

Defunctus. See Dissolution.

DECLINATION, T. Nidersichbiegn, L. Deorsum se steeletere, and is almost the same with Precipitation; for which Gramarians use the Word Declination, Declension, or going from one Case to another, and in the Vulgar sence, a man is said to decline in his Fortune, when he salls from Prosperity to Adversity: but in the Metalick sence, it it to fall from the top to the bottom, by which means the Metal is better than when it was at the top; and 'tis often seen that adversity makes Men better and of more use (as Metals are) by being Cast down; a Phraise often used in this Book. See Precipitation.

DEFT, (l. 1.&c.) an English Saxon Word, therefore I retain it; signifying fair, clean, neat (quasi sine defectu) or without defect, on the contrary undeft is unclean, &c. (Skin-

ner.)

DELINEATE (1. 2.) or to Describe a thing by certain

Lines or Figures.

DIAMETER (l. 1.) is a certain straight Line, drawn through the *(enter of a Figure, and of both sides bounded in the compass of it, cutting or dividing the Figure into two equal parts.*

DISHES (l. 1.&c.) T. Schueffels, L. Discus, A. Dishes, and these are of various sorts and shapes, but the most useful about

Strice

Metals are made of Pewter, Iron or Clay, for I do not here write of Epicurean Dishes, but of Dishes or Bowls that are certain measures in Mines, which are filled with Oar, by the Labour of the Miners, whereof a certain number are paid as a duty to the King, others as a duty to the Church, and the rest to the Proprietors, and according to the number of Dishes delivered, so the Miners are paid; and then they may eat the Fruit of their Labour in other Diffes. VVardens.

DISSOLVING (1. 2. &.c.) that is, a metal easy to be loosed from such other metals as are fixt or intermixt; and thence Death is called a Dissolution, when the Soul is loosened from its Terrestral part, and becomes a Caelestial Metal, and from hence the word Dead is oft used in Erckern.

DISTILLATION (1.2. & c.) is a drawing of a Liquor made thin with beat, into a Receiver, by Alembicks, Retorts, &c. and is mentioned by our Author, though of little use to Refiners, who deal with hotter fires and harder substances.

DRAGGONS-BLOOD, L. Sanguis Draconis (1, 2. c. 13.) our Author wheth it for Lutings. Dr. Salmon faith, It is the product of a Tree, red like Blood, or the colour of a Dragon, and comes to us from America, and by boyling condensated: but Pliny (1.36. c. 7.) saith, That the Indians make it of the substance of a Dragon, 'crush't and squiez'd with the weight of an Elephant, falling upon a Dragon, that hath fuck't him to Death, whereby the Dragons and Elephants Blood are mingled together; and of this the Indians make a Colour like Cinnabar, so as though they bear one name, they are of different Natures, and which it is that Erckern means, I leave it to others; for the Blood of the Ox, &c. we see in other of his Experiments is used in Luting and Cements: there is also an Herb growing plentifully in England, called Dragons Blood, which is much used to tinge Colours, and hath a Restringent quality, and to may be used with (lay in Lutings.

DRAM (l. 1.6.c.) T. Quintlein, L. Drachma. See VVcight.

DREGS,

DR WORDS Metallick DU

DREGS, T. Trussen vapfen, L. Fax, from whence we use the Word Feces.

DRIVE or Driving, T. Abtreiben, L. Abigere, Depellere. 1. 3. c.25.) fignifieth the forcing of metal to cast its dross upwards, as the feces downwards, 1.3. c. 25. & 26. and in many other places used.

DROSS. T. Treusen. L. Fiex. A. the scum of metals: see Dreggs, Feces, Scorias, Lees, Slacks, &c. so it seems Dregs is the purge or settlement at the bottom of melted Metals, and Dross the vomiting the crude matter upwards.

DRY, T. Abdoerren and Treigen maken, L. Siccare (1. 3.

c. 26.) see Ovens.

DUCCATES, See Money.
DUKE-GOLD. See Money.

DULCIFICATION, T. Susq, L. Dulcis, or reducing the ill Tasts or Scents of Metal to sweet and pleasing; and thence the Ponders often are called both Sugars and Salts, as they are different by Extraction, and the perfuming of them called Hedichra, and these are dispersed in our Author, and are called Sac-

charia Auri, or the Sugar of Gold.

DUNG, T. Tingen, L. Sturcus, and of these Horser Dung and Ox-Dung, and some other Dungs are a chief Ingredient to Lutings (used by our Author 1.2. e. 20. &c.) and the Dung of (reatures are not only used in this Art, but in almost all other Arts and Sciences; by Chimists called Ignis Sapientum, or the Wise-man's Fire (Howel) and though it be in contempt amongst Ladies (and the less Learned Inquirers into Nature) yet certainly the Heathens had them in such Veneration, that they Sacrificed to most of their Idol Gods, upon the account of Stercorary Virtues in them: and therefore the Translators of our Bible into Latine, instead of Idols calls them Dij Stercorarij (Junius and Trem.) of which I apprehend this reason: viz. that the several uses which they made of Dung, either for Medicine or Manuring their grounds, might be propitious to them: and I have read it from some Traveller of note, That among

the Indians it was usual, . that when they intended Homage to their Superiors, or welcome to their Friends, they did evacuate their Dung into their Hand, and so daub it on the Face of whom they intended to bonour or pleasure, and was ever accepted by them, as the first and best of their Welcoming Geremonies: for Agricola tells us of Mans-Dung made as sweet as Civit. But to return nearer home, when I remained in London, during the great Plague in 1666. Dr. Glisson (famous in his time) being my old Friend and Acquaintance, perswaded me to take a piece of his constant Antidote, which was only the Dung of one that had dyed of the Plague, dryed, and so kept in a foraminous Box, for the best Antidotical Perfume; but I thank God I escaped without it: and let us but consider of the great Virtue of the Dung of Geese, Ducks, Peacocks, Dogs (generally known and used) it were worth the while to make a (ollection of them, from Johnson's Natural History of Quadrupedes, &c. and it may very well compleat a large Book of those useful Experiments; especially if a little variety from Pliny be admitted: so I will conclude with this Direction , That Stone-Horse-Dung is of certain and known Virtues in curing scaldings, scorebings or burnings by hot Metals, if quickly applied to the part grieved.

DUCCATE, T. Duckat. L. ducalis aureus. A certain Gold coin which was first coyn'd in Rome, Anno 547. and afterwards it began to be used in other Places, and so called because it had the Image of a Duke (that is, some eminent Leader of an Army, à ducendo) and worth about 6 s. 8d. English, now 9 s. (Holiock) This Coyn was held formerly the best Gold, but now it is much adulterated, so as Goldsmiths are ve-

ry careful in receiving them.

DUST. T. Stanb. L. Pulvis. See Ponder, Albes, Pulve-

uricelawance is say usual, what when they, introduced it coard



EA

ARTH, T. Erd, L. Terra. A. Earth, from the Saxon: Now, in every Territory there are differences of Earth, of there are accounted fixty eight forts: but of thole which are esteemed the best in England (which other Nations make use of more than our selves.) some of them are rather lapidious than fragile, as yellow Oker (of which I have feen a Pit or Quarry in Mr. Whorewood's grounds at Halton in Oxford-shire:) also red Oker (which some call Markingfrone) in many places, and both of these are improved by artificial Okers: and of Fullers Earth there is store, and very good, in a Lordship of the Earl of Bedford's, near Oburn-Abby; also in Sir John War ground in Suffolk, and in many other parts of England; (of which the Dutch make good use, though there is a Law to the contrary.) As for chalk which is burnt into Lime, and White Earth for Dishes, there is very good in a Mannor of the Lord Abergaveny's, near Normich, in Norfolk, and Potters-Clay for Pots, and Marl in most Counties, with which they manure and much improve their Grounds; also earth for making Brick and Tile for Houfes, &c. of which there is plenty in most Counties, and commonly they burn to a red Colour : but there is a fort of Brick-Earth in many parts of Suffolk and Norfolk, and in other Counties, which burn white, and are more lafting and durable than the red, and these, other Countries borrows from us; and we borrow from them the Terra sigillata, Terra Lemnia and Terra Armenia, and many more of great use and Virtue: but that which is common to us all, is Sand, and this is particularly used for those Ovens which are called Sand-Ovens Sculpture II. and XXIV. for separating Metals: Now these have their feveral Names and Natures, as Pit-Sand, drift-Sand, Sea-Sand, &c. which may be experimented in Chimical Operations, viz. what kind of Sand is most proper for Metals. and what for Mortar, &c. But before I pass this Discourse, I cannot but speak of the Sands at Leklingham in Suffolk (vet spreading into Norfolk) having their rise from an Hole in that Village, therefore they are called Icklingham-Sands, or rather Mowing's Sands, but their Motion is different from all others, for these do not move but by a Western Wind, and then they go East, and lie still and compact in any other Wind, and yet it hath walk'd from thence above Eight Miles to Brandon and Downham, two Towns East of it, covering the ground at least a foot deep for more than a Mile in breadth; and whilft the ground is so covered it produceth not the least sprig of any green thing: Now Brandon and Downham are two Towns scituate on Suffolk - side, by the edge of the river onse, which runs from Thetford to Lyn - Regis: and the Inhabitants did make very high Banks to defend their Meadows, and to prevent the stopping up of the River, so that you might see good Meadow-ground on the East-side of the Bank, worth 20 s. an Acre; and on the West-fide, Sandy ground, the Inheritance not worth two pence an Acre to be fold. Inhabitants being not able to defend their River or Meadows any longer, left the Sands to act their pleasure: and then they fairly march'd over the River, and are gone about three miles into Norfolk, still keeping the same point of motion. Now, whether this proceeds from any extraordinary attraction of the Sun, or inclination of the Sands to the Sea-shoar, by way of sympathy, being about twenty miles East-ward, I shall leave it to further Consideration: and my reason of writing this was, that in fand Ovens for Metals the different forts might be tryed, some being of a very fresh, and some of a very salt, and others of a verydry Nature. And

And I cannot but further observe, that the Western parts do as much admire at the Eastern sandy Grounds producing pregnant Crops, as we at their mountainous Crops, both having their Fertility from the artificial and laborious Mixtures of other Earths, with their stones and sands: see Sculpture XLI. clay, Sand, &c.

EGG, T. Eye. L. Ovum: l. 1. p. 20. this word hath as much difference in our Neighbouring Languages as any I meet with, and therefore I shall set them down; the Greeks call it Oven: the Saxons, Eghe: the Belgick, Eye; like the Teut, the French, Oeuf:

the Italian, Novo: the Spanish, Huevo, &c.

In the Egg there are three parts, the white, the yolk and the tredle; the white of an Egg is called in L. Albumen, T. Eyeclar, and by Pliny, Ovi Albus Liquor, and this is called Eye clar, from the bright spots in it, by whose delatation the Coliquamentum, which is made from it, is stilled (by that Learned Dr. Harvy,) the Oculus or Eye of the Egg, agreeable to the German word Eye; the Tolk is called in T. Totter, L. Vitellus, from Vita; the Treddle is called Chalaga.

There is little use in Metallick matters of the Yolk or Chalaze, but our Author often mentions the use of the white of

Eggs, as a chief Ingredient for Lutings.

But upon this occasion of writing of Eggs, I am put in mind of a Camelion, which was bestowed on me by Mr. Fasset (an Eminent and Honest Chyrurgion) which was sent him out of the East Indies, and with it the very Stalk and Cluster of small Eggs, as they were in the Body, and one Egg in its sull proportion, as white as Pullets Eggs, and as big, considering the proportion: this Egg from the Camelion was a perfect round shell, whereas Hens are Oval, so as I find this difference, that the Camelions Eggs are Oval within, and are cast out of the Mouth round, but Hens are round within and are cast out of the Fundament Oval; and the reason may be, that the Camelions Eggs comes out of its Throat (the extention of which is of one constant Globular form;) and so Snakes and Fish (whose

(whose Eggs are round) do send them out of their Mouths, and then take them in again, as they perceive any danger to their spawn or Eggs; but Hens Eggs come out of an Orifice, which opens by degrees, which makes the first part of the Egg narrow (for the little end comes ever first) and so the passage extending gently, the pliable Egg encreaseth in bigness, and at the exclusion doth narrow it again, but not so much as at the first

egress.

Now it is to be observed, That when the Egg is unloosned from the Knot or Cluster of the little round Eggs, it soon receives extention into an Oval form, even whilst it remains in the Body, in complyance to its passage through the Fundament; and whilst it is in the Body, it is prepared also with a white Film over the whole Egg, resembling, but is not a shell, because it must endure compressure, and being now ripe to be expulsed, then by a certain spirituous liquid Cementation, or glutinous varnish from its Dung (which passeth out with it) and by the ambient Air (at its coming out) it is crushed in an Instant into a solid shell, which will not endure compression: And this I mention the rather, because I find that the Learned Dr. Harvy attributes the hardness of the shell to the approaching Air, and not to the Cementing Dung, and doth not in the least Discourse of the causes of oval and round forms of Eggs.

ELECTUARY, of which there are near an hundred mentioned in the New London Dispensatory, whereof the chief

are from Metals or Minerals.

ELIXAR is exalted Quintessences, made by infusion and Digestion of Metals,&c. whereof there are also 25 forts in the aforesaid New London Dispensatory. the chief of them also are

from Metals. See Quinteffence.

ELL, T. Elen & Eblen, L. Ulna, Cubitus, A. Ell. Now it is here to be noted, that the English Ell is as long as two German Ells: and so it is to be applyed proportionably to the making of Furnaces, &c. See Finger, Hand, Measure.

ENAMEL, See Amel.

EQUILIBRIO, See Weights.

ESSENCES, (Doct. Salmon.) are the Balsamick parts of Metals, or of any other thing clearly separated from their gross parts, whereof 16 are numbred in his London Dispensatory, and the chief of those from Metals or Minerals. See Quintessee & Elixir.

ESUSTUM, T. or Copper calcined and then called Calze

Veneris. See Products of Metals.

EVAPORATION, and to evaporate, T. Dampffein, or to take away the Dampness or exhaling of the humidous parts of Metals, by a gentle fire, or heat. (D. Salmon) L. Evapora-

re, or to take away vapors. See Fumigation.

EXPRESSION, T. Ansa Trucken, L. Expremere, i. e. a straining or drawing forth Metals or Liquids by pressing, and this done either with Linnen or Leather. See Filtration, and Quick-silver, the word is also applyed to the speaking fluently.

EXTERN. T. Avez wendig, L. Externus, or the out-

ward part of Metals, or things.

EXTRACTION, T. Ausz Zichen, L. Extractio and extrahere, that is, the drawing the Essence, life or vertue out of any Metal, by a fit Menstruum or Liquor from Oyl, Tartar, Calx viva, Vinegar, &c. whereof above 60 are in Dr. Salmon's New London Dispensatory, and have peculiar names, viz. the Extraction from Iron is called Crocus Martis, and so of the rest.



remain at the bottom of melted Metals, which may be reduced to a profitable Ponder; and we also call faces from facere, or that which is made to flow or float on the top, or sink to the bottom of metals; and the word Dross, seems to come from Ros, or thick dew, which ariseth from Metals, and condensed bodies: also the word flacks T. is Slacken, L. Scorias, which signifieth also Dregs; and these are so called before the Metal it self is by Pracipitation cleared from them; and it may be observed, that Argol (the Dregs of Wine) which is seces of another Nature, for it hath this Property, that as the seum, dregs or faces of Metals sly to the top or bottom, this betakes it self to the sides of Vessels, as if it scorned to be called either Scum or Dreg.

FERMENTATION, T. Saurmachen, L. Ferment or to leaven, raise or improve; but as to Metals, it is used for rarification, ripening or flowring them by addition of Ingredients, as our Bread is ripened by Leaven, and Beer is flowred by Yeast, and in many parts of our Anthor it is used: See

Dregs, Drofs, Scoria's, Yest, &c.

FILE, T. Feile, L. Lima, A. File or Rasp, to file metals to a Ponder, and the silings are called Limations, but we use the word File in three other senses, viz. File, from silum Thread; a File of Souldiers; which may also come from silum, because they stand in a direct Line, like an extended piece of Thread.

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FILTRATION, also from Filum a Thread, because Cloths woven of Thread, are used for straining Quick-silver, &c. but that is more properly called Expression (as before) for this Filtration is done two ways, either by brown Paper, or Pendent Lists of Cloth, whereby the liquid Water may drop guttatim, from one Vessel into another.

See Expression.

FINGER, T. Finger. See Meafure.

FINING, Refining and Clarifying, T. Saeuberung and Reinguns, L. Purgare, Mundare, and are only the making the Metals more perfect in their Species or Kinds, by often melting them from their Drofs or Dregs, l. 1. p. 18.

FIRE T. Fewr, L. Ignis, is the chief Operator in the Diffolving of Metals, still shewing its power and activity on the fulphurous part of Metals, and makes it sty away or submit.

FISH-BONE, T. Fisck bein, L. Os piscis. See Bone-Ashes.

FIST. T. Tauft. L. Pugnus. See Meafures.

FIXATION, to Fixt. T. Hesten. L. Figere, is the making of that which is volatile in Metals to be Fixt and endure the fire, and not fly away; and this is done by sublimation, still adding some fixt Metals; as Lead-Glass, Lead, &c to the Volatile.

FLAME, T. Flam, L. Flamma, or the Oyly part of Wood, or combustibles, impregnated by fire, for the more easy passing it self into all the porous parts of Metals.

FLEAKY, Flakes, flaky, T. Floken, L. Floccus, Frag-

men and Strictura, A. Flaky. See Shivery and Shivers.

FLEGM, T. Rhoden, L. Flegma, Pituita, or the waterish, volatile and unsixt part of Metals, and as in Man it is of a thicker substance than spittle, so in Metals it is of a thinner than the Scoria's or Dross, and that which ariseth from Sulphur or Vitriol, is commonly acid, sharp and salt.

FLINTS, T. Fewerstein, and sometimes in the T. they are called Hornestein, from the colour: L. Silix, there are such store of these in Norfolk that it makes a City in Spain

accounted one of the wonders of the World, being encompassed with fire, that is Flints, to be no wonder: but the Metalick Flints are such as accompany the Veins of Metal, and from whence Metal is made; but whether the Norfolk Flints, though full of Ignitous matter, will afford the like, may be tryed, by fuch as do not value the charge of Experiments; and then the great Labour and Expence of digging in Mines might be

faved. 1.1. p. 7. &c. See Stones.

FLOCKS (of Wooll) L. Floccus, the same with Flakes, Flocks of Wooll, T. Ein Loken Wull (1. 2. c. 20.) and A. called Locks of Wooll, by lafily using I for f, for it hath its name from a number of sheep which bears the Wooll, which makes Flocks (being the remnants of the Wooll after Combing and Dreffing it) for spinning; the like is made of the remnants of Flax after Dreffing, called Hards, and both of these are much used for Lutings, and it may be a Quere, whether the Flocks of Lemster Wooll, which is the finest in all England, or Norfolk Wooll the worst, be the best for use? but I prefer Leimster Flocks, because its Wooll is called Leimster Oar, oftner than Leimster Wooll, because the feed of the Sheep confists of those Hearbs and Plants which have their Virtue from the metalick Oars under them; fo as I know, that the Sheep of Leimster, being removed to places where there are not such subterranean Oars, their Wooll in one year will be adulterated by their Feed, the word Flocks is also metaphorically used for Societys of Men, and Beafts or Birds, &c. l. 1. p. 9. &c.

FLOWERS. L. Flores. T. Blum, from whence we have our Word Blossom; this word in natural Plants fignifies such parts, as are extracted by the Sun into delicate shapes and colours, and as they are the last Works of Nature upon Plants, fo that which Chymists calls, Floss Auri (or of any other Metal) is, as it were, the last sublimation or extraction by fire from any Metal; and as the Flowers of Plants have their vertues fuperior to all the other parts, as leaves, stalks, &c. so the Flowers of Metals, which some also call Ponders, are superior to the

Gold

Gold, Silver, or any Metal in their substantial Bulks, or multi-

farious ways of Extracts or Magisteries.

FLUS, T. Fluez, I retain the Word Flus, because it comes from the L. fluere to flow, as that which is fluid or flowable, and and sometimes (as it is a Composition of the Glass of Lead) it is called Lead-Glass, which being put into dissolvible metal, it gives expedition to their Dissolutions (l. 1. c. 8. c. 26. so l. 2. c. 5. &c.) and from hence may come the Word flushing or flowing of the Blood to the Face, from other parts, &c.

FOR CEPS. T. Tangs. L. Forceps. A. Tongs. See Utenfils.

FORGE. T. Einschnide. L. Fabrica. See Utenfils.

FORREIGN. See Outlandish.

FORMS Chimical. see Salt.

FRESH, T. Frisch, L. Recens. Su Oars.

FUMIGATION, from L. Fumus, A. Smoak, T. Rauch, but as to Metals it is used when they send up sharp and stifling Spirits: see Evaporation, but note that Fumigation is applyed to dry bodies; Evaporation to liquid, to shew the difference between Fumes and Smoaks.

FUNNEL. See Utenfils.

FURNACE, See Utenfils and Ovens.

FUSION, T. Geissig; the Word is oft used by our Author, and by Metallists, but more by Distillers; sometimes signifying putting in; from insundere and sundere, and sometimes in metals called sufile or sufible, being so meltable as it may be poured in or out.



AMAHEZ, is an Arabick Word, fignifying the Figures of things (as of Birds, Beafts, Snakes, Trees, &c.) naturally represented in or upon Stones, which usually attend Mines, as other transparent precious STONES do, as I have shewn under the words Colours and Yellow; for I intend not here to speak of Talismanical Figures from Constellations, for which I refer you to Gafferel, G. Agricola, &c. But first of the ontward Figures of Gamabezies, of which fort Thave feen many taken up about Aderly and Pomfret in Tork Shire, and in other parts of England, which do perfectly represent Snakes, as they usually lay roll d up in the Earth, when alive, so as these seem to be Snakes petrefied, only their Heads are wanting in all, and they are seldom above two or three Inches Diameter, and of a blackish colour, yet I have heard of, but not feen, some inclining to a Goldish Colour: But it was my chance in the Year 1668, to find (on the fide of a Stone-Cawfy, between Burport and Aximinfter in Dorsetsbire) one of the largest snake-stones that ever I heard or read of, being above fix Inches Diameter, and of a Free-stone colour, and one might judge that there had been an Head on it but broken off, and as a Rarity I bestowed it on Dr. Warner one of his Majesties Physicians, which was very acceptable to him.

Now as to the *inward Gamahez*, I had some years since a whitish Flint, inclining to a light Blew, which being casually broke in two, upon the inside of the two broken parts, there were

were the perfect Figures of a Tree, with black Lines and dilicate shadows, such as I have seen in Paintings, representing Trees in the midst of Snow, and so seem'd the black Figures on the white stone: I then thought my self well skill'd in that Art, so I could not but give my Verdict on Natures side, beyond any Arboreal Figure that ever I saw done by Art.

GALLON, T. Kandel, L. Brocus, and from T. Kandel, the word Can or Veffel (to drink with) is derived; the proportion of which differs in England, as it doth in Germany, being in some parts four, in others two quarts, which is

a Gallon.

GARDIAN, T. Gaerdigein, L. Gardianus. see Warden.
GUILDERS, a German Coyn (see Money) also such as use to lay Leaf Gold upon Metal, or otherwise, to make it appear like Gold, are called Guilders, T. Guilder, L. Aurare: see Mony.

GLASS, T. Gleizen, L. Vitrum, is by fire produced from all Metals, but that which is of most use for helping to dissolve Metals, is produced from the Dross of Lead or Tin, and so called Speize Glass, and Tin Glass (l. 1. c. 8. and l. 2. c. 23.

There is also that which is called Glass-Gall, Glass-Cup or Hematithe, a Stone of which Glass is made, and used also for

Metals (1.2. c. 3. and 1.3. c. 5.)

GLASS-CUP, T. Glass-Kup and Blutstein, L. Homathites, A. Blood-stone (1.1. c. 34. 59.)

GLASS-GALL (1. 3. 6. 5. 52. See Glass.

GOE, or to goe, the word is commonly used as a motion to the dissolving of Oar or Metal, and signifies much of the same with driving and slowing, being only degrees and terms of Art towards dissolution.

GLIMMER, or Glumering, T. Glantz, L. Splendere, A. shining Oar, which the Latines call Rutilatio not properly so appliable to bright Oar, but Resplendescentia may do well enough. (lib. 1. cap. 2.5. 11. & lib. 2. & lib 3. 7. 4.) See Oars:

and fometimes, it is taken for Tallow, lib. 2. cap. 28.

GOLD, lib.2. &-c. It was writ so by the old Saxons, and Britains, and still so by the Danes, but the T. now Goldst and Belgick Gout, and if we observe what little difference there is between Gott, Gut and Gud, used in these two Languages for God; and Gout and Goldst for Gold: We may well think those Ancients did make this Metal their GOD: and that we may not altogether blame them, we may well bring-in the Spanish and Italians, who call this Metal, ORO, fignifying to pray, as if it were a Metal, to which their Fore-Fathers did pay their Devotions and Prayers: and all of us feem at this day to be guilty of this Metallick Idolatry: but to prevent that Imputation, the Latines call it Aurum, and We Gold, being of a different Dialect, from almost all the present European Languages, except the old saxons, as I said, and

Now, as Quick filver is called Mater, so this is called Pater Metallorum, and therefore there may be some Dispensation for a filial Love to the nobler Part of our Mother Earth, especially if it be without idolatrous and covetous Applications. We have little natural Gold in England from any of our Mines, yet we are not altogether without it, for I am affured from a Cornisb Gentleman, that hath a considerable Interest in the Stanneries of Cornwall, That in digging for Tin, they often find little Grains of Gold, not in the Tin-metal, but in the outward fandy circumjacent parts of their mines: and that the biggest he ever saw, was not above the bigness of a fmall Pea, nor need we much to fearch for it, or labour artificially to make it: for what we have from other parts in Africa, Afra, and America do sufficiently supply us, especially our late Trade with Guinea in Africa, from whence tis brought to us in little Grits or Seeds; yet I was told by an eminent Goldsmith, That he had often bought pieces of above an ounce in Weight, and that was fo good, that though it had not an high Colour, yet the Colour was recompensed by the

GO

the little loss in melting : Whereas the Seeds of other Gold are much adulterated with the filings of Iron, which they draw off by the Loadstone: but when they bring their Artificial Gold, made into Duccates, they are first to use their skill in separating a confiderable quantity of silver from the Gold, which is commonly made by Art, to contract the Gold, whereby it will indure the touch like Gold: but their sciffers foon decide the Controversy, and cheat: so as Art discovers the Artificial Gold from other mixt Metals. Our Author faith, lib, 2. c. 1. That the feed of Gold came out of India by Nilus, wherein he is mistaken (as other former Antients were) in taking Gebon,in India, to be in Afia; of which Mistake, Sir Walter Ramligh hath convincingly shew'd their Error (H.M.l.1. c.6.) Yet very probably Nilus may afford Variety of Gold, in respect it hath its Heads, from the two great Lakes of Zambre and Zailar (and not Zambre alone, as Dr. Heylen would have it in the lower Æthiopia, and passeth the upper Æthiopia, or Habasines Empire) which is full of Gold, and then running above 2000 miles, and so may well bring it into Ægypt, and from thence cast it into the Mediterranean Sea, and by that Sea tost into Asia and Europe: But, as I said, We have a shorter and better way for it to Guinea, in Africa, from the river Nigro, and the Coasts of it, and that we may the better credit a greater Efflux of feeded Gold from thence, than from any other in Africa, 'tis found by late Geographers, that this River doth rake the very Bowels of the Earth for it, for it feems (as they tell us) that it hath its rife from a great Lake, called the Black Lake, within two Degrees or 120 Miles of the Equinoctial (and within four degrees Eastward of the River Nile) and so it runs Northward about 600 Miles) whereof under ground about 60 miles) and then rifeth again and falls into the Lake Borneo, from whence it bends it course directly Westward (differing from the course of Nile, which runs directly North) and so after it hath run above and under ground more than 2000 miles (through many Kingdoms and Countries, rich in Gold) it un-

unlades its Treasure into Guinea, by many lesser streams, where the Natives are always dealing for Gold, and it felf at last in the Atlantick Sea, over against the Islands called He-(berides; so as we never cross the Equinoctial to go thither; which is less trouble than unto the farthest part of the Mediterranean Sea, where Nile vents it self: or to the Mouth of the two Eminent Rivers of Ganges or Indies in the East-part of Afia (andtherefore called the East Indies:) Now where the land of Havilab which Pison encompasseth (mistaken for Ganges) wherein there was Gold, and the Gold was called good; as also where Paradise was, or is, whether beyond our known World, or the Middle Region of the Air, or elevated near the Moon, or as far South as the Line, or as far North as that Line; or whether near Havilah in Africa, or Havilah in Afia; or whether a place called Eden or Paradise was peculiarly created for the Reception of Adam after his Creation; and Christ fesus after his Resurrection; I shall leave to Sir Walter Rawleigh, and others to determine, but we are affured from the facred Story, that there was Gold near that Place, and that then (in the Innocency of times) the Gold was good; which must be known by Assaying, and doubtless that Knowledg was communicated to Adam, yet we hear no more of Gold in that Holy Writ till 2800 after Adam (though it was accounted the Golden Age) and then, (Gen. 24. 22.) Rebeccab was presented with Gold-Earings, and shekles of Gold, to it feems they had the Art of Melting and casting Gold into Assayings and Forms, as may be collected from the feveral Distinctions in the Sacred History, concerning Beaten Gold, pure fined and refined Gold, and crown Gold; And we are affured that in Moses's time, they had the knowledg of all Metals, as may be read in Numb. 31. 21. where Mofes taught the Soldiers how the Spoils of their Heathen Enemies were to be purified, commanding (as from GOD) That all their Gold, Silver, Brass, Copper, Tin and Lead, and every thing that endureth the fire, (in the furnace, according to the Sy-

Syriack) should be purified by fire, and then to be accounted clean : yet, it is also said in that Text, That it shall be purified by the Water of Separation, by which mater certainly is meant Quick filver, because this doth purify, cleanse and devour Metals; and fo Dr. Salmon calls it a Volatile Juyce or Liquor; for nothing but Fire or that Quick filver or Aqua fortis can fe-

perate those Metals.

Now of that Text, the Commentators gives but little account, passing it in general, only as a Water of Purification; where as there were two forts of Water of Purification: viz. that which is mentioned for purifying Metals, and this other for purifying Men and Women, which in Numb. 29. unto verfe 11. is plainly set down, how, in what manner, and with what Ingredients it was composed: viz. that a young Red Heifer, without frot and without blemish, and which was never put into a Toak, was to be brought to the Priest, and one was to flay her before his Face, and the Priest was to take some of her Blood with his finger, and sprinkle it seven times before the Tabernacle of the Congregation; and then the Heifer with her Skin, Flesh, Blood and her dung, was to be burnt in his fight, and whilst it was burning, he was to cast into the midst of its fire, Cedar-Wood, Hysop and Scarlet, and after that, both the Priest and he that burnt the Heifer, washt their Cloaths with Water, and bathed their flesh also in Water, and yet they remained unclean until the Even: (by which time, it may be supposed, that all was dry'd) in the mean time, one that was clean was to gather up the Asbes of the Heifer, and lay them up clean without the Camp, and he also, for this act, was to be accounted unclean until the Even; and these Ashes were kept (as Lees) to put into Water, which was call'd the Water of separation for the Congregation of the Children of Israel, as also for strangers sojourning with them to be sprinkled with, and thereupon also called the Water of Purification for sin, ver. 9. so as we see clearly this Water of Purification of Men, was a distinct Water from the water of Purification and Separation of Metals; and the Ingredients of

here it doth fignify such Metals as one doth grind small. T. Malen and Gerienen, L. Molare, that is, being ground, it is a Foundation to other proceedings.



AND. See Measures.
HEARTHS. See Ovens.
HELLER. See VVeights.

HELM, Helmet. T. Helm, L. Tegumentum, made of Clay or Iron, used in the Metallick Art, for covering of Ovens, &c. as in Sculpture XVII. &c. the Word is also used for an Head Piece in time of War, and for the chief Rudder that guids a Ship, all signifying something of a Defensative or Preservative Nature.

HEMATHITE, which is no other than the Blood-stone, of a dark-red colour, L. Hematites, T. Blutstein. Pliny saith, It is of Kin to a Load-stone, of which there are ten sorts, but that which is called Hematites Fossilis (digg'd out of Iron Mines) is of a Purple Colour, which we do not find in England, and but some few of the other. see Glass-Cup.

HER METICK-SEAL, that is, to joyn the Mouth of a Glass, first heat in the fire, and then nipt together by Pincers; so called from Hermes the first Inventor. Pliny. see Coment.

HORNY. See Horny Oars.

GROUND, this Wordhard many feeles in our English, with HOMI Earth, Foundation or Principle, or Respons that



NCH. See Measures. INCINERATION and Reverberation, are two forts of Methods in Calcining Metals. See Calcine and Ashes. INCORPORATE or Incorporation; that is, when Metals are mixt, they are called Incorporated, or their Bodies joyn. ed together: and from hence Bodies Politick, or a number of Men joyned in a Fraternity, are called Incorporations, because they confift of all forts of Tempers and Metals. 1.2, c. 1. s.2.

INFUNDING, Infusing and Infusion (lib. 1.) that is, a pouring or putting: in but the Infusion of Metals and of Plants

have two ways of proceedures. See Fusions.

INGOT, called by that name in the Tentonick and English, and is a little long Vessel wherein Gold is cast, which Vesfel is called an Ingot, and the piece of Gold taken out of it hath the same Name. 1. 2. c. 47. and Sculp. XXVIII. Fig. 5.

INSPERG is oft used in Erkern, from Inspergo, when one Metal hath certain parcels or sprinklings of other Metals, whereby their goodness is seen before proving. 1. 4. c. 1.

INSPISSATION, is the method of Fixation of Metals. INSTRICK, is a Term of Art, used to signify the first work in separation of Metals, 1.3. c. 22.

IRON and Steel: see Metal: T. Eysen, Iron-man, L.

Ferrum and Chalybs: 1. 2. c. 20. S. Su Oars,
JUG, T. Krug, Heb. Chug, A. Jug or Pot: so it seems we do retain the Word, which is of little difference from the KE-Hebrem.



ETTLE, T. Kessel, L. Cacubus. See Utenfils. KELL or Kiln, or Kill for metallick Matters, T. Kalck-Ofen, L. Fornax and Calcaria, A. Kill, they are allfo used by that name, for drying Malt, &c. see Furnaces and Ovens.

KEINSTOCKS, I retain the word as very proper, and is fully explained. 1.3. c. 22. See Thornels.

ADDER. See Utenfils. LEACH (1.3. c. 26.) this word I retain fignifying bard work (often mentioned by Erkern) and the Etimology may be, because such bard Work, do occasion Le Ach, on the Ach in the Joynts of the Operators.

LAMINS. T. Bleck. L. Lamina, A. the Plates of Metals. 1. 4. c. 4.

LAPIS LAZULI, I. 1. of which Blew Vitriol is made.

LA WORDS Metallick. LE

LAPIS CALAMINARIS, L. Cadmia: see Cadmia, Calaminaris and Stones.

LAPIS TUTIJ, a Compound made of Calaminaris, good

for fore Eyes. See Calaminaris and Stones.

LATTEN, T. Latton, Auri Chalcum and Orichalcum, also Coronarius, and is a Compound of Copper and Lapis Calaminaris, and so cast into Forms and not wrought with Hammers, in respect of its friableness or brittleness, that which is also made of thin Plates of Iron and so Tin'd over, is vulgarly

called Latton. See Plates, Iron, Tin.

LEAD, T. Bley, L. Plumbus; it is called also (Howel) Aurum Philosophorum, because it doth as it were govern Gold and other Metals in their Precipitations, and from thence wee use this word to lead or conduct, because this Metal doth as it were, lead and conduct us to the knowledge of all other Metals (1.4.) and several other parts: see Metals; and certainly no Metal hath more excellent effects in Chyrurgery, than the Artificial Leads made of it, under the names of white and red Lead, and therefore it is put under the highest Planet Saturn, flow in motion and fure in operation, and of this virtual metal we have as good and as great quantities in England and Wales proportionably, as in any parts of Europe; besides the great quantity of Silver contained in it: But before I close this Discourse (because it was omitted in the word (eruse) I must inform you, that for this common Lead (which is a natural Metal, and plentiful in all our Mine-Countries) there are Mills erected (fuch as the Society for the Mines Royal have in Wales) where they make white Lead (which is only a product of that Metal, Lead, corrupted with Vinegar or Urine, and afterwards being ground in the Mills, and formed into a white colour, is called white Lead, and after that Refined, and then hath the name of Ceruse, which yields the best and most perfect white, and at these Mills there is made also red Lead, of the common Metal Lead, and is brought to that colour, only by the Art of using Fire to it; and both being thus made, as S well

well the red as the white, are of excellent use, not only for Painters, &c. but to all Chirurgeons (as I have said:) There is also a mineral Lead, which we call Black Lead, something like Antimony, but not so shining or sollid, of which fort I know but of one Mine in England, and this yields plenty, both for our selves and other Nations, and this Mine is in Cumberland, which they open but once in seven years (I suppose the reason is, least they should dig more then they can vend) this also is used by Painters and Chyrurgeons, &c. with good success, especially being mixt with the products of Metals: and of late, it is curiously formed into cases of Deal or Cedar, and so sold as dry Pencils, something more useful than Pen and Ink.

There is also a white Mineral in England, called white Chalk, tending to a transparency, but of a Leadish quality, and therefore I place it here, rather than under Earths or Stones.

LEAD-GLASS. See Fluis of the hath more exc. shuft as C. RATHER. See Utentile of it, aslineate the Artificial Leads made of it, aslineate the

LIMBECK, T. Alimbick, L. Alimbicus, quia extrabendo materiam lambit (Minsham) and also called sublimatorium, quia materiam evebat in sublime, and he saith, it is an Arabian word; but in short, it is a kind of an Oven or Furnace made of Metals, vulgarly called a Still, and used more for distilling Waters than Metals, and is sometimes mentioned by Erckern, but chiefly as an Helmet to the Athanor or great Furnace (1. 2. c. 32. f. 7.) Now of these Stills, I deny not but those which we commonly use, are very fit for their purposes; but I have contrived one (whereof I have made often Tryals) which perform the like, with much less fire, and less trouble, because the fire need not to be tended but once in 10 or 12 hours, and the Waters (of feveral forts) which I have Diffilled in it, are every way as effectual, but the manner and may of Distilling therein, doth every day improve in my Experiments, and when it is fitted to effect all the intents and purpoles of the common Stills (with some additions, which they cannot perform) I shall divulge

vulge the Invention, without Patent, or any expected Remard, but thanks see quick-filver to lo comit lie ni bereviole ad or more

LIMETS. See Files. as dres of Down of west to lasigned to I LIME-CALX, I have writ formething of this, under the word Calcine; but now I shall speak of Lime, or the Calc of Lime-stone or Chalk-stone, which Cake is used both in Cement. ings, Lutings, and in melting of Metals, with other Ingredients, but the great use of this Lime, is to make Mortar for Buildings, and therefore I shall refer it to the word Mortar; only observe this, That when Lime-stone or Chalk, whilst it is immediately from the Pit or Quarry (because it is properly a Stone, though of a fost nature) is called unflack't or unburne Lime, but when it is burnt, called flack t, and so all Metals unburnt or burnt may be also called, unflack't or flack't and the pieces flackes, which word is often uled. LOAD-STONE or Magnet (lib. a.

LINNEN. of see Utenfile that is that selfenst use of the Linner.

LIQUATION, L. Liquatio, from Aqua & liquidus: A. liquor or moisture: and liquation is a term in this Art of Chimiftry for one of the Methods in dissolving Metals, and the word liquifaction of the like sense, and from the same Radix is also applyed to Metals when they are melted by the

heat of fire, or Sun: see Conglutination. M. HEM acres a lles verla

LITTARGE, T. Blegg Leidt or Glet, L. Lithargious, or the stone of Gold or silver, from the Greek Lethos; and sometimes called the spume or froth of Gold and Silver, but generally the Excrements, Scoria's or Drofs of Gold or Silver caused by Lead, and if it be Gold-Litarge, it looks of a Tellow Colour and tho it be drofs; yet the Metallits give it this diflind name, because it hath more excellent Virtues than any other Excrement, Recrement or other Drofs, and that it may be cleared from other words of almost the same found; sol think it fit to distinguish them here : This word is written Littarge, and by some Litbargy, and that which signifies the publick Office of Devotions, LITTURGY; and the fleepy Difeale, LETHARGY (with an E:) and bwith that the plenty of

our Littarge or Lithargy may raise up our Litturgical Devotions to be delivered in all times of our Wealth, and from the Lethargical or sleepy hours of Death, as well by our Devotions as by the excellent spirits, &c. made of our Littarge peculiar to that Apoplectick Distemper. (See those words.)

LIXIVIUM, See Menstruum, Lee or Lees.

LYE, called also Ligh or Lees, to distinguish from a lye, or to lye, or to speak untruth, or to lye or lay down to rest.) T. Langen, L Lixivium, from Lix signifying Ashes, or as Minshaw calls it, Humor Cineri mistus, of which see more in Buck and Menstruum. And here I may observe that as in Latine, Lix signifies Ashes so lixa is Water; and those two mixt, makes the lees, with which women wash and buck their cloths for so

lixa also signifies.

LOAD-STONE or Magnet (lib.4 cap.21 and 22.s. 4.)

T. Magnet steine; but when it hath relation to Navigation, its call'd Segel-steine, or sail-stone; but the Latines Magnes and Magnifficus: and A. from the Saxon, Load or Leading stone, or lapis cujus ductu Nauta instituant cursum; and Erckern for this and many other qualities calls it a Jewel, and its pretty to see how the Latines quibble about this word Magnes, for they call a great Man Magnas (on the account of Honour;) and Magnus great, on the account of bulk, &c. and this stone Magnes, being of so great Virtue, that it is scarce comprehensible, and its probable, that the other two words do borrow their titles from it.

Pliny tells us, (lib. 7.) That this word Magnes was given from Magnes the Name of a Shepherd who was the first finder of it, and makes five kinds of it (lib. 36. cap. 16.) Cardanus but three kinds, who observes, That Aristotle was altogether ignorant of the maratine use of it, and that Galen and Al. Aphrodosius (two great Inquirers into the secrets of Nature) have not so much as once mentioned the wonderful Nature of this Stone: but now Authors do abound in their discourses upon it, and make all things easy and plain in their Naratives of its Vir-

tues and Operations: only when their Discourses are applyed to its Variation by the Needle (touch'd with it for the use of Navigation) there they disagree very much in their Opinions; and amongst the rest, Boetius tells us, (cap. de Magnete) that there are two magnetick Mountains; and that those magnets which are digg'd nearest to the Artick Pole, have most of the Artick Virtue; and such as are digg'd nearest to the Antartick, have most of the Virtue of the Antartick; which is the cause of their Variations, and many other pretty and plausible notions are writ of them, but I shall only men-

tion some of my own Observations.

1. That this Stone is found in most Iron-mines in England, but are not so effectual in their attractive power as those which we have from foreign Parts, and therefore ours need to be nourished with filings of Iron) for stones have a vegitable life to be preserv'd) and to be kept from the Juyce of Onyons and Garlick, and moist places, which do unglutinate, and so destroyes or subdues their Virtues: and therefore those Lapidists whose Art it is to fit Loadstones for Navigation (or other uses) will not suffer those Plants to be near them: and I have often try'd, That when I have touched my knife with a Loadstone, and thereby impowred it to take up Needles or small Weights (and so it holds its Virtue many dayes) but the Knife once touch'd with an Onion doth utterly loofe the Virtue which it borrowed; I confess I never tryed Onions or other acid things to the Poles of my Loadstone, because I chose rather to believe than hurt the Stone: especially a Lapidist of my Acquaintance affirming the Truth of it, who was so great an Artist that he told me, That with a Magnet of the bigness of my head, he could drive the Soul of it, into as little a compass thereof as a Nutmeg, but before I could see the effects of his Art, I was diverted with other Occasions, and could never find him after. Yet it was my good fortune to be acquainted with a worthy Gentleman Francis swith Esq; (of Finch Rusboke in Worcester-sbire, since deceased) who was Master of

[T] much

much found learning and very ingenuous in his Discourses, when he thought fit to expatiate himself; or otherwise reserv'd: and we happened upon the Discourse which I had with the Lapidist upon which he produced a Loadstone, fixt with its irons for the North and South points , which I had the freedom to weigh in my Gold-Scales, and the Iron pieces and points and Gold (for Ornament which embraced it) weighed just eleven grains, and it attracted a piece of Iron of an ounce Now, there being according to the Venetian account weight. 6912 Grains to a pound, every ounce is 576 grains, which is 52 times 11 grains fo that it took up an Iron of above 52 grains more than its own weight (confidering its embracers) and by my description of the Lapidist, he believed, it was bought of the same person and looking upon it as avery great Rarity, I took upon me the Confidence to tell him, That it was pity fo great a Jewel should lye concealed, and added, that I believ'd it would be a very acceptable Present to his Majesty: He approved of my Propolal, and accordingly did present it, and it was so accepted, and got a good Office soon after, I cannot fay for that, (though it deferved it) but for his own Deferts, and I hope it is still preserv'd amongst his Majesties Raritics.

Another piece of Curiosity I saw in the Hands of Sir William Persal (since Deceased also) viz. a Terrella or Load-stone, of little more than 6 Inches Diameter, turned into a Globular Form, and all the Imaginary Lines of our Terrestrial Globe, exactly drawn upon it: viz. the Artick and Antartick Circles, the two Tropicks, the two Colures, the Zodiack and Meridian; and these Lines, and the several Countryes, artisticially Painted on it, and all of them with their true Distances, from the two Polar Points, and to find the truth of those Points, he took two little pieces of a Needle, each of about half an Inch in length, and those helaid on the Meridian line, and then with Brass Compasses, moved one of them towards the Artick, which as it was moved, still raised it self at one end higher and

higher, keeping the other end fixt to the Terrella; and when it had compleated it Journy to the very Artick Points, it stood upright upon that Point; then he moved the other piece of Needle to the Antartick Point, which had its Elevations like the other, and when it came to the Point, it fixt it self upon that Point, and stood upright, and then taking the Terrella in my Hand, I could perfectly fee that the two pieces of Needles stood to exactly one against the other, as if it had been one intire long Needle put through the Terrella, which made me give credit to those who held, That there is an Astral Influence that darts it felf through the Globe of Earth from North to South (and is as the Axel-Tree to the Wheel, and fo called the Axis of the World) about which the Globe of the Earth is turned, by an Afral Power, so as what I thought imaginary, by this Demonstration, I found real; and am convinc't by this, and other Experiments, That not only the whole Earth is guided by this Astral Influence, (fixt in the Septentrional and Astral Points) but every particular within the circumference of the Terrestrial Globe, hath a Magnetick tendency to the Septentrional Points, naturally fixt in them, as may be Experienc'd in Plants, Stones and Metals (of which one might write a large Volumn) and it is commonly known, that in Clay, which have not been formerly dig'd (as I mentioned of that under my House (in Title (lay) being dig'd in pieces of 6 Inches, more or less in length, make them into Rolls, pointed at each end, and hang them with a thread in Equilibrio, and they will turn themselves to the North, to shew that there is an obedience in all Vegetables, to the Septentrial Astral conduct, and so it may be evident on every other Vegetable; and though the teffer forts of them can scarcely be experimented, in respect of their minuteness, yet in Plants of greater bulks, we may see the predominancy of the North Point in their vegetation, which is the reafon, why Plants that are removed do not grow, or but very flowly, till they have recovered their first position to the North, by a fecond compliance to the Northern Magnetick Attra-Etion.

And it is not only thus in Vegetables, but in sensitives and Rationals, which I might inlarge: yet before I leave this Discourse, I cannot but say something of the Constellation that attends this Artick Point, which is called Cynosura, pretended in the stories of Constellations (see Dr. Hood) to be the Daugh. ter of Califto, and so had the name of Ursa minor (a Female) yet hath the tail of a Dog, and the end of that tail is called the Pole-Star, and this polar Point is called also septentrio, from the feven stars which hover about it, and those seven stars called Septentriones: Now the Scithians held the polar Point to be an Iron Nail (which is our Axis) and this they adored as a God, and before the Load stone was known for Navigation, the 2 stars on the shoulder of this Bear or urfa minor, were Directions to the Spaniards instead of a Compas, Card or Needle: the like is faid of the Constellation (called Helyce, Sifter to Cinofura) which is in the Southern Point, fixt in ursa major; and the seven chief of this Constellation are called Charles's Wayne, and are in the hinder part and tail of this great Bear; but I have faid enough of this, especially concerning the Scitbians belief, that it was Iron (probably not then knowing the Name of the Load-stone, and therefore called it Iron instead of Load-stone:) but to pass these Metallick Parts of the Terrestrial Globe, and celestial Influences attending them. I cannot but recommend the Experience I have had (in lying in my bed with my Feet to the North and Head to the South) in my rest, fleep and dreams, from other Positions, which I leave to the Consideration of others; and return to the Magnetism of Metals; wherein all Chimists agree, That Gold is the Magnet of Quick silver, Iron of Copper, Copper of Silver, and Tin of Lead; and these Magnetisms are still guided by astral Influences, not only of the Seven Peculiar Planets, to the Seven Metals, but to the Septentrional Axis or North Point, which directs the Influences of the Seven Stars upon the Seven Metals. And now I shall conclude, and refer you to that admirable Experiment which our Author mentions of this Jewel, l. 4. c. 20. (colleated

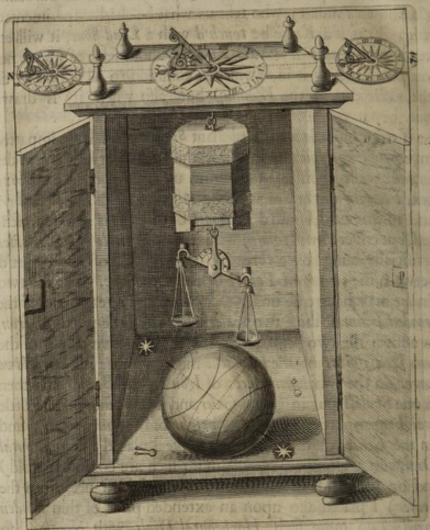
cted from Serapion (an old Philosopher) as also to Cardanus, (a known Author) who tells us what he had experimented, viz. That if a Knife be touch'd with a Load-stone, it will enter into any part of Man's Body without sense of Pain, not only in thrusting it in, (which is common to all Weapons till the Air entreth the Wound) but also when it is drawn

Yet I cannot leave this pleasant Subject, till I have imparted my own Experiments, in making this lewel (for fo Erckern defervedly calls it) useful to inform us, as well of the Ebbing and Flowing of the Sea, as of the Alterations of the Weather, and to that End, I fram'd a Model or Case (as is here represented, but covered with glass) with a pair of little mooden scales artificially hung by a thread to a thin piece of Wood, plac'd between the two iron Points of the Loadstone, so as the two Scales may hang true under each point, and at each end of the mooden Beam of those two Scales, I fixt two little pieces of Iron, to answer the two points, whereby the attractive power of the two Iron Points of the Loadstone might operate its attractive power on the two lower pieces of Iron on the Beam, and then in one Scale I put in Quick-filver, and in the other certain little weights proportionable to the weight of the Quick filver; and on the Center of the top of the frame I placed an Horizontal Dial, with a Compass-Needle in it (fuch are commonly fold) and on each fide of the frame (at equal Distances from the Center) I placed also upon an extended piece of thin wooden board, two more such Horizontal Dials with Needles, so as the Gnomon's of all three, might answer each other in a diametrical Line. But having been hindred in perfecting my real Apprehension, of obtaining thereby many pleasing and useful Experiments, I must refer the further account of them, till but in a mixture of Metals, its called Balan a semit reations of light Earths, Gleba: and we also call a fife (which is come

tuon in our Markets) a Lump, in respect or its form close,

and compadied without a regular thape, and the word may

Sculpture XLII.



LOAM, see Clay.
LOTH, see Money.

LUMP, l. 1. c. 4. Teut. Klumpen. L. Massa, or a piece of any thing composed of hard, and moist, mixt, as Clay; &c. but in a mixture of Metals, 'tis called Bolss, and in mixture of light Earths, Gleba: and we also call a sish (which is common in our Markets) a Lump, in respect of its form, close, and compacted without a regular shape, and the word may well

MA WORDS Metallick MA

well come from Lumbus or Lumbrieus, by changing b into p, which two Letters differs not in their labial utterance, but by the addition of some other Consonant or Vowel: also Lumbus is properly a Store-bouse (for refuse Metals or lumps of Me-

tals) and for other Wares.

LUTE, Luting, The Tent. calls it Laum, the L. Lutum, and they have a word called Testudo, which signifies not only the outward Case, or belly of a musical Instrument called a Lute, but also Clay, and as Lute for Clay, and as Lute for a musical Instrument, are synonimus, so they are in their operations, for as the Belly of a Lute serves for reverberations of Sounds which makes them musical, so these Lutes or lutings serves in a Chimical Notion to reverberate or repercuss the spirits of Metals, to make them barmonious and useful to Chimists, and confequently to others who partake of their Art: and therefore the (himists have a Past or (lay compounded with many Ingredients, whereof the chief is that which they use about the necks of their Retorts, &c. which they call Lutum Sapientia, shewing the Wisdom of the All-Disposer, that, that Earth which preserv'd the Metal whilst quiet and undisturb'd in its Bed or Mine; is now made use of also, to keep its spirits from being useles.



AN, See Vir.

MARCASITE, T. Marcasit, L. Pyrites, and we Marcasite, Erchern saith, le is rich in Gold, Dr. Salmon,

mon calls it Bismuth, but I find it to be no where else, and makes it to be one of the Recrements of Silver; he agrees with other Lapidists, that there is both a Goldish and a Silverish Marcafite, the one yielding Silver the other Gold, however, they are excellent Fire-stones which we find in our Mines in England, but not so good for Fire-locks, as those which are brought from Germany, &c. And our Marcasites do neither afford Gold nor Silver worth the charge. Diascorides faith, That Brass may be made with composition of this stone, but that will not quit cost, because the Marcasite is not so soft as Calaminaris, but it may be tryed whither by mixing it with Calaminaris it will not give a nobler Tinge to Brass, and because it is not generally comprehended in Metals, but of an

Epicene or doubtful Gender, I shall refer it to Stones.

MARBLE, T. Marmel steine. L. Marmor, and A. Marble, which is but a little Variation from the general Name of Marmor, in Greek Marmoras, and we have leveral forts of them, which confift of various colours and uses, and of these we have in Devenshire, and other Counties in England, good white and black, brown, blewish, green, serpentine, yellow and grey, faintly intermixt, and though, ours confifts of various colours and degrees of hardness, yet they are short of those which are brought us from beyond Sea, or at least we think so; and as for the *Porphory* or red *Marble*, we have none of it that ever I faw: And the Alabafter which is a kind of foft white Marble, we have but little good of it, but of the Lapis Lidius or Touchstone, which indeed is a kind of black Marble, by which (being polish'd) Goldsmiths try their Gold without Touch-needles) and of these we have plenty, especially in Darby sbire. (See Touchstone.) but the Occasion of Erckerns mentioning Marble, is because the stone is the hardest of any common stone, and so used by Painters to grind their Colours on, and for reducing Metals into Duft by Metallists. See Lime, Morter and Stone.

MARK, T. Merch, L. Marca, fignifying eight oun-

ces; the Word in English is applyed eight several wayes: See

Dictionarys.

MARK CUTTING, that is, cutting of pieces of Metal which are mark'd out to be divided, so the Art is in dividing of the pieces to be cut, whereby they may bear a just proportion of weight one with another, and this is performed only with a cold Chizel (Dr. Revell.)

MARLE, T. Marghel, L. Marga. See Earth.

MATRAS, We retain the same Name. see Utenfils. MEASURE, T. Masz, L. Mensura which are considered either of Longitude, Latitude, Altitude or Profundity: and these are sometimes used distinctly, or joyntly, and so reduced to Measures of Application, T. Zupburgung, and to Measures of Capacity, T. Emphaning, the first of the four (called Longitude, L. Longitudo) is termed also in T. Masa, A. Length, but the Latine hath variety of Words adequated to the extention of things to be measured, as the Measuring of Lands, Geodefia, &c. 2. Latitude, T. Breit, A. Bredth, broad, and large, L. Largus, and Latitudo : 3. Altitude, L. Altitudo, T. Die babe. A. Hight. 4. Profundity, T. Lage, L. Log, and Profunditas, A. Depth, deep, and many other names, according to the proportion of natural or artificial Contentures, as Cyathus and Coclearium, &c. about which Diaionaries may be consulted, for I speak only of such as are mentioned by Erckern for metallick uses, of which some are uncertain measures, (viz. a Fingers length and bredth, an bands thickness, and breath, a span, a mans foot, a cubit, &c. and fome certain, viz. a yard, an ell, a fathom, &c. and of the mensura Capacitatis, some are also uncertain, as Crucibles, Tests, Cruises, Jugs, Pots, &c. and some certain, as Pints, Quarts, Galons, &c. of which in order; And first of the Finger, T. also Finger, L. Digitus, which signifies the length and bredth, but we may read in Georgius Agricola (de mensuris & ponderibus, and other Books) that they confift of feveral Proportions; and in Gallen (de usu partium) of several uses: and of this

this word Digitus, Holiock makes no less than 24 Observations: but that which concerns this Subject, I have in part collect. ed from Cor. . Agrippa, that the Thumb, or first finger (Teut. Dann, L. Pollex) was dedicated to Venus and the Moon; and in Metallicks, lucky to Silver and Copper; the fourth Finger to Mars, and lucky to Iron and Copper, red (and yellow, artificial, that is Brass:) the third called digitus infamis (I know not on what grounds) to Saturn and Jupiter: and lucky to Lead, Tin, Silver and Gold: The second finger to the Sun and Saturn, lucky only to Gold: the first or little Finger to Mer. cury, and lucky to Quick filver, Tin and Silver; and these Notions are the chief Foundations of the Art of Chyromancy or Palmistry, so that by the Fingers and lines in the bands, the temper of men might be the better known for Metallick and (bimical Purposes (but the Poet who eyer he was that made this Verle)

Miles, mercator, stultus, bene nuptus, amator ;

applicable to the 5 fingers, had I conceive another prospect, to shew that their Fate was at their Fingers ends, and by the Influences of the ftars did direct them to their most genuine Imployments, whereby the Chiromancer might know to what one was by Nature adapted; and accordingly, by that Artift, was directed to apply himself: but to pass these Curiosities, it is writ by several Authors, that the length and bredth of the fingers, and to of the hand, gave the first Rules to the smaller Measures, the next is the Span, T. Span. L. Spithama, which confifts of three parts, viz. the Thumbs, (having three joynts) made one; the space between the Thumb and finger, making the other, and one of the fingers (having also three loynts) making the third, so in all seven; and though these feven do differ in proportion (the spaces and joynts being unequal) yet from the top of the Thumb to the top of either finger fully extended, was the span, confisting of seven proportions: and 'tis observable, That David calls mans Life a span, which

which afterwards he explains, by faying the Years of Man are seventy, that is, seven decimals, or seven timesten, which is seven spans, so as the short span is from the Thumb to the end of the fourth or little singer, but if he had a long Life or Span viz. from the Thumb's end to the end of the middle Finger, it occasioned but pain in the extending it (from police the Thumb to stultitia the Fools Finger) which is the Vanity he speaks of, and as the spaces differ in proportion, so doth our several Ages.

The next is a Foot, T. Fusz, L. Pes, and though this natural Foot is an uncertain Measure, yet it retains its name, by a certain new Measure, called a Foot-Rule; and as to the first, I may say, that that Foot hath some Anology with David's Span; for by the Span the length of our Race is adjusted, and by the

Foot that Race is to be run.

My next confideration is of a Cubit, which is accounted from the Elbow to the end of the middle Finger. T. Cubit. L. Cubitus, and the same word Cubitus also signifies a Couch or Bed, telling us, That before our Race is run, we grow weary, lay down on our Cubit (or Couch) to ease our Limbs, where we lean on our brachial Cubit or Elbow, and commit our Heads to be supported by our Span, or handle of our Cubit, and then we consider of our abillity or disability, in getting to the End of our measure of application, and the Divine Prize of our Race proposed to us.

Next for the mensura capacitatis, it consisted only of the contraction of the palm of the Hand, which was originally thought sufficient to hold so much as might quench the Thirst of Na-

ture.

But when by excess we for fook the proportion of our first Constitutions, Frames and Pugils, some having Fingers, Hands and spans, more than treble to the common length, and also their Feet a Cubit long (as Pliny tells us) and of the Sciopides (which Munster speaks of) that one Foot sheltred their whole Body against the Sun, whereby in process of time, almost all Men

are

Men and Women became disproportionate to that perfect proportion (which I have mentioned in my Volatiles on Adam, from Paulus Lovatius) it was time to make some certain Measure both of Application and Capacity, least the large gripple Hand, should take away all from the leffer, and justify it from its large Dimensions, and therefore much to the Honour of the Botanists and Galenists; the Standard of meafures was made from the Barley-Corn, which is so Noble a Plant, that it is observed (whether it grows upon a fertile or steril Soyl, yet) it continues one constant proportion of Measure (though it may differ in weight) and of thele, three in length or fix in breadth do make an Inch, which the T.calls ein dannim breit, or the bredth of the Thumb, but in Latine the word is Uncia, which they apply both to an Inch of Application and to the Ounce of Ponderofity, still making the Grains of Barly or Wheat their Judges, both in measure and meights: now this Uncia or Inch of Application (as Arrius Montanus faith) consists of the breadth of fix Barly Corns, thereby making bredth to have a Priority to length) but the later Writers, more properly make three Barly Corns in length, to be the length of an Inch, and twelve Inches of a Foot, and for Measure of Ponderofity, those who are for the Troy Weight, make twenty four full Grains of Wheat, and twenty penny Weights to be an Ounce, and twelve Ounces a Pound, which complyes with the measure of Aplication (or 12 Inches to the Foot) and this weight is used for Gold and Silver, &c. but others who are for Aver-de-poile weight allow 20 grains of Wheat to make a scruple, three scruples a dram, and 16 drams to an ounce, and 16 ounces to a pound: and these of Ponderosities do also comply with the measure of Capacity; for I compute that a Pound of Troy, viz. 5760 grains of Wheat will fill a certain Vessel which the Latines call Hemina, and the English (and in most Europian Languages a Pint (or Pinte) two of which makes a Quart, and four a Pottle, and eight a Gallon, so as the Pound of ponderosity and the Pint of Capacity

are both equal, and this agrees also with the Measure of Application, for a foot square (on a cubical account, makes 144 Inches, so that for every one of the 144 Inches, 40 grains of Barley being allowed (as the just proportions of Capacity)

it amounts also to 5760.

Now as (I have shewn) that the Latines do apply the same word Uncia, both to an Inch of Measure, and to an Ounce of Weight (and, it may be, for the Reason which I have given) so they apply the word Ulna to a Yard, Ell and Fathom in Meafures (and so by Dictionaries jumbled together) whereby the genuine proportions of those Measures are confounded; whereas a Tard, in T. Girte, and L. Verda, is applicable to any Rod or Stick, that is not appropriated to any certain rule of Dimension; but as Ulna or Tard is fixt to a certainty, it fignifies the length of 3 Feet, or 36 Inches; and an Ell, T. Ellen, and A. Ell, from Elbow (or Ell-bone, because from that bone to the top of the middle Finger, is accounted a Cubit or a Foot and half) so 2 of those Cubits makes a Tard, and 3 Foot and 9 Inches makes our Ell, and a Fathom, which is a Measure used about finking our Mines (called also Ulna) is two Yards: I might mention many more Measures of Application, used both above and under Ground, for the guiding and working of Mines, as also of other Measures of Capacity, as Furnaces, Ovens, Pots, Pans, &c. used for Metals: but I must not run too far upon this copious Subject; yet because the Ells length, and other Measures (which I have named) are often mentioned by Erckern, and knowing that one Ell English is two German Ells, and the like of many other Measures; I intend this at first, only as a Cantion to Assayers, &c. in making Furnaces or Instruments, according to the German or English proportions; which must be left to their Ingenuity to judge, what lengths or bredths are best suiting to their Operations.

MEDALLS. T. Schraw grochen, L. Sigillum fusile, that is, a piece of cast Gold or Silver, wherein some observable thing is represented, and is given by Princes, as Memori-

als of Virtue, or notable Accidents, and are accounted rather gratifying Presents than current Coyns, and the word signifies also Counters, or something imprest on them, worthy of our account.

MELTER. T. Schmeltzer. L. Fusor, and by our English, Mine-Workers, (as at Consumlock and Tallibant, &c. in Wales) where they still retain the words Smelter and Smelting, which was brought into us 1. Q. Eliz. by one Hosetter a German; but in sining the Metals (after they are smelted) for distinction, the work is called melting and remelting, or sining and refining.

see Alchimist, Metalls, Utenfils.

MENSTRUUM, which we Translate Flowers, and define them to be Purgatio frigidi & indigesti humoris quem natura quasi noxium ejicit; now the word Menstruum as it relates to the Female Sex, (of which you may read in Pliny, I. 7. c. 15. is pernitious: but our Menstruum relates only to Metalls (which are all seven of the Neuter Gender) and the menstrual parts of them, do afford many great vertues and excellent medicines, and is the most sublime part of the Scoria's of metalls, and therefore also called Flowers, from its nature of slowing and shewing it self on the top or corners of the Vessells, where it usually resides.

MERCURY. See Metalls, Mineralls and Quickfilver.

METALS, T. Metal and Ertz and the Metal-Worker Berck-bawer and Berck-werk from Berg, mons: (wherein they are generally found) and Werk, Opus: and the Latin Metallum and Metallarius, A. Miner; the kinds of Metals are accounted seven viz. Gold, Silver, Copper, Iron, Lead, Tin and Quick silver, which I treat of in their Alphabetical Discourses: But as a Deputy Governour for the Mines Royal in England and Wales, I must aquaint you,

That, I as for Gold, (we have it not in sands as in Africa or America) or so intermixt with other Minerals, that it will requite the charge of Separation, and yet upon information of two Mines (one at Pullox-bill in Bedfordsbire, and another in little

little Tarmton in Glocestershire) which, as was pretended, contained a great quantity of Gold in the Oar, we granted two distinct Leases; but they proved not at all successful: 'tis true, that among the Tin-Mines in Cornwall, they find little pieces of Gold, and seldom above the worth of 10 s. But this, as they

dig for Metal, not in the Metal.

2. As for Silver, we have none, but intermixt with other Metals, especially in Lead; And in the time of the late Wars, Mr. Bushel set up Mills at the Mines in Cardiganshire, and made out of those Lead-Mines 20l. of Silver out of every Tun of Lead: and at Shrewsbury, a Mint by his Majesties Permission was set up, and then coined so much as paid that part of his Army, but it doth not now answer the Expence, or at lest the knowledge of it is kept from us: and I am consident we have several Lead-Mines in England which would yield in every Tun, from 20l. to 80l. of clear Silver, and why this is not put in practise, I shall hereafter disclose.

3. Of Copper we have very good and plentiful; See the word Copper; and why those also are not wrought, I shall say

more hereafter.

4. Iron is not in our Patent, only Iron-Wire, for the making of which, we have Mills at Tinturn in Monmouthshire; See

more in Word Wire.

5. Of Lead We have the Government both in England, Wales and part of Ireland (except the Lead-mines at Dovegang, in Darby-shire, and at Mendyp in Somerset-shire; and also all other Mines that do not hold Gold or Silver, because in those two places, and some others, the Lead is look'd upon to be so poor that no Silver can be extracted from them, or at least, not proportionable to the charge of sining, &c. of which you may see more in my Book called Fodina Regalis.

6. Of Tin, we have also the Power of Inspecting them in all Mines, (except cornwall, where they are managed by a peculiar Court, called the Stanneries from Stannum, the L. for Tin, of which you my see more fully in Cambdens Britania, p. 185.)

and for other Tin-Mines none do venture on them because of

the great Product of Cornish-Mines.

7. Of Quick filver we have very little or none in our Mines, so as we are fored to have it from beyond Seas, for which reason, whatever others account of this, as the seventh Metal, we cannot, because it is not our Native Metal, and therefore we may rather chuse Antimony, of which we have plenty; or Brass, of which we may make sufficient for our selves and Neighbours.

And there is another Metal which Pliny makes the seventh Metal, by the name of Electrum, containing upon dissolution the fourth part of Gold, and a fifth of Silver; but we have none such, yet such a thing is mentioned in Holy Writ: see

Fodine Regales.

And as for Gems, we often find in our English Mines, Saphirs, Amethists, &c. but very imperfect, for want of a stronger heat, as in hotter Countries, and about Bristol in the Callamine Hills, there are plenty of such Stones which imitate Diamonds, where I had the luck to find one of a good value, which

I caused to be cut and set, and yielded a fine splendor.

MINERALLS.T.& A. L. Mineralia; these are Metals of a middle nature, between the 7 Metals and Stones; of which sort, Erckern mentions these; Allum, Antimony or stibium, Armoniack, Arsnick, Brimstone, sulpibur, Calaminaris, Cinabar, Talk, Vitriol, Nitre, Orpiment, sandover, &c. which I treat of also distinctly, in their Alphabetical Discourses; but of all these we have so great plenty in England and Wales, that we need not have recourse to Foreign parts for them, only in those Countries where the Metals are not, I do not find any of these, or scarce any other Mineral, for it seems they are of a friendly nature not to part.

Mines, Ertz-Grub, from Ertz-metallum and Grub fodere: (which Word Grub we still retain in England in the same sense) L. minera, which relates to places in the Earth, where Mettals or Minerals are found, and I conceive the word Mine

is no other than a translation of Meus, which the Belgicks write Miine, and the T. Mein, and A. Mine, so as doubtless they have all this sence; that, that Metal or Mineral, which I find in the Earth is Mine (Propriofure Salvo Rege) and this is still a custom at Mendip, and at the Dovegang before mentioned) however altred in other places; but here it only fignifies the place or Bed, where the Metalor Mineral is lodged (without relation to the Proprietor) and they who dig for them are called Miners, it may be from Minores, being a People of lesser Quality than those above ground, so that in the Romans time, they were Slaves, or fuch as for Offences, were (instead of other Punishments condemned to the Mines (Good-

win's Ant.) See Alchimift.

Whilst I was writing this, a Friend of mine came to me, and seeing me intent about this Book, ask't me why I left some other Subjects about Parliaments, &c. of which I Published but some parts, and others were expected? I told him, that I had not the opportunity of seeing Records, as I formerly had, and so did betake my self to this of Metalls, being far more pleasant, in respect it consisted of greater varieties than any one of the Liberal Sciences or Arts, and withal added, That there is a certain Chain in all our Affairs, by which we are invisibly guided, of which the Story of Joseph (fold for a Slave, yet proved a reliever of those who inslaved him) is fignificant, and though that Story doth not quadrate in all Mens Actions, to have the like success; yet in this, to me it doth; for even those Notions which I had of this Subject, which began with some dangerous Attempts (as I shall shew) have continued in my mind by accidental Occasions and Imployments, till this very time, that by them I now find my felf full of content and happiness, in the Divine and Humane Contemplations of them and their circumstances; and now, Sir, faid I, give me leave to begin with the first link of this Influential Chain, which is held at both ends, by the Hand of Divine Providence.

Whilst I was a small Student of Pembrook Hall in Cam-Z bridge, bridge, my good Mother (then a Widdow) confulted with Sir Tho. Bendish (a near Neighbour, and related to her) how I might spend the Summer Vacations to Improve my self, and thereby keep me from other inconveniences, which usually attend Youth (being then 17 years of Age, and of that University 3 years) Sir Thomas (who was a Practical Master of most Sciences, and inlighted into all, and afterward Embassador to Turky, whose Transactions there, for 14 or 15 years, deserves a particular History (which in Gratitude I shall endeavor to perform) replied, Madam (faid he) if you please to intrust your only Son with me, I will my felf accompany him for two Months every year, till we have seen the chief Varieties which England affords, that he may be the better accomplish't for Foreign Travels; this fayour was kindly accepted, so in three Summers more (before I left the University) he did perform what he promis'd, and the first Summer, our first Gess led us through Darbisbire, which affords more pleasing Objects of Art and Nature, than any County of England; but I shall speak only of such things, as relate to the subject of this Book, and of my entrance into the concern of Metals; the Theory of which, with other Rudiments, my Tutor, Mr. Boswel (Brother to the Boswel that was then Resient at the Hague) had imprest in my thoughts: but as to the inducing Practicks, we fpy'd feveral Wellsnear the Roads over the Dovegang (which abound with the poorer fort of Lead Mines) fo we rode up to know the uses of them, and we were answered, That they were not called Wells but Shafts like Wells, only Shafts were iquare, and common Wells round, one made of Wood and Timber, the other usually of Stone or Brick, and whilst we were speaking, a Basket of Lead-Oar was drawn up (as our Buckets are to our Wells) I ask't, whether I might be fafely let down in the Basket to see their Works? they assured me I might, and fo with Sir Thomas's consent (who in respect of his Corpulency thought not fit to lead the way) I was let down (not in the Basket) but by a strong stick, laid cross the Hook of the Rope,

I fate on it between my Legs, one hand holding the Rope, the other guiding me from grating on the fides; fo foon as I was down (being about 24 Fathom, or 48 Yards) the Labourer that waited for the Basket, was quickly informed of my intents, who presently, at my request (promising Reward) fetch't two Candles lighted, by which I faw, that there was no other pallage than what I came down in, and by what I was to go into the Mine, but by that time we had gone half way, I told my (onductor, that I could not keep my Candle light, and at the same instant both Candles went out; Sir said be, I pray Stay bere, and I will go fetch more Candles, for it is nothing but a damp; at which words, my Spirits were much discomposed, yet I had so much left as to crawl back to the Shaft, and suck't in as much Air as relieved me; my Conductor foon returned with more attendents to light me, but I was very unwilling to return again, but gave them liberally fomething to drink, which the more obliged them to perswade me to see their Works, as furing me, That those Damps were not killing, but they had taken care (by keeping open the passage of their Waters) that no such Accidents should happen while I was there, and that they had good Aqua Vita, Rosa solis, and good Ale to cheer me; with that, I went to the Mine, where their constant Lamps and Gandles, which they lighted for my fake, did make the glitterings of the Oar very pleasant tome, by which I also savv their method of Digging, and vvas vvell treated vvith their promised Drinks, besides good Beef and Bread, so as their liberallity encreased mine, and then I was attended to the shaft, and To dravyn up as I vvent dovvn, and in my gentle passage, I thought of Virgil's Distick,

Dic quibus in Terris, eris mihi magnus Apollo, Tres Patiat Cæli spatium non amplius ulnas.

But I was not Edified by it, and so I came safe up, and gave a pleasing account to Sir T. Bendish.

From thence vve vvent to Eldon Hole, (being on the

other

top of the highest Hill, in the Peak-Forest, which we computed to be above an 150 yards long, and more than an 100 broad, the bottom (as 'twas told us) not to be fathomed; and by prying, I had certainly fallen into it (for the ground is slippe-

ry) if I had not been caught hold of.

But Sir Thomas espying some work-men making of Walls, (for there and in other stony Countreys, they make their Inclosures of loose stones (or slates) in stead of which in Suffolk, Norfolk, &c. they make Ditches, and plant them with Quicksets, on the fides of the banks, but in Devonsbire, &c. they use high Mounds of Earth and flag, and plant them on the very top of the Mounds, and both are beneficial Fences by their Products, (whereas those walls affords none) but he resolving to try some experiment did ride to them, and by our generous Promises, perswaded three of them, with their Pick-axes and Tools, to mount behind us, to the Hole; where first, they dig'd a pretty large stone, which we tumbled in, and the noise of its motion pleased us: then they dig'd a second stone, as much as fix of us could well roul in (for the mouth of the hole was declining) and presently laid our ears to the ground, and we could tell eight score distinctly, before the noise of its motion ceased, and then to our apprehensions, it seemed to plunge it self into water; and so we tryed a third stone, of more than the former Magnitude, with the like Observations, which pleafed the Labourers (with the Addition of our Gratuity.)

From thence we went to Buxton's Wells, bath'd our selves that night, and the next morning (of which I shall speak more in the word Waters.) we went to the Devils Arse of Peak, (saving your Reverence, as the learned Mr. Cambden expressed his Civilities) where we saw a large hole, in the bot. tom of a steep hill, on the top of which stood an antient decay'd Castle (of which you may read more in his Britania) We had Candles, and saw as much as we could, till we were hindered by running Streams. Now of these two Holes, there are many fabulous stories; but some years after, upon viewing

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other Mines, and their shafts and Audits to them, I apprehended that this Eldon-hole vvas an antient Shaft (made in the Roman's time) to a Mine, and that the Devils arfe was the Mouth of an Audit to that Mine, and I am the rather of that Opinion, because I conceive, That the Level of the Water (which stopt our further passage into that Audit, Arse or Fundament of the Mine) is level with the Water at the bottom of Eldon-Hole, and the word Arfe may be applyed upon two accounts, first that upon aMistake of the word Arse, for the Latine word Ars or Art, where the Romans, when they brought out their Oars of Lead, and probably made Silver of it, and did thereby shew their Ars Metallica, which the British not being latinig'd cal'd Ars, and as an Art which they did not understand, they (as the Vulgar do yet) attribute it to the Devil, and to call'd the Devils Arfe or Ars diabolica; (as we fee in the Weapon Salve or Sympathy Ponder, the knowledg of which two great Secrets were attributed to the Devil, as we may fee by Godelmanus, and other Books, till they were convinced of their Error: or it might come from Arce the Ablative of Arx. Latine for a Caftle, and probably this Castle was originally built to protect the Treasure which came out of the Hole under it, or to keep the Miners in aw (there being the like Castle at the Roman Mines on the Darren Hills in Wales) and possibly the Governour of it being severe in his Duty, the Vulgar (as they are apt to do in any regular Government) might call him, and it, Diaboli Arx, and fince opprobriously the Devils Arfe. but I have faid enough as an Apology for the Word, and for my Opinions therein.

I conceive they are not fo fabulous as those which are

told in the Country about these two Holes. some on mot

Here my Friend interrupted me, and ask'd how Eldon Hole, (from the ulual proportion of a Shaft) came to be fo large as I described it; I answered, That Gutta cavat lapidem; and if one drop by often cadency will make a bole in a stone, it is easy to be credited, That the fall of Clouds of Waters, (from the Aa time

fo

Mines.

widen it from Virgil's dimension of 3 ulna's, yards or ells square, (for I conceive he meant the Shafe of a Mine) to this great Dimension, at which he smiled: and so I went on; Sir, said I, the next two Summers, we made a surther Insight to several mines & Caves with no little danger (which I refer to other Discourses) and also their several wayes in their operations at those Mines.

Some few years after, the Wars came on, where my Spetculations were improved by the information I had at exford; that the Royal Mines in Wales were very helpful to his late Majesty during those Civil Wars (as I have shewn.) And, after the Wars viz.1650. telling these Stories to Mr. W. B he told me, He had a share in the Society for the Mines Royal, and desired to transferre it to me, in trust, which I accepted, and did execute it, for near 10 years after; and then resigned it, but the Societys sinding my Diligence, and Insight into that Assair, were pleased to bestow two quarter parts on me to continue me, and as a Testimony of my Gratitude, in Anno 1670, I writ a Book of their Priviledges and Rules, which I called Fodina Regales, and dedicated it to them, with a promise to proceed in the publishing of Erckern, which now I have done, and some other pieces which I hope to do.

And thus, Sir, said I to my Friend, I have given you an Account of several Links of this Chain, which guided me into this Laborinth of Metals: But to get out of it, that which I aim at, is to write a little more of their Products, and to offer some Expedient how the Mines may be made more profitable to his Majesty, and to other Proprietors, with some Advantages to the societies, which, God willing, I shall perform in due time, and then we parted, he wishing me good Success to my Endeavours.

And so I went on, where I left, namely to Acquaint the Reader, that Erckern doth tell us of several Mines in Germany, p. 28. especially in Austria, p. 285. Bobemia, Belgia, Flanders, p. 170. Hungary, p. 103. and Saxony, p. 77. he also

for mentions the particular Cities and Villages to which they belong, and where they are refined viz. at Bruffells, p. 170. Cracow, p. 208. Cuttenburgh, p. 142. Friburgh, p. 6. Galmay, p. 285. Goflar, p. 78. Heffen, p. 285. Holland p. 170. Foakims-Valley , p. 34, Islenburgh , p. 285. Caufingen , p. 285. Knien, p. 100, (where he faith the Mines contain good Duke-Gold) Lick beter, Manhren, p. 4. Meichsen, p. 4. Mifria, p. 6. Norimberg, p. 86. Saxen, p. 4. Schwath slackenward, p, 83. Shefron, p.4. Sorath, Suevia, p.285. and Suahem ---Tyrol, p.285. Villach, and Waldenburg, and many other places which he and Geographers do mention (See Heylen) and therefore I think fit also to mention the Counties of England & Wales wherein Royal Mines have been discover'd to us, viz. in Bedforsbire, (bestire, Cornwal, Cumberland, Darbysbire, Devonsbire, Dorsetsbire, Durham, Essex, Glocestersbire, Hereford-sbire, Kent, Lancasbire, Monmothsbire, Notinghamsbire, Northumberland, Rutland-sbire, Sbropsbire, Somersetsbire, Staffordshire, Suffex, Warwick Shire, Westmorland, Worcestershire, Torksbire, and in all the twelve Counties of Wales, so as of the 52 Counties there are 38 of them Metallick Counties, but in many of the reft, viz. Bark sbire, Buckingbamsbire, Cambridgsbire, Hampsbire, Hartfordsbire, Huntingtonsbire, Leicestersbire, Lincolnsbire, Middlesex, Norfolk, Northamptonsbire, Oxfordsbire, Suffolk, Surry, Wiltsbire there are good Minerals, but in some of them neither Metal, Mine. ral or good Quarries, and yet they are recompenced fome other wayes.

Now, though Germany abounds in Metals and Minerals, yet Erckern acknowledgeth that they have a better fort of Copper and Lead from the Mines in Poland (as it feems p. 268.) and a better fort of Gold from Hungary, p. 108. India and Æthiopia, p. 101. and a better fort of Lapis Calaminaris, (and other good Oars of Metal) from England (which Erckern calls Britain, p. 286. and a better fort of Saap, to contemper Metals, from Venice, than their own, so though we have as good Mines

Mines in England, yet we are forc'd (for want of a conftant use of them, and thereby improve our Knowledg) to borrow the Products of their Mines, and indeed our chief Knowledg how to work them (as I find by our Records) and they may well have greater Experience than our selves, because Erckern tells us, That the Mine at Goslar, formerly under the D. of Saxony, but now under the D. of Brunswick, hath been in constant working for above 700 years, to his time: and Heylen tells us, That the D. of Saxony's Mines, (the Territories not so big as England) yields to him above 130000 l. yearly; now why ours are not made so beneficial to us: I attribute it either to Reasons of State, or want of Knowing the several Arts which belong to the Working of them.

MINT, T. Muntz, vel locum ubi monetam cuditur, L. Monetarium, Officina monetaria, Taberna monetaria, Officina Cusoria, A. it signifies with us, (as Cowel renders it) the place where the the King's Coyn is formed, be it Gold or Silver, which is at this prefent, and long hath been, in the Tower of London, though it appear by divers Stories, and other Antiquities, that in antient time the Mint was at Callis, Ann. 21 R. 2. cap 6. and An. 9. H. 5. flat. 5. cap. 5. the Officers belonging to the Mint, have not been alwayes alike : at this present they seem to be these; the Warden, who is chief of the rest, and is by his Office to receive the Gold or Silver of the Goldsmiths, and to pay them for it, and over-see all the rest belonging to this Function (his Fee is an hundred pounds per Annum:) the Master-Worker, who receiveth the Gold or Silver from the Warden, causeth it to be melted, and delivers it to the Monyers, and taketh it from them again, when it is made (his Allowance is not any let Fee, but according to the pound weight:) the third is the Controller, who is to fee that the Money be made to the just Assige, to over-see the Officers and Control them, if the Mony be not as it ought to be (his Fee is one hundred Marks per Ammum:) then the Master of the Assay, who weigheth the Gold or Silver, and

Now it feems by Cowel, That Mints were erected in most parts of England, but he mentions no particulars, except Cumberland, Northumberland and London, (see his Title Moniers) yet under the word Mint, he cites the 21. of R. 2. c. 16. and 9. of H. 5. c. 5. in which two Kings Reigns, the Mint was removed to Callis, being then under the English furifdiction; and I do not find it, either before or since, removed from the Tower of London, except in the late Usurpation, and then his Majesty caused one to be Erected at Shrewsbury, to Coyn the

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MISPICKLE. T. Miszpickle; I know no other word for it, being mentioned as a kind of Oar, distinct from others (l. 1. c. 2. s. 1. 1. and l. 3. c. 1. s. 6.) but it may be derived from

the next word Miffy. See ours.

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MISSY. T. Missy. A.& L. Misy. which G. Agricola from Pliny, calls Atramentum sutorium, or Shoe-makers Black; but Pliny makes it a kind of Vitriol, and is confessed to be a mineral, and the Oar sparkling like Gold; so as I conceive Missi-kle is an Oar of the same nature, only spotted; which the T. calls spickled, A. speckled: so it is a kind of Missy-Oar speckled.

MONEY. T. Mintz. L. Moneta, Pecunia, &c. fee Coyn, Metals, Measures and Weights; and this Money is proportioned from 20 Grains of Barly Corns, which make a feruple (according to Physicians terms) or a Penny according to metallick terms; and 20 pennyes make an Ounce, and 12 Ounces (either of Gold or silver) makes a pound (according to the Trojan computation, and thence called Troy Weight :) as for Haver du-poise weight, or Haver weight, it hath 16 Ounces to the Pound, and Metals and Gems are not concerned with it: however, the Barly Corn bears the sway in both; so the poor produels of the superficies of the Earth, seems to give Laws to all our subterranean Treasures, both before, and when it is made passable, and communicable or currant Money; whereby I conjecture, that the word sterling Money, may not improperly be derived from Sterilis, or natural unfructified Ground (which is proper for Barly) whereas fertil, dung'd, or artificial Grounds, makes it more ponderous, and its Grains not of fo true a standard for sterling Money, as those of a more Natural Earth.

Now to all Silver or Gold Money, there is an Allay; that is, a taking away part of the fine Metal, and adding the like part of the baser; that is of Copper, &c. and this is done upon two accounts: first, that the baser Metal may make the finer to be

more

more apt for Coynage: the other is, that the Soveraign of that Government where it is so allay'd, may by the deduction or allay, be paid the full charge for the Coynage or Minting of it: Now the less allay that is put to the Coyned Gold or Silver, doth render the Government the more Honourable, and the Soveraignty of a greater Esteem, than in other parts, where they have great-

er allay (Vaughan.)

It is good for a Traveller to be skillful in the different allays, whereby, as a Friend of mine toldine. That he carried out an 100 l. with him, and with his ant of Exchanges, in Countrys where allays differ'd, he borehis Changes of Travel, and brought his stock home again; however, this Mony thus allayed, is called Coyn, when the Soveraign Stamp is upon it (which is a Legal Stamp) and every Soveraignty ufeth a different Stamp, as here in England, and in the Empire, France, Spain, &c. proper to its Soveraignty; and every piece of money to stampt, hath almost a different allay: yet all Princes do agree in severe, yet just, Penalties, for Counterseiting allays or stamps, and make it, as in England, High Treason. vid. Coke. 2. In. p. 575.

MONYERS. fee Money, lately called Bankers.

MORTAR. T. Gips. L. Gibsum, made of Water, Cala viva, Lime and Sand, and used in all sorts of Structures, to

cement Bricks or Stones. See Calx and Sand.

MORTER. T. Morsell, Morsner. L. Mortarium, which Minsham says, is morte earum rerum que in illo teruntur, and though we write one with an A. the other with an E. for distinction, yet the Beaters for that, and Pesses for this, makes Minshams discription serve for both of them. sa Sand and Pesses and Sculp. II. and IX.

MOULD. T. Model. L. Modulus. A. Frames, &c.

See Utenfils.

MULLET, T. Mallen & schleifer, L. Molarius, marmorius, a little flat piece of marble stone on vyhich Painters grind their Colours, and Metallists their Metal to dust, from molare to distinguish it from the Mullet fish.

MUNK,

MUNK, T. Munich, which I conceive, comes from the L. Munitus (and not from Monicha) as an Instrument that guards and strengthens the Operation of Metals, by covering it from the Air, and therefore though A. write it munk, it were more proper to be writ munt, as an abreviation of munitus.

NE NE

EALING or Anealing, T. Abgeadnet. I find it not in our Dictionary, but in Cotgrave it is Nelleure, and fignifies a vernishing and enameling: the difference is in the Arts; that enameling is upon solid Bodies, as Gold, Silver, &c. but anealing is usually applyed to the coloring of Glass, such as we had in former times, and still have in Church Windows, in excellent Varieties, and sometimes it is used for tinging or coloring of Stones, where it is done by fire, but here the word is applicable only to such Coppels, &c. which are covered and strengthned with Clar, for resisting the fire, and the manner of anealing them, is allwayes done by a gradual, and not a violent heat. 1.1.c. 10. see Amel and Clar.

NEEDLE, And it is applyed to several things, and hath thereupon several Names in several Languages, but in Latine it is called Acus from its Acuity or sharp point, (and is sometimes applyed to ingenuous satyrick Wits;) the French call it Aquila quasi Anquilla (as Minsham) because it is proportioned like an Eel sish, but the German here calls it Nadelen from Naeden or Naen, suere, i. e. to sow or stitch toge-

ther,

ther, and this word Nadelin is the nearest to our word Needle. Which word being used in the New Testament , to shew the difficulty of a Rich man to enter into the Kingdom of Heaven: It stands such men in hand that deal in Metals (in order to make themseves rich) to see how far they are concern'd in the impossibility mentioned in the Text, now St. John makes no mention of a Needle, but St. Matth. ca. 19. ver. 24. faith, It is easier for a Camel to go through the eye of a Needle, (per foramen acus transire, Sept.) than for a rich man (that is he that abounds in Money, made of metals) to enter into the Kingdom of God; and fo St. Mark; cap. 10. v. 24. and in St. Luke 18. 25. but the Latin is foramen acus, the Needles eye, which, my Author (whom, I cannot readily call to mind, or else I should own him) saith, there was a little Postern Gate in the Wall of Jerusalem, which was called foramen acies, or the Needles eye, through which a Camel could not pass without Kneeling (which faith Pliny Camels are taught to do) fo as by going on their Knees, a Camel might pass through that Gate, which otherwise it could not do; and so the Story alludes to a rich and bumble man, who by Humility may eafily enter into the Kingdom of Heaven, but not a proud rich man, that will not stoop, but puts more confidence in his money or metals, than in an bumble or devont mind, which is imply'd by the bending of the Knees of the Camel.

Now, this word Needle is once only used in the New Testament, by those three Evangelists, and no more, but it is used oftner in the Old Testament to other purposes, and is alwayes joned with the word work, as Needlework. But in the Translations of the Oriental Languages, the Translators differ, for Dr. Walton in his Polyglot renders Needle-work, Opus recamantis, Opus Polymatrii, Opus Varietoris, Opus picturarum, opus Imaginum, so as there is nothing of a Needle, but from the Chaldee, and there he translates it opus acu pictum, and from the Arabick which he renders Phrigianum, and Junius and Trimelius (published before that Poliglot) in every place of the

[Cc] Old

Old Testament, where the word Needle-work is used (as in the 26, 27, 28, 36, 38, and 39 Chapters of Exodus, and in the 5th of the Judges, and in the 45 Pfalm. ver. 14 for it is used in no other places) do follow the Chaldee and Arabick, in the words Opus and Artificium, but not in acu pictum, yet the two most eminent Poets of their time in England and Scotland concur'd in the uniting of those words, for Sandys writes thus, Psal. 45. 14.

Shee shall unto the King be brought, In Robes with Phrygean Needle wrought. And

Dives opum, dives Pictai vestes & auri.

(where note he useth Pictai for picta, as Virgil, Lucullus, and other Latine Authors do oft change the Diphthong & for ai) so that Sands hath the Needle-work in the word wrought, and that he calls Phrigian (from Phrigia, where it is supposed that Art was first taught) answering the Translation of the Arabick: and Buchanan, Picta answering the Translation from the Chaldee; and these Needle-Works are there also called faminalia torta, because the Art is mostly used by Women, and therefore Acus for a Needle is properly declin'd in the feminine gender.

Now, the shape of the Needle was taught us by Nature, for there is a fish which I have often seen on the Coast of Suffolk, which commonly comes there with the Mackerel, and differs only by having a snout of about 12 Inches in length, being a firm have in the state of the Needle

firm bone in the shape of a Needle.

Now, whether this be one of the Needle fishes mentioned by Pliny, I. 32. and call'd Acicula (and one of the 176 sorts of Fishes which he there enumerates, or the Acus Aristotelis, or the Acus Opiani, mentioned by Jonston, lib. de Piscibus, I cannot say; but Cooper, from Pliny (yet I find it not in Pliny)

Pliny) describes it just like the Suffolk Fish; Acus, saith he, is a Fish long, small, and smooth, on the back colored as it were with green and blew, his Beak long and sharp, and makes this of the masculine Gender, and we call it the Needle sish.

Acus also iometimes signifys an order in Battle, and so called Acus belli, when they are at point of Fighting, Acus also signifys the spiral parts of Wheat, Oates, Barly, &c. being like so many Needles, and not chaff, as most Dictionaries have it: And there is an berb called Acus pastoris, or Acus moschata being sull of Prickles like Needles, but vulgarly tis call'd Venus's Comb or Charvell, the chief Virtue of which is to provoke Lust, and so may be called Acus libidinis. There are many other Instruments of this name, Needle, which are used by Carpenters to cripple, graple, or joyn houses together, and

Thatchers Needles to thatch withall, &c. 114 and

But the chief Application of this word Needle is in Navigation, and there called Acus Navigatoria, or the Mariners Needle, or Compass, in respect that he compasseth the Seas, by the Virtue which it borrows from the Loadstone; (of which I have spoken at large) and is of such a transcendent Nature, that which way soever the ship moves, still the head of the Needle fixeth it felf to the North, and the other point to the South, and this admirable Instrument hath no other title in our Language than Needle: I hope that none that shall read this long Discourse of Needles will think it needless: but it was from Erckern's Touch-needles which he calls Streich Nadelen, and Agricola, de re Metallica, calls them sometimes Gold, or Silver or Copper Needles, by the touch of which the worth of each Metal may be known, and they differ in the making, forming and shaping of them, as may be seen in Sculpture 8. & 18: and in G. Agricola, p. 199. which she ws them in an acular or Needle-form.

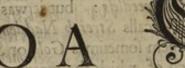
Now, there being great trouble and nicity in making of them either way (for indeed it is one of the most curious pieces about the Metallick Chimistry) therefore the Chimists,

Gold-

Goldsmiths or Tryers of Gold and Silver (to fave trouble) do make use of a Touchstone, being a kind of fost Marble, of which you may read more in Stones I read but of one fort of Needles more, which Cambden speakes of, in his Britania, p. 700. viz. of a Vault under the Church of Rippon where there was a little hole, called St. Wilfred's Needle, through which a virtuous Woman might pals with eale, but if the were otherwise disposed, she did not pass, but stayed below to be tryed of what Metal the was made. I me ai sight but a si

NILE, or the River Nilus. See Gold, Metal, Mine. NITRE, a light, ruddy, yet white substance, full of holes like a Spung, and refembling common Salt almost in colour; but quicker of Taste, and is mistaken by some for Salt-Petre; there is also a Nitre which comes out of Africk, of a purple Colour, but that which is now commonly fold to us for Nitre, is Salv Petre refined and candied, and used sometime in stead tion , and there called Acus Navigatoria , or the . saroll to

NOSEL Sce Arithmetick of a did was to all the NUT ambod and Measures i bas (squal to a steel svad which way loever the flip moves, still the head of the Needle





awers nev be know ARS. T. Erkes. A. and Saxons, Oar. Danes, Aare and Aaure; the L. Metallum Grudum (Skinner) for I find no fingle word for it unlessit be Fodina, which may be applyed to other dig'd things; but in our Patents for the Mines Royal, is writ Emre, which figsofting our one State allich Chimilay) therefore the Chimifer,

fies a place where Water is, for Water allways attends Metalls, and from thence the Ewres, which was formerly made of Silver, to pour Water into Basons, is called Emre; and from thence comes Sewer, or one that takes care for drawing of Water, where any Land or place hath more than is necessary, but generally in our Language, we call that which is digg'd from the Bed of any Metal, Oar; as if one should say o admirablilia Kerum Metallorum, for most of our Monosyllables are but abstracts of many words compacted into one, as may be feen in Sir Edward Coke's Instit. and other Learned Etymologers; also we usually call those Oares wherewith Watermen Row their B ats, aluding to the pains and labour which is used with the Armsin both Professions, by Digging and Rowing; there is also Leimster-Oar, of which I have spoke, under the word Flocks: but of the Metallick Oars, there are as many forts of them, as there are Metalls: yet I find but four Latine Words, and those compounded; viz. Balluca, for Gold Oar: Pomphilix, for Copper or Brass Oar: Stricture, for Iron Oar: and Plumbago, for Lead Oar (Holliack) and therefore Erckern sometimes calls the Product's of Metalls, from the Mines Erks and oars, and sometimes Stones, Goldt-stein, for Gold Erk or Oar: Silver flein, for silver Erk or Oar: Kupferstein for Copper Erk or var: Bley-stein for Lead Erk or var: Zein-stein for Tin Erk or oar : Speiz-stein, for Quick-silver Erk or Oar: Ein-stein, for Iron Erk or Oar: Slack-stein, for steel Erk or oar: But I conceive, that when he useth the word ERK; in fignifies the OAR joyned with the Excrement, and when STEIN, it fignifies the intire Metal, separate from the first crude and beavy Matter: Now the Names that he gives for distinction of OARS are these (as they are variously dispersed in his V. Books) viz. Blent Oar, Cat-silver Oar, Cobolt Oar, Copper and Coppery Oar, Crude Oar, Fleaky or Flacky Oar, Float oar, Fresh oars, Glassy oars, Glittering, Glistering and Glimmering Oars, Gold and Goldish Oars; also white, red, brown, Goldish oars; Grey Flints, called Iron-man-oars and gross [Dd] Oares;

Oars; borny, bard, barfb Oars, Lazure Oars, Leadish or Lead Oars; mild and muddy Oars, Slate-stone Oars, Silver, filvery, Spady, Sparkling, Spelter, Spizy and Sulpbury Oars; also Talk, Tinmy Dars, Washt and Wolferan Dars; and many others, which are dispersed in several parts of his V. Books: and some of them discoursed of here also, in their Alphabetical order; efpecially where we retain the same Apellations for the like Oars, to which the Reader is referred.

ORANGE. Orpiment. See Colours.

OVEN. T. Offen. L. Furnax, and the same words are used for Furnaces; but Kilns, which are a kind of Ovens, are called T. Calk and L. Calcaria and Furnax : of the leveral forts of these, you may see in the Sculptures, in their proper pages: viz. the Athanor in page 2. 123. 161. 172. 177. 185. 207. a Wind Furnace, p. 2. 56. 200. an open Furnace, p. 2. an Affay-Oven, used by the ancient Refiners, p. 13. an Affay-Oven, used by the Norimbergers, p. 13. an Affay-Oven made of Tiles, p. 12. 235. an Affay-Oven made of Potters-Loam. p. 13. 235. an Affay-Oven made of Armour Plates; p. 13. 153. a Granulating Kiln, p. 56. an oven to burn Silver, p. 80. a Roasting Oven, p. 112. the By or Side Ovens; p. 123. 161. 172. 177. 185. Oven for Retorts, p. 177. a melting Oven for Copper Oars, p. 248. and others. Now for your affiftance in the more fully knowing of these Furnaces, you may read Dr. Salmon's 5th Book of the New London Di-(pensatory; which I have formerly cited, where from p. 821. to p.828, he makes 17 feveral Furnaces for feveral uses, and each of them may also be varied, according to the Ingenuity of the Artist.

OUNCE. See Weights.

OUTLANDISH. T. Eintrembbling- Ausgleanger, L. Extranens, Aliegena, Exoticus, which A. terms Strangers, Aliens or Forraigners; all intending those who are not of the same Country, and those the Tems called Heathers, and the Greeks (according to Plantus) Barbarians. See Metallick Countrys.

OX T. Oches, Rind and Rund. L. Bos and Teriones, qua/z quasi terra terat (Minshaw) we call a gelt Bull, a Steir or Runt; but the Germans call a Bull ungelt, a Steer; and the Lat have also a Distinct name, Taurus: and A. properly a Bull: so the Ox hath three names, viz. Ox, steer and Bullock, and these are of the greatest size, and it is called Bullock, or more properly Bullack, because it lacks something which it should have: the lesser fort are called Runts (according to the Teutonick word) viz. Welsh or scotch Runts, these and the semales of this kind have several other names, as Beeves, Coms, Neat, &c. in which the metallick Art hath little to do, but with their Blood, Bones, Dung and Tallow, which are employed for several uses about Metals, and their meat for the sustinance of the Artists. see Blood, Bones, Dung, Tallow.

OYL, T. Oele, L. Oleum, and Linseed oyle, T. Lein-samen, L. Linarus: Which is no other with us than the seed of Flax, which in other Languages is Line or Linnen: but for the Oyl of Linseed it is well known to all that do paint with oyl, that it hath this Quality, that though it be liquid like other oyls, yet is of a more drying nature than any other Oyl, and therefore the more fit for Metallick Lutings, &c. lib. 2. cap.

27. fect.53.



PAGAMENT. I retain the word, because I find that in Florio's Italian Dictionary, Pagamento signifies any kind of Payment, l. 1. c.1. f. 1. which signify any broken pieces of Coin'd Money, which before made good

good Payments, and this word we abreviate from Pagamento. PALE-COLOUR. T. Bleich, L. Palidus, and A. Bleak, Bleek or pale. See Colours, l. 2. c. 43. S.I. and we have a word Pale, which the T. call Pkall, L. Palus, used for pieces of wood to pale in or impale a piece of Ground, or inclose it with Wood, as with a Garment (from pallium an outward Garment, which being decayed of its native colour, there

usually grows moss on it, of a pale colour.

PAPER, T. Pappyr, L. Papirus (l.2. c. 23. s. 3. of which Pliny faith, That all civility of this life, and the memorial and mortality also of Men after Death (by which he shews that he was not of the Sadduces opinion) confifteth in Paper, which faith he, was made of a Plant, having the name of Papirus, and he cites Varro to tell us, That the first Invention thereof was in the time of Alexander the great when he conquered Ægypt, and built Alexandria, where it was first made; and till then their Memorials ever were writ on stone, lead or Brass, oc. and, as I take it, fosephus tells us, that upon Enochs Pillar of stone, (which remaind to Moses's time) were writ those things which were done before the Flood. Also the Ten Commands were writ upon Stone: but for more easy Portage, and transmitting the minds of men one to another, Paper was invented (as Pliny faith) in Ægypt from the Bark of a Plant, lib. 13. c. 11. and 12. where you may read the feveral names it had, the first and best fort called Augusta, the next Livia; &c. and many more forts of it, and tells you also the manner of making it; and that what they did not use of that Plant for Paper, was imploy'd for making little Boats, and the outward Rind, for many uses, especially for Ropes, which makes me think, that the Withy tree which grows plentifully in Worstershire (of which I have spoke in the word Coal) is of the same nature, for this Plant Papirus (as Funcius faith) was about ten (ubits high, and so is the Withy, and that Papirus grew about Nilus, and other waterish places, so doth Withey, and that they made ropes of it, and so they do of Withy: so that I conceive, the inward Bark

Bark may make the like Paper, which may be tryed for experiment-fake only; for our Paper (made of Rags by Water-Mills, call'd Paper Mills, of which I have feen many in England) is much better and more useful with less charge) however, the Knowledg of such antient things are not to be lost, and whatever Pliny saith of the Antiquity of it, the Chinists pretend to the use of Paper long before Alexander, as a Friend of mine (Cap. J. Hall) told me who had been thrice at China, and the last time brought me a fair Book, all written in their Language long before that Emperor, and that the leaves were only made of the Bark of a Tree, but of that he could give no certain Account.

To PEARCE, or Pierce, T. Booren, L. Forare (lib.1. c. 34.) and we after the T. to Bore, probably alluding to the Bore, who, in rooting up the Earth with his Snout, doth as it were bore it, for the Lat. calls a Bore, Aper, because he doth aperire humum, and so by boring it doth open a passage into

Metals or other things.

PEEBLES. See Stones.

PELLICAN. T. L. A. and all from Pellecanus (Sculpture 29. f. 4.) the Greek word fignifies perforare, or to pierce through; in allusion to the Bird called a Pelican, which hath a bended Bill, by which, (as 'tis said) when her young ones are poisoned with eating Serpents, she picks an hole in her Brest, and gives her Blood to them, which cures them; and so this Instrument, doth as it were suck the blood or spirits out of several Ingredients (for so Blood is composed in Bodies) of which the Aqua fortis and Aqua regis are made, and by those waters both Gold and Silver are cured of their poisonous natures.

PENDULA, See Sculpture XI, these are of two sorts, one hanging constantly in a perpendicular line, the other is in a constant motion and of a late Invention for Clocks and Wat-

ches, and made of Iron or Steel.

PETREFACTION or Petrification, T. Stein-Dreben, L. Petrificatio, which is nothing else than a making that to be, which before was not, a Stone; and this effected by Art or [Ee] Na-

Nature, those which are done by Art are the Counterfeits of Gems, as Rubies, Saphirs, Emeralds, &c. and Counterfeits of Gross Stones, as Marble and other common Stones: but I speak of such as are done by Nature, and those of what I have feen, which I conceive are only performed by a peculiar Water ordained for that purpose, as at Poolls-Hole in Darbyshire, where are great grey stones, like our Free-stones, made by the cadency of Water, and some of those stones also cemented by Water, so as there are two or three large Arches of those stones cemented by Water, and where they were not perfeetly joyned; by the light of Candles, I could fee through one Arch to the uppermost, and so they lay promiseuously in the Vault, as big as a little Church: the leffer Stones are in the nature of Icicles, but not bright, and so encreased in hardness, length and dimension, according as the Water descends on them, to as at the points are drops of Water still condenfing into Stone.

The next which I saw, was at Oky-Hole, near Mindip-Hills in sommersetsbire, where the nature of that constant dropping, petrefy'd it self into a Christaline Form, and so seem'd (by the light of Candles, of which I had store) as so many Christal Icicles.

After this, I had occasion to Visit Sir Robert Coke, at his House called Durdans, in Surry, now belonging to the Honourable Earl of Berkly, where I found an Artificial Groto, made of Flint Stones, and looking up to the top, I perceived many little pendent Stones like Icicles, hanging on the Arch-Flints, and calling Pool's and Okey Holes to mind, I broke off some of them, and found them to be congealed Stones, and as the others were of a Free-Stone and Christaline temper, these were Flinty drops of Water hanging at the ends, like the other almost congealed stones.

These Observations I made of Lapidinous Waters, condenfing themselves from the matter through which they pass.

The next are of the like Waters penetrating other substan-

ces, so petrefying them: and one of them is near Knasborrough Castle in Yorkshire, where there is a Well which turnes pieces of Wood and Leaves into Stone, and other things of a complying nature: But I had a Honey-Comb presented to me from thence, which was made perfect Stone by that Well, which I the more wonder at, because things of cerasious tempers are usually

Resistables to Water.

The other is that at Deepham in Norfolk, there is a Tree 13 yards about near the root, and at least 80 Foot high, which bears a flower very pleasing to the Ey, and Smell. Sir Tho. Brown Doctor of Physick, eminent for universal knowledg, call'd it while he lived, a Teasle Tree, and said, That he never saw but one of them, about the further part of Germany, and that many had try'd to graft or inoculate part of it, but without success. Now at the bottom of this Tree there is a Spring of the like nature, with that in Tork-shire for Petresaction; now, I wish, that a Graft might be carryed from thence into Tork-shire, and planted near that petresying Well, by which it might be seen whether the Tree gave any such Virtue to the Spring, or the Spring to the Tree: from which, and other Inquiries I have still been diverted by publick Imployments.

The last which I shall mention, is of Earth which hath a petrifying quality, and this I was only inform'd of by Mr. Castle, a known person both for Integrity and Estate, in one of whose Mannors, near Cambridge there is an Earth, where as he told me, He had taken up several pieces of Wood which were turned into persect stone, and this is confirmed, in Cambden's Brit. p. 401. of a Ladder turn'd to stone, which, he saith, was taken out of the Earth at Asply Gowish (I suppose in the same Mannor) which was kept in the Cistertian Monastery, near Asply, as a great Rarity, and I have both read and heard of the like Earth in other places: But it is an Error to attribute this to the Earth, whenas it is only a lapidinous Water, which is in the Earth, and insuseth it self into such porous Bodys, and so makes it become stone, and that which confirms me herein,

is. That near this, there is a Quarry of stone, or Earth and water turn'd to stone, but it is of that nature, as Mr. Castle inform'd me, That if it be digg'd by theRule of the Compass, and mark'd N. for North, and S. for South, &c. and laid in any structure as it was digg'd from the Quarry, it proves a very durable stone, but if laid otherwise, it moulters to sand; which is of late years not only observ'd, in digging and placing other Stones (though more confolidated) but also in removing

Plants, derived from Water and Earth.

Now I observe in the whole matter, That this Water that thus petrefies it felf or other fubstances, is adapted with a lapidinous Nature, not only to condensate it self but such other fubstances as may imbibe that quality: so that it is not properly called, cold (as is commonly faid) that turns water into Icicles, but a volatile lapidinous water, that flyes about, which as cold or coldness doth improve to petrefaction, so Heat or other warmths do hinder from condensation, and this petrefying water is of a falt and frigid nature, as we may fee, that if Snow and Salt be put into a filver, tin or pewter Pot, and fet on a Bodrd, wherein fresh water is to be pour d, and then move the liquor about in the Pot with a Stick, and in less than half an bour the water under the Pot will be congealed to an Ice, and to will glew or freeze the Pot and Board together, of which you may read more in Berkley's Argenis. So I shall referr the further Discourse of Petrefying to the word Waters.

PEWTER, T. Speanter, but the Pewterer or maker of it is called Kanngiesser, L. Plumbus Cinereus (Holliock) and Argentanus (Minsh.) but the Italians call it Stagnaro, from Stannum, Tin, for it is properly an Art derived from the Stanniries or Tin Mines; because the best Pewter is where all or the greatest part is Tin, yet they put with it sometimes Silvery Lead, but for want of that, a little poor Lead, or the Ashes or Dross of Lead, but when it is much adulterated with Lead, it is quickly discerned by the weightiness of it : but the

T my the become time; and one type on bem me begins

of thank a server of a

T. calls a Pemter Dish, Dish Zienen schueshel, which is a Dish

made of Tin. 1.2. c. 20. s. 2.

PIBBLES, T. Keisel-steine, from Kisel a Flint, L. Calenlus à Calcando, because it may be kick't up and down; and as they are little of themselves, so they are of little use about Metalls, otherwise then as they are beaten and mixt with

Metallick Flints, l. 1. c. 4. f. 2.

PICTURES, T. Bilden-Geinaild-a-maklen, L. Pictura and Imago; the Makers of these are called Picture-Drawers, Limners and Painters, and these are of several sorts, but the chief Composition of their Colours are from Metalls; especially the Essigns on Coyns, which may be numbred amongst Picturas solidas, and this admirable. Art of Picturing is borrowed from Nature; so that in this Age the Art is come so near to the Original, that nothing but want of Life, seems to distinguish them. 1. 2. c. 48. s. See Sculptures.

PINCERS, T. Zangs, from thence we have our word Tangs or Tongs, that is, to hold fast; L. Forceps and Volsella, these are of several sorts and sizes, according to the uses; for common Fires they are called Tongs, for small Works, Plyers and Nippers; but in Metallick Work, Pincers or Tongs: see

Utenfills, and Sculpt. 11. Oc.

PIPKIN, T. ein Topfein, from whence our word to tope or to drink, and the Potters Clay, of which these Pots are made, is called Toepff, L. Ollula, a little Pot, and these are used about Metalls.

See Utensils.

PITCH, T.Pech (according to Minsham) but Erckern, Bech, L. Pix, and so most of other Languages, writ with P. and this Pitch is a Black Gum, which comes from a Tree of that Name, but are of the fort of Pines (whereof we have none in England) but have the Gum plentifully from other parts; the white Pine yieldeth a white Gum, the Pitch or black Pine, a black Gum; we have several uses of this Word; viz. the pitch of an Hill; to pitch a Bar; to pitch Tents; and a pitch't Battle: and all are but Allusions to the glutinous nature of this Gum.

Gum, used in Luting of Metallick Vessels: l. 4. c. 12. s. 2. PLANCHES: see Blanches, both of them signifying white pieces of Silvery Tin-Plates, and sometimes for Wedges of Gold or Silver, or other Metalls, and from thence the word Planks are used, for slat or plain pieces of sawn Wood, thicker than Boards: l. 1. c. 1. see Blanches.

PLATES of Metal, T. Ein Blat ven Metal, also Blech, L. Lamina, l. 4. c. 4. s. 4. or pieces of Metal made flat and smooth, and these are of Iron, Tin, Brass, Copper, and such as are of Silver or Gold (wrought in various shapes) as Cups, Di-

Thes, &c. are still called PLATES.

PLASTER, T. Gips and Tinchwerk, L. Gipsum and Emphlastrum, this is a composition of Quicklime, made of common Lime-stones, but the best is of Alabaster, and this is used without any mixture of Sand, and is an excellent Fence against Water; but Pliny tells of a natural Plaster in Cyprus; but we have none such, and therefore do use Alabaster or Talk, both of which he mentions (1.26, c. 24.) wherewith in those days they made Fret Works and Images; but of later years they are grown to a great Perfection, by a Past of that Plaster, to mould and fit it to any part of Man or Woman, and so take the perfect proportion of that part, be it of Face or Hand, and when that is dryed, they put a like past into the Mould, so as by joyning of the part so moulded, the whole Body of a Man or other Creature may be represented, in a pure white shape; which may be coloured as they please: These are graceful Figures (and may be feen at many Stone-Cutters, but very fubject to break) yet much less than those of Wax, which Art is also come to great Perfection. See Utenfils.

POLISH. T. Polieren and Polirs. L. Polire. 1.1. c.34. s.6. and this is done by rubbing Metal with Puttee (made of calcin'd Tin, or withother Stones (as the Hematbite, &c. see Blood-Stone) or other smooth and bard Metals, as Steel, Iron, &c. to make it render its natural or artificial colour more beautiful; and it may have a just relation to Policy, by which Art, even

Governments of Kingdoms, States or Cities are made smooth and

pleasing to the Judgments of Men. see Hemathite.

POTTERS - work, and Pots, T. Toepffer, Zeng or Werck, L. Figulus, and Operator Figuli, (l.1.l. 2.l. 4.) that is a maker of Pots; which the Jews well knew when they wrought in that ART under Pharaob, but whether they were metallick Pots, as Crucibles, Tests, &c. it is not faid: and he that is a good Assayer as Erckern was, will see them made himself, and not trust to the Potter. see Clay, Pots, Cruises, Jugs and Utensils.

PRECIPITAION, T. Nider schlag, (l.1.c.33.f.3.) L. Precipitatio, or to beat or to make that Nider, or Nethermost, which was uppermost, and I do use the words often to cast down, for so L. precipitatio signifies: Now how Metals are thus cast down or precipitated, is seen in several parts of the four sirst Books: but the general way of Metals is sirst to dissolve them in Aqua fort. or Aqua Regis, or Spirit of Nitre, or Vitriol, and then they may be precipitated with Sea water and Alcalious Lixiviums.

PROCESS, (1.2. c.45) is no other than the proceeding in the Metallick Art, as it is in the proceeding of the Civil Law, till Judgment, &c.

PROOF, proving, l. 1. l.5. Vid. Affaying, of little diffe-

rence, for Proving is but an Affaying.

PULVER ATION, and Pulverifing (1. 1. c. 8. f. 4) fignifies the beating of any Oar, Metals or other things to dust, (fortimes called T. Slant. L. Pulvis) or to ashes. (T. Aschen. L.Cinis,) or to Ponder, (T. Pulvir, L. Pulvis:) and these three are made by natural or artificial Fires or Heats (for contunding or beating things to dust, ashes or ponder, is but an artificial motion of Heat (for no motion is without beat:) and these dusts, ashes or ponders are but the last Works of Nature upon all Bodies, for the next work is a metaphysical reducing the Ashes of all Bodies to a Purity; and as we see here the dust of Metals and other things by Calcination, Incineration or pulveration,

veration, what admirable products are from them; so we may thereby be convinc'd that the omnipotent Chimist of all Creatures will shew his Divine ART, in improving the Dust and Ashes of our Bodies into a greater Purity than what we in this World (or terrestrial Mine) can injoy: for here we are subject to all impure Mixtures till a super-celestial fire shall purify us, and who knows but that the Spheers of the feven Planets are the Gradations of those seven Fires which David speaks of, with which we must be seven times refined, before we can be admitted into St. Paul's third Heaven or the Heaven of Heavens: and I cannot here but call to mind the Rapfody of Dr. Donne (Ser. vol. 2.) Speaking of the Resurrection of our Dust: faith thus, 'Where be all the splinters of your Bones which a ' (bot hath shivered & scattered in the Air? (or, of those Bones 'which the Metallick fires have confumed to ashes?) where be 'all the Attoms of the Flesh which a Corroseve hath eaten? or a "Consumption hath breathed, and exhal'd away from our Arms 'or other Limbs? in what wrinkle, in what furrow, in what bowel of the Earth, lye all the grains of the ashes of a Body burnt a thousand years since? in what Corner, in what Ven-' tricle of the sea lies all the felley of a Body drownd in the 'general Flood? what Coberence what sympathy, what dependence maintains any relation, any correspondence between 'the Arm that was loft in Europ, and that Legg which was 'lost in Africa or Asia (score of years between)? One Hu-'mour of our Bodies produceth Worms, and those Worms suck 'and exhaust all other bumours, and then all dyes, and all dryes 'and moulders into dust, and that dust is blown into the River, 'and that pudled water tumbled into the Sea, and that ebbs 'and flows with infinite Revolutions, and still, yea still God doth 'know in what Cabinet every feed pearl lies; in what 'part of the World every grain and particle of every mans dust doth lye.

Now we are to believe, that this feattered Dust over all the Elements shall (in the twinkling of an eye) have a glorious Resurrection. furrettion, far more glorious than what is producible by Metallick Art, which serves here but as an Illustration of what may be expected hereaster; but to return to our Chymical Dust, Ashes and Pouder, the dust of Diamonds is most remarkable, because nothing can master, cut, or polish a Diamond, but by its own dust; and it is a delicate Art, especially their Mills, by which with the dust of it they make so many curious Angles, as that they are all resectionary glitterings, and sparkling Lights to each other.

Then for Ashes, the several Lixiviums or Lees which are made of the several sorts of them, they are of great use in Chimistry, especially those that are made for Salt-petre, without which scarce any Metallick Operation can have good effects.

And for Pouder, the most eminent is, that which is made for Guns, viz. (of Salt-petre, Charcoal and Brimstone, and some other ingredients to heighten their tempers,) and when it is persected for the use, it doth as it were revenge its own Contusions, by shattering the pieces of others almost into Atoms, and therefore called T. Buechsen-pulver, L. Pulvis tormentarius, as if it had been invented by the Friar, to torment others before their time.

Now seeing I am writing of Gun-ponder, I have long since considered of the vast quantity that is spent in salutes, &c. and it was my chance to meet with an Ingredient of a cheap rate, with which, supposing a pound of ponder to be used, I took a 4th. part of it, and three parts of my Ingredient, (which was not of the charge of a 4th. part of Ponder,) and with that mixture did make a Report rather greater than less than the whole pound of ponder would have done; but this compounded ponder is more for noise than execution, which is the chief use of Salutes, or for Triumphs, whereby half 3 parts of 4, in the charge of common Gun-ponder may be saved.

And feeing I have told you of a ponder of Salutation, give me leave to tell you, That I have found out a ponder of prefer
[Gg] vation,

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vation, such as without Salt shall keep Meat in its Blood and Gravy, untainted or unputrified for more than a year; of which some little experiment I have made, but not sufficient to satis-THE STEE WITH WITH WITH A PRINCIPLE STEEL STEEL fy my felf.

There is yet another Powder which I am to speak of, viz. a Powder of Dulcification, which is a peculiar Art, but for that I shall conclude with Herbet, that Divine Poet, as an ad-

monition for the good ule it,

When Hair smells sweet through Pride or Lust, The Powder hath forgot the Dust.

PURIFICATION, purifying, T. Rein, Reinigen, Saeuberung, L. Mundatio, Purgatio, Purificare, Clarificare, Defacare, to separate Metals from dross, either by washing, by clarifying, filtring, digeftion, or diftilling; and this is done by water only, or by fire only, and fomtimes by both joyntly : See Clean-

fing, Purging, Clarifying.

PUTRIFACTION, T. Verrottung & Verfalung, L. Putrifactio. A. Rottenness, Corruption, Putrefaction, &c. as Bees from a Lions Carcass (Judg. 14. 8.) Snakes from the Corruption of Horse-bair, Magots and Flies from corrupt Flesh, Eels from corrupted Dews: and in all Histories of Nilus it is faid. That the Mud thereof breeds (befides other larger Creatures)an infinite number of Mice, in which Experiment, we need go no further than the Island of Foulness, in Dengy hundred, in Effex; where, as my Author Mr. Bernard (a very credible Gentleman) affirm'd to me, and it is confirm'd by (biswell in his Britania Baconica, that about the end of every year, in his ground there, a prodigious number of Mice, were bred from the Soil of his Grounds, so as he had often seen some of them not fully shap'd, and these Mice about August, did deyour all the roots of the grafs, whereby the grafs being withered, the whole ground feemed like a bed of chaff, wherein the Mice delighted themselves; but whilst they were in their sports,

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about the end of every September there came a fort of little Owls (in great numbers, but much less than those which are bred in England,) and so being fill'd and fatned they slew away again, and what with the chaff and carrion of the Mice, and dung of the Owls, the next Spring the grounds produced again plenty of Grass, which fatned him yearly many good Oxen: Now this putrefaction is not only seen by producing such Insects, but in Metals, for the Rusts of them are but rots or putrefactions, as when Ceruse is produced of Lead made rotten with Urine or Vinegar; and Verdigrise produced from Copper made rotten by sumes of Wine, and many such like putrefactions. See Pulveration, &c.



UARRY, T. Steinegruben (which word Grub is used in English to search for Stone, &c.) L. Lapidicinia, Latonia, Latumia. Lithomia, and Fodina; and for a Quarry

of Mill-Stones, Cotaria.

It is not agreed from whence this word is derived, but the French comes nearest to the matter, viz. Querir, from the Latine Querere to seek (or pro qua re querit; and so an Hawk is said to have her Quarry, when she hath got what she slew at; however it is called also fodina, which is the title to a Mine, and indeed the Mines for Metals, Minerals and Stones, are so near of kin that they may all be called properly Fodina, see Mines, Minerals, Stones, Waters.

QUENCH (or to Quench) T. Ermorden, that is, to put to Death, also Andeschen, L. extinguere, which (in Metals)

is, when the heat of them are taken away by cold water, so quenching thirst is the allaying of heat in the body by some cooling liquids: and it may also come from the Quince Apple, which hath the quality to allay slames, thirstiness, &c. coming from hot causes.

QUICKSILVER, T. Queckfilver, L. Argentum vivum, Argentum liquidum, & fufile, & Hidrargirum, or Argenteum aqueum, and this by Chimists is devoted to the Planet Mercury, and so by them also called Mercury, for its Agility; and therefore the Heathens (who worship'd it as a God, yet)

put an humane shape on it, with Wings to his Feet.

But our Metallick Mercury or Quick filver is of two Sorts, viz. Adulterated, and Natural; as for the Adulterated, it is easily discovered, by putting some of it into a Spoon, and so over fire let it evaporate, and if it leaves a black, or duskishness, 'tis false, but, if white or yellow, 'tis good. As for the Natural (as I said in the word Metal) we have very little or none in our Mines, so that we do fetch it from our Neighbours out

of Hungary, Spain or America, &c.

Many have written largely of the Nature of it, and therefore I shall only tell you, It is seldom found in the Earth with any of the beforenamed Metals, but delights it felf in the Cinnabar, Vermilion, or Minium Stone (of a Metallick nature, (much us d by Painters and Dyers) and there naturally is enclofed; and Mr. Nicolls (in his description of America) tells us, That in the Vermilion Mines at Palcas, it yields to the King of Spain every year 8 or 9000 Quintals (which is so many 125 l. weight of Quick-silver) and that of later years they refine more Metals by Quick-filver than by Fire, in which operation it hath this peculiar vertue, that it separates and consumes all of them but Gold and silver, and though it will not ly in one Bed with them in the Earth, yet when they are made Play-fellows, or fellow-Labourers (for the use of man,) it doth most naturally sympathize with Gold, and divides and separates it from all other Metals, with which it is at any time intermixt: circling it about withwithout any other intermixture but it self; but it doth not so intimately and perfectly unite it self with Silver, for it doth not pierce it, but consumes the courser Metals from it, if there be any mixture; and though it be the heaviest of all Metals, yet if any Fire offer to meddle with it, it evaporates it self into the lightest substance smooth, to some colder Region, (as its resuge or shelter,) where it again embodies it self, and becomes as perfect as at first, by assuming again its natural colour, white; and 'tis observable, That though it lies in a Bed of pure Vermilion, (which gives a glorious red colour to all things wherever tis used;) and though it is used, and in a manner incorporated with Metals and other things of various colours and natures, yet this noble active creature still retains its whiteness, purity and efficacy.

For though by the strength of Art (as Paracelsus tells us,) it is sometimes force to assume a yellow colour, (to shew its affection to Gold) and sometimes to a pure red (to shew its native kindness to Ciunabar, yet these are rather assumed and assimulated colours (in respect to other ingredients and compositions with it,) than any real change of its own whiteness, and so for its Medicinal uses, it is sometimes called Mercurius dulcis, Mercurius vita, Mercurius sublimatus, and Mercurius pracipitatus, yet in all these dispositions of it, it still reverts to it self, (especially by the assistance of Fire, to make it Volatile) that it may be the better fixt in its original purity.

Now these observations cannot but raise my Thoughts, to make them applicable to the great Mistery of Resurrection; wherein I consider, That as the Gallenists are, or may be confirmed in the verity of it, by St. Paul's Argument to the Gorinthians, I Cor. 15. 35, &c. So the Chimists may be also confirmed in the same by their Chimical practice, for they see that Mercury doth by heat so evaporate, that nothing of it is discernible to the eye; yet that evaporation being stopt in its career, by the top of the Limbeck, it there sixeth again in its form, colour, and indeed in all its qualities, properties, and persections.

[Hh] Now

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Now it is an undoubted Principle, both with the Gallenists (who follow St. Paul,) and the Chimists (followers of Moses,) That all Terrestrial Bodies consist of Salt, Sulphur and Mercury, (which last is the chief) so as our humane bodies being of a more Mercurial temper than other bodies, may experimentally, and therefore rationally believe, That all the Atomes of our bodies being incited to it, by an internal heat, do like Mercury ascend to some other limiting Sphere or Orb, and there stays, till GOD (the Worlds great Chimist) thinks sit to dispose of them at the general Resurrection, or particular (as he thinks

fit.)

Now, where this sphere or Orb is (which some call Heaven and Paradice, others Limbus Patrum, and Limbus Infantium; and others have another place, called Hell, and Limbus inferiorum, (as it were Antipodial to the other:) I shall venture to give my guess, and possibly with as little satisfaction to the World, as others have done in theirs: and that which guids me to mine, is this confideration, That the name for Quick-filver is Mercury, and that that Name Mercury is also fixt to the Planet of that Name (next above the Moon, whereby I apprehend that the Chaldeans and Egyptians (who are faid to be the first Authors of the Astrological Characters of the 7 Planets) did make both the Planet Mercury, and the Metal Mercury to bear one and the same figure, thus (2) well knowing more of the sympathies and concurring operations of the Celestial and Terrestrial Mercuries than is yet communicated to us; but the Hebrews (before them) made seven of their Letters to signify the seven Planets and seven Metals, and thereby the figure of Mercury (before it was altered by the Egyptians, was in this form [3] and sometimes thus[3:] And the fewish Rabbins did hold, that those two Letters did contain great Mysteries, (not yet also unfolded to us,) and therefore I hope it is no offence to conceive, That the Sphere of Mercury is the Paradice or Receptacle of all the Mercurial spirituous Forms, of which our bodies do confist, and when they are evaporated from

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from hence they (by an invisible ascention) are received and remain in that Paradice or repository, so that the Globe of earth being 21600 German Miles in circumference (accounting 6400 foot to a German mile) and the Diameter 7200 Miles, and the Planet Mercury in the lower part of its Sphere (next the Moon, being 10255773 German Miles, and the upper part of that Sphere next to Venus, being 22855511 German miles, then the space of the sphere of Mercury (considered Diametrically) between the lower part of the Sphere of Venus, and the upper part of the sphere of Luna is 11599738 German miles, which great space may easily contain all the Mercurial forms which can possibly arise from the content in the small circumference of the Terrestrial Globe, and allowalfo sufficient room for the body of that Planet, (being as'tis faid, but 442 miles in Diameter,) so that it hath a space of 62999698 German miles above, and as much under its own Globe, in which

it may move and actuate.

And, as the Planet Mercury is imployed in its own Circular Motion, within its Sphere to order and put every Mercurial Matter that ascends to it from the terrestrial Globe into peculiar Repositories; so the Moon may be admitted also in her Sphere to give the first rarification, and purification, to the afcending Spirituous forms to make them the more fit in their Passages to Mercuries Reception of them, and retain the refuse within her own Sphere, which consists of a space also (viz. between the Spere of Mercury, and the outward Circle of the Terrestrial Globe) of 10234173 German miles, for the Planet's themselves, viz. of Mercury and the Moon (as I have shewn of Mercury) do take up but a little Room to roul about in each of their proper spaces or Spheres, and though Kepler, and others of late do not agree in their Computation about the dimentions of these two (and the other Spheres) yet these which I have fet down(being generally fo computed) may well ferve as an instance, that so great spaces were made for some such uses as I have exprest: so that by the active Operations of the Bodies

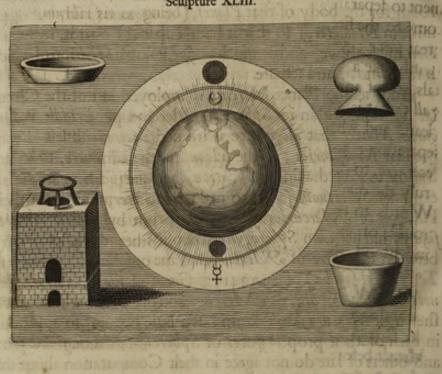
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Bodies of these two Planets (Luna being but as a Servant or vebicular to Mercury) the Mercurius Dulcis and Mercurius Vita of all bumane Bodies may be sublimated into that celestial Paradice, and the Caput mortuum or Mercurius pracipitatus thrown down into a Limbus, either in the space of the Moon (at present) or to the Abysis of the space of the Earth, when it shall (by the last conflagration) be evaporated or annibilated in. to a kind of Vacuity for that purpose.

But having spoken something more of my Conjecture in my Volatiles on Adam and Eve (under the Discourse of Resurrection) I must refer you to it; and shall only add this follow-

ing Sculpture for Demonstration.

Sculpture XLIII.



that to great the er were much for the phales. By letter the reason of the palmyd tanted thomp

o ran or hold Memb made liquid, or what is drawn from them

REPLING fignification when Sweets are them when sweets are them when them when them when them when the clearly cleaned are them. Replied Repl

ATTER, 1. 2. c. 2. T. Raeder, I find no Latine word of kin to the fense of what Erckern intends by it, viz. a riddle, screen, or sieve, that is an Instrument to separate the clean from the unclean Oars, before they come to the fire, and so may be called magnum (ribrum, or a great sieve; yet it may come from Rotatilis, that is, moving I wiftly like a Wheel, or Rota, shewing the proportion of Metals, or of any thing else; Riddle, which in the T. is Ratgall; that is, that the Question being what part of the Oan is clean, and what unclean, this instrument doth unriddle it by separation: and for the word screen, it is doubtless from secernere, to divide, and sieve from segregare or severe, to know truly the quality of the thing by separation; There are other Words to the same effect, as seirce, boulter, not worth the trouble of examining their Original, but by Ratter is to be understood the great seive, and the other the lesser seives. See Sieves. we'd veretable Sout, which is improved to an hie

RAW (1.2. c. 3. f.4.) T. Rohe and Rode, also ungesotten and ungekockt. L. Crudus and Atrox, A. Ram, which is some old British word, signifying not concocted, and so applied to Metals before they are brought to the fire to be boyl'd or roasted, see Roasted.

REEDS, 1.5. c.4. f.3. T. Roby. L. Canna and Arundo. See Hrenfils.

RECIPIENT or Receiver, 12. c.20. s.6. T. Emphahen, L. Recipere, fignifying Glasses, Pots, or Vessels which are made [Ii]

to run or hold Metals made liquid, or what is drawn from them by fire, or otherwise. what is drawn from them

REFINING fignifies no more than when Metals are melted and fined; yet to make them better, they do refine them; that is, melt them again and again, till they be clearly cleanfed, purified and purged from the unclean metal or matter; cleaving to

the more pure.

REGISTER, T.L. A. Register, and it signifies with us a Memorial or Record, so the Word is applied to the Records in several Courts of the Common and Civil Law; and these are very ancient (as appears by Sir Thomas Smith, de republica) but in the Metallick Art it is used for Pluggs or Stopples to be put in or taken out of little boles made in Furnaces or Ovens (called mind boles and air-boles,) whereby the fire may be better governed, by giving heats or cools to the Metals, accord-

ing to the discretion of the Chimist.

REGULUS, 1.2. c. 35. &c. L. A. Regulus (which fignifies a small King,) but Erckern in all places (where he hath occasion to mention it,) doth make use only of the word Koenig (or King, and not Regulus,) from konnon, fignifying knowledg, power and ability to Govern; and the Old Saxons called him konning and cunning, which we translate subtile, (yet not as the vulgar interpret it crafty,) but one that is Learned, and judicially polite in his Government; now though Metals, (by fome) are put among inanimates; yet others believe that they have a vegetable Soul, which is improved to an higher Soul by Obedience to its king; for it is agreed by Chimists, That this king doth give fuch a foul and temper to Metals that thereby they prove beneficial to the World, and gain an esteem to themselves, both for their Origination to Wealth and to medicines, colours, founds, &c. and all these they obtain by obedience to their king: and this puts me in mind of our Alphabetical Letters (which I think is included in the Talismanical science) whereof God himself faith, That he is the Alpha and Supream King of them, (as of all mankind, and other creatures:) to that

if we consider them in their virtual effects, then such men as are Learned in them, and do pay their obedience by Devout Vows and Promifes to him, may be called Vowels; fuch as ad and do his Will at Land, may be called Confonants, fuch as admire him for the Wonders they fee at Sea, may be called Liquids; and those that fit still in their passive Obedience (not grumbling or mutining) may be called Mutes, and these are the Grammatical methods of Letters and mens Obedience; now from the con-Conunts liquids and mutes, with the conjunction of Vowels (like Magistrates) they are formed into Words; and therein also God the Son will be owned as the chief of Words; and when they come to a Talismanical Operation, they may be ascrib'd to the How Ghoft: In thort, though the Letters feem to have no vifible vertue in them, yet this is evident, that by submitting themfelves (or men like God-fathers doing it for them) to that order which the great Alpha hath thought fit, mysteriously to direct, they are formed into syllabical words, sentences and discourfes, whereby God, Angels, and Men feem to have a mutual correspondency; but when there is no obedience to that order, there is nothing but misconstructions, non-sense and irregularities, pernitious to themselves and others; And it is not only thus in Metals and Letters, which (though accounted inanimate, as I faid, yet are or will be forced to be obedient and regulated by a King: but in lensitives, the Bees have a King, and by their obedience to him, they enjoy the fruits of their Labours, and take pleasure in returning each to its own Cell, or House, which is guarded with Waxen walls, and filled with Honey sufficient for its own food, and an overplus to supply others, and this proceeds from the happy product of Obedience, whilst the stubborn, refractory, or lazy Droans are thrown out of their Hives, Houses, and Homes, which they might otherwise have enjoyed, if they had not been disobedient; I might instance more, but it is enough for me that I have shewn the advantages which Metalshave by their Obedience to their King or Regulus. Same Aleger October and resultand and other creatures: I do that

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RETORTS, see utenfils were to mist him modeled and some

ROASTING of Oars or Metals, l. 1. c. 10. T. Groesten Roesten, A. Rost a Rore usta, or the burning away the Den or moisture of Metals.

RUBRIFIED, l. 2. c.44. J. 2. T. Fast rotten, L. Rubrisscatus, and I suppose the Red Sea is called Mare Rubrum, from some red Mineral under it.

RUSSET cloath, T. Unbercite, L. Pannus fusci coloris, A. Russet cloath, which is Brown or between a white and black colour; it may come from Rusticus, because Country-men seldom use dyed or undrest cloath, but only the natural colour of Sheeps Wooll, when it is neither black nor white, but as a mix d colour; however this is recommended by Erckern for retaining of the Gritts or Sands of Gold, so as they may not suddenly be wash't away with other Rubbish.

S A S S A

were ser tormed into fullabreal merds, fentences and afficur

SALT, 1.1. 1.2. 1.3. 1.4. and 1.5. T. Saltz, L. Sal, which may come from falus, Health, according to the Verle, Non fapit esca probe, que datur absque sale: for indeed it gives not only to Humane bodies, but to Metals a vivacity and sanitude; Minsbam deduceth it from salire, because it sparkles and leaps in the fire: Now of Salts there are several sorts, (as may be read in Pliny, lib. 31. cap. 7. to the 11. and in other places and Authors) but most Chimists do agree, that there are seven several sorts, which are influenc't from the seven Planets, to attend the seven Metals; and these Erckern accordingly makes use of, viz Sal alkali (or sandiver, or Salt of Glass,) Sal Armoniaci,

Sal Nitri, sal Vitrioli, Sal Petre, (and common Salt.) Sal Tartar (or Argol, of which I have spoken,) and also Sal Gem, (which is the feventh Metallick Salt,) and is produced from a Rocky Christalline stone, and of these he speaks, and of no more, it being a subject of great extent, for I conceive there may be as many forts of Salts, extracted, as there are Terrestrial (reatures, for all things do confift of Salt, sulpbur and Mercury (as I have faid) but that which I aimed at, was to give an account of our natural falts, from springs in Cheshire and Worcesterfbire, and from the Lands on the South fides of Devonsbire and Cornwal, which are full of Salts; for with those Sands, so mixt, they manure their Lands to a great profit, and of which most other Coasts of England are wanting, and have only the Sea-water to make their Common-Salt, but I cannot enlarge my observations upon any more words, because the Printer calls for what I did write of a Metallick Dictionary, after I first proposed the Printing of Erckern, but intending within the compass of a year to publish Georgius Agricola, de re Metallica (being fully translated,) in English, and also to add a Dictionary to it, I shall referve my remaining Essays (if what I have done hitherto, be approved) till then, and so I proceed in the Dictionary.

SANDS, l.1. 6, 29, &c. T. and A. sand, and so the Belgick, but the Italian, the Spanish and Latine call it Arena, and the French, Sables, (which in Heraldry signifies black,) also it is the name of the Furr of a little Beast, called sabellus, and mustulus, sarmaticus, of a sandy colour. However sand is of various uses in Metallicks (as sand-Ovens,&c.) and consist of great varieties in Bugland, which may admit of curious speculations

See Earth, Gold, Mortar, Ovens, Petrification, Stones, Water.

SANDIVER, 1.2. c.5. f.1. &c. is the same with sal Alkali, which Pliny, (1.31. c.7.) calls the Tragasean salt, and is the

same with sal Vitri, or salt of Glass.

SCALES, are of a Ballance for weighing Metals, whereof you will find two forts in Erckern, viz. Proof scales, l. 1. c. 34.

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f.12. and infet scales, L1. c. 35- f.2. T. Tung, schuell, L. Lanx, also for scales which come from Metals, T. schuepen, being the same word which they use for the scales of Fish, signifying the four for flaky matter taken off from Metals, sometimes by filing, but chiefly by fires, l.2. c.26. s.2. and c.36. see Fleaky and Flaky, Shivery, &c.

SKIM or skum, 1.2. c. 47. s.2. and 1.5. T. schaum, L. spuma, A. froth; but in Metals it is, when they first rise into a droffy matter, yet not so thick as drofs till it is more condenfed; but in other things it hath only the name of Froth, fit to

be skimm'd or skumm'd off: See Dross. Scorias, Yeast.

SCORIAS, I. 2. c. 25. f.2, &c. T. Trufer, L. scoria, A. droffy.

See Drofs, Skim-

which

SEARCE, to searce, T. salter, L. cribrare, A. to searce, ferce or farce (Skinner,) which is to express the operation of a seeve. see Seeve.

SEEVE, T. fib and fieb, L. cribrum, A. feive, feeve, or

Give (Skinner.) See Ratter.

SEPARATION, T. Absorderen (from souderin, to soder or to joyn, and so absorderen, to disjoyn, L. separatio, A. separation, and in the infinitive of separa, it is separare, or segregare, from whence the T. call a separating Oven, a sagar offen, 1.3. c. 15. and so sagar worke, which is a distinguishing or dividing mixt Metals from each other, or other matters, adherent to the Metals. see Quickfilver.

SHIVERY, or to shiver, l. 1. c. 34. s.3. T. schivern or schiffern, L. disrumpere, when Metal is loose, and easy to break into pieces; and sometimes light Oar is called shiffer Oar.

SILVER, T. filber, from the Greek filbo, (Minshaw,) A. filver; now as to the inlarging the Etimology of this word. used by the T. and old Saxons, and so continued here; I must refer it to another time: only I observe that the French and Italian do comply to the Latine word Argentum; but the Spaniard calls it Plata, probably from the chief City and Province of that name, in America; or from the great River Plata, which

which runs 2000 miles through the American Mines, before it unloads its Wealth to the Spanish Navy (termed his Plate-Fleet) which supplies himself and his Neighbours with its Treasures of Silver, Gold, &c. I might also add many things about the fining and refining of their Silver, before it comes unto that Fleet, but I refer that to Erckern's four first Books; and N'N's Survey of America: for I know not the Author, but I find it ingeniously write see Metals, Mines, &c.

SLACK, slack stones, and Slicks, T. schlack and schlick, (often mentioned by Erckern, l. 1, 2, 3 and 4.) L. Laxus, and all signifying the loose parts of Oars, or the Oars made into Metals, yet still do remain slack and shivery in some part, and sometimes is taken for Dross, and that Dross calcind goes for Calx, or slackd Metal: see Calx, Calcine,

Lime, Drofs, Flakes.

SMELTING, l. 4. c. 14. l. 4. c. 1. &c. see Affaying.

SOPE, T. Seiffe. L. Sapo and Smegma; Pliny, l. 28. c. 12. gives an account of its Vertues, and how it is made, but I question whether that be the Venetian sope, mentioned by Erkern, l.2. c.47. s. 2, & c. or the Tin-sope, l.4. c. 13. or the Gold sope, l.5. c. 10. s. 8. of which I shall discourse at another time.

SPAN. T. Spann. L. Spithma. See Measures.

SPAR. l. 3. c.27. s. 6. T. Sparstein, a white stony Matter, that usually embraceth the oars of Lead and Silver, called, L. Fluor; the word is also applyed to long pieces of Timber which serve for the Roofs of Houses, call'd sparrs.

SPARKLE, vulgarly spartling Oars, T. Fnencklen-erka,

L. scintillare.

SPELTER, T, is the name of a course Oar containing little filver, 1. 1. c. 2. s. 11, and 15. of which there is a better fort of Oar called Bismuth or Wismet, viz. when it runs bright and well in the fire see Wismet:

SPIZE, or T. Speizy-Erks, or groß thick Oars, reckoned among course or unclean Oars, and in Erckern (l. 1. c. 2: sect. 11.) fully described cap. 16. for the melting of which, which, particular Ovens are made, see Ovens.

SPUNGE, 1. 2. c. 4. f. 1. T. Schwam, L. Spongia, but how it is produced from, and used for metals, deserves a lon-

ger Discourse.

STEEL, 1.4. c. 20. and 27. T. Stabel, & Stabel Steine, L. Chalybs, now this and all other forts of Iron, are by Pliny (1. 34. c. 14.) comprehended under the word fricture, and he farther faith, That the goodness of Steel ariseth from the goodness of the Iron-Mine, from whence it comes, with the affiftance of Waters, and various Quenchings of it in Waters or oyls, to which he adds. That 'tis wonderful that Man's Blood should have such Virtue in it as to be revenged on the Iron-blade that shed it, for being once imbremed therein, it is given ever after to rust, and canker. see Iron.

STONE. T. Steine. L. Lapis and Petra, which hath banc Petram in the Accusative Case, for making such work in the World, by its affinity to bunc Petrum: But not medling with those Disputes, I might very well have inlarged my felf upon this Subject of Stones, especially of those which English

Quarries do produce, but I must also deter it.

SUBLIMATION, l. 1. c. 28. L. Sublimatio, which is a separation of thin and fine Bodies from their gross and impure parts by means of a gradual Heat, whereby there is a white powder called Sublimate made of Calcantbum, Quick-filver, Vitriol and Sal Armoniack, which is used as a strong Corrofive upon Metals, &c. See Calcination & Quickfilver,

SUDS, See Lees, Lixivium.

SULLAIN, Stubborn, that is, Oars or Metals that are not easily melted by fire, as the soft flowing Metals or Oars are.

SULPHUR, T. Schweffel, L. Sulphur, and lapis ardens; of which there are various forts, both natural and artificial, and many delightful Observations may be made on them: See Brimstone & Bitumen.

SUN, T. Sonnen, L. Sol, from which Celeftial Heat and

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also from the Terrestrial Fires, many excellent things are produced in Metals; viz. in making Aurum Potabile, as also a most sovereign Water from the rayes of the Sun, by reflection on Gold, which I may hereafter communicate.

TAT

ALCK, l. 1.c. 4. s. 2. T. A. Talck, L. Talcum, (by Pliny, l. 36. c. 22. called Lapis specularis, of which he gives a large Account. It is a foreign stransparent Nature; refisting both beat and cold; the red is mentioned by Erckern, but the white more common.

TALLOW, 1. 1. c. 17. S. 3. T. Unschlet, L. Sevum or

febum, A. Suet or Tallow, much used about Metals.

TARTAR, See Argol, Dregs, Feces.

TEST, T. Schirbin, L. Proludium (Holiock) but I had rather take it to be an abreviation of Testis, as a Witness of the goodness of Metals, by trying and proving them in little vessels, prepared by Assayers for that purpose: see Cenci. bles and Utensils.

THORNELS, T. Deerleins, fully explained by Erckern what they are, L. 3. c. 22. s. 3. In short, it is a term of Art, for that which remains of the roasted oar, unmelted: see Keinstocks.

TILE, 1. 2. c. 41, f. 1. See Brick, Earth, Oc.

TIMODE, l. 2. c. 2. s. 8. T. a name for Cloth made of Flax, or Hemp or Wooll; and so in A. called Linsy-woolfy; which is used sometimes for strainers of Metals.

TIN, 1.3. c. 12. f. 6. T.Zin. L.Stannum, from whence we [L I] have

have the word stanaries; by which Court the Tin-Mines in Cornwall are governed: now this English Tin is esteemed to be the best in all other parts of the World; the Spaniards and Italians calls it stagno de cornoij valla: the French de Corno Vall en Angliterre, su Zwitter.

TIN-plates, are properly Iron plates covered with Leaves of Tin, and because of the outward Colour, call'd Tin-Plates.

TIN-sope, T. Zinseife. see Sope.

TONGS,
TOUCH-needles See Needles.
TOUCH-stones Stones.

TOWER, Trayes, Trevet. see Utensels.

TREMBLE, 1.2. c.48. T Beben, and Zuttem, L. Tremere: see Boyling, Seetbing, Quivering, &c. All expressing a different motion in Metals, whilst Melting.

TROY-weight, See Measures and Weights.

TUB, l. r. c. 11. f. 5. T. Fas, L. Vas, A. Veffel or Tub: and are of various Forms uled about Metals. See Utenfils.

TUNNEL, l. 2. c. 16. f. 5. &c. T. Ein Tunnen, LTinella. A. do account it the same with Tunnel or Funnel, and yet the T.L. and A. have different words, viz T. Tas, Trehter, and L. Vas and Infundibulum, A. Tunnel and Funnel. see Utensils.

TURF, 1.4. c. 9. f. T. Hin Grasz-buch, L. Caspes, A. Sods, Turf, Peat, which will admit further Discourses, viz. which of the three is best for melting Metals, when other Fuel is scarce: sa utensils.

TUTTEE. 1. 2. c. 39. s. 2. T. Tutian, L. Tutium, Pomphilix and spodium (which Pliny doth distinguish) but in A. they all go under the Name of Tuttee; which is nothing else but the the volatile part of Brass, when, in burning it sticks to the upper part of the Furnace, and the common sort of it is only Calamine stone calcined, of great use for Medicines.

VIAL or labels bone for Englosses at the elblein Pales

DAMES.C



APOUR, T. Dunst, and Damps, A.V apour, which ariseth sometimes from beat, and sometimes from cold causes. See Evaporate, Quickfilver and Sublime.

VERNISH, l. 2. c. 29. s. 4. T. Furnaess, L. Vernix; a compounded liquid substance made with Oyls and Gums, to make Metals or Metallick Utensils look slick, and resemble Glass, in which the Indians do excel.

VEINE, l. 2. c. 12. f. 1. T. Gengen, L. Vena, A. Veine, which Minsbaw (I suppose for sound-sake) writes vain, so making our veins but the efflux of vanities, but those who thought the Terrestial World to be a great Animal, and that the ebbing and slowing of Seas are but the systole and diastole of its breath, might well believe that Metals and Minerals were the Veins of its body; but of the nature of Metallick Veins, G. Agricola gives the most exact account.

VENETIAN Glass, h.2.c.16. s.5.T. Venidischem-glassz. L. Vitrum Venetianum, from the City Venice, where Erckern speaks that the best Glasses for Metallick use are made, and probably so in his time; but now that Art in Venice is thought to be equalled in England: see Glass.

VER DIGREASE, l. 2. c.27. f.1. T. Gruen-span, A. Spanish green, L. Ærugo, or the Rust of Copper, by hanging plates of it over the sumes of Wine, from whence a Crocus will arise, which we call Verdigrease; see Brass, Copper, and in Colours, Blew, Green-

VIAL or Glass Bottle, 1.2. c. 30. S. 1. T. Roelblein Fiale, and Angster, according to the proportions, L. Phiala and Ampulla.

pulla, A. Vial, to distinguish it from the Musical Instrument call'd Violi.

VINEGAR, l. 1. c. 33. f. 1. T.Essig. L. Acetum, A. Vinegar, now the various ways of making and using it, in Metallick experiments, may deserve a large Discourse, as being one

of the great fecrets of Nature.

VITRIOL, 1.2.c. 33, &c. T. Schuster-schwaeitz, L. Vitriolum and Calcanthum (which latter makes a black colour.) Now of Vitriol there are many natural sorts; but the three chief are 1 of a Saphire colour, (which comes from Hungary and Cyprus:) 2. of an Emeral or green colour (from Smethland and Goslar) often mentioned by Erckern; 3. a white (from Denmark &c.) there is also an Artificial Vitriol, made from Copper or Iron, or both, which is called Roman Vitriol, or Lapis Cælestis, from its transcendent vertues; of which (besides what Sir Kenelm Digby writes; I could add many from my own experiments but must refer them also to my intended Essays on Agricola; see Brass, Copper, and in Colours, Black.

tramarino, and is a Gem found in Mines, sometimes called Lapis Luzuli (often mentioned by Erckern, l. 1. c. 2. s. 1. 1,6.c.) and is of a pure blem, and of which (either considered as a Gem, Oar or Stone) the Italians do make a pretious Blem for Paint-

ers, fold beyond the price of Gold.

VOLATILE, 1.1. c.10. f.9. T. Flutch-tigon, L. Volatilis (which fignifies a Bird, Holiock) according to Paracellus it is used for any light matter, either ascending from Metals, or other light substances. See Quickfilver.

UPBUCKING, 1.4. c.14. fignifies forme extraordinary washings of Metals, and so the word upboyling, is more than

ordinary boyling.

URINE, 1.2. c. 8. s.2, &c. T, Dertlarne and Bruntz, L. Urina, from Uro, because it is of a scalding and burning nature, of great use about Metals, it is distilled and extracted, by a natural beat and internal Furnace in all Creatures, by which natural

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tural extraction, we learn the method of all salous productions. see Salt, &c.

UTENSILS, T. Branchers, L. Vtensillia, A. Instruments, useful tools, or houshold necessaries; but I must refer those which are mentioned by Erckern, to the Contents of the Sculptures, placed immediately before his first Book,) where you will find most of them recited, and referr'd to their pages, as also in the second part to their Capitals; only there is an omission of the T. and L. words for them, which will be rendred in Agricola.



WARDENS, l.i. e.i. T. Gwardeins, L. Guardianus, A. Guardian and Warden; I intended an addition herein, to shew that the Original of this word, as to an Official duty, was first given to the Warden of Mines, and that all other Offices which bear the Title of Wardens, were derivatives from thence, viz. of the Mines, Mint, Stanneries, Church, Ports, Fleet, Colledges and Companies, which I shall hereafter inlarge and place according to their Antiquities.

WARM, T. Warme and waerm, L. calidus, A. warm, that is to bring Metals into a moderate warmth or heat.

WARTZ, l. 1. c.35. T. Wartz, A. the Pin of the Beam, and these are little pieces of Iron (like Excrescencies) filed out of the Centre of the Ballance on each side of it, which are sitted for the two little boles of the Fork, whereby the Ballance is made capable to move, and from hence our English word Warts, for excrescencies on the bands, or other parts, is used.

WASHING,l.3. c. 2,&c. T. washein, L.Lavare, A. La-[M m] vations, vations, and Washings; Now you may have a full account of the manner of washing Metals in N.N. before recited.

WASTE, T. Vermuesten, L. Vastare, A. to waste, con-

fume or lessen the bulk of Metals.

WATER, T. Wasser, L. Aqua, ex qua omnia (as Scaliger and other more antient Philosophers define it.) See Erckern in many parts; and this subject of Waters might afford many pleasing Discourses of ours in England, and of such also as are of great natural uses in Metallick Operations besides Artificial, yielding curious varieties, especially from some Waters in those Countreys which do not consist of Mines, where the waters only by heat of the Sun, without their sire, do yield a perfect sediment of Gold Sands.

WAVER, T. Schwenneken, L. vagilare, A. to wag to

and fro: See Trembling.

WAX, T. Wachz, L. Cera, A. Wax. see Cement and Gluti-

WEATHER, l.1. c.34. s.8. T. Wetter, L. Æther, this hath great operation in Metals, for as the Weather, so Metals are bard or more dustile, &c.

WEIGHT, l. 1. c.36, &c. on which subject I did intend

to enlarge; See Measures, and Agricola de mensuris.

WELL, T. Brun, L. Puteus, A. Wells, for Springs of Wa-

ter, and called Shafts for Metallick Wells; see Mines.

WHEEL for waters, l. 4. c.8. T. Wasser-Radst, L. Haustrum, used for the raising of Waters out of Springs or Wells, with which the Miners wash and purge the Oars from the earth or rubbish, and then the Miners may say well, the Oars are well wash't with Well-water, but of the description of the several sorts of Wheels you will see more in Agricola

WHETSTONE, 1.1. c 34. f. 9. T. Wetzsteine, L. Cos, which is used to Metallick Instruments, and to rub Metalls.

WHITE, T. Wize and blank, L. Albus. see in Colours, White WINE, T. weine, L. Vinum, of various forts and uses in Erckern. See Pliny.

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WINE.

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WINE-Rone, See Argol Tartar.

WOOD, T Wald and Haltz L Lignum, A. Wood, of leveral forts for Metals, see Charcoal Coals.

WOOL, T. Wolt, L. Lana, used about Metals.

WRINCLE, T. Runtzel, L. Ruga, that is, Metal not polite, but shriveled, distorted, and full of contracted parts, unusual to

its natural smoothness, as in bands, faces, &c.

WYRE, T. Kufforn dratt, on Copper drawn, L. Aurum netum, i. e. Gold Wire, on Gold drawn or spun out of Gold; and Filum Auricalcum, or a kind of Thread drawn from Copper. A. Wyre, but I find no Monofyllable for it in any other Language.

XA XE

ANTHUS, a pretious stone, which Pliny 1.37. calls also Henni, of great virtue to give success in Mens Imployments, and consequently to Metallick Works, Erckern doth not mention this, but speaks of Hazel-Nuts, from which Plant, the Virgula Divina (or Divine Rod) is made, by which Mines of Gold and Silver are discovered; and one of these I have out of Germany, but I cannot yet promise any effects by it: See Georgius Agricola, and my Notes on him

XEROCOLLYRIUM, which is an unguent made of Copper, or Copper and Lapis Calaminaris mixt, to apply to such Eyes as are prejudiced by Metallick Operations, and this is help'd also by Tuttee, wash'd in mater, then made into powder, and so into an Oyntment, which is commonly called Unguentum Tutium or Oyl of Tuttee:

XIPHON,

XIPHION or Phasgenion, Pliny 1.25 the root of which Plant stampt and mixt with Wine and Frankincense of equal Proportions, takes off all excrescent Scales from Bones, and may have the like effect upon the scales of Metals.

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ARD, See Measures. YELLOW, T. Galb and Geilb, see in Colours, Yellow. YEST, T. Test, (but Erckern calls it Hasin, 1, 2. c. 1. s.) A. Test, also Barm, God's-good, Rifing, Beer-good, Foam, Froth: the Latines calls it Spuma: and the froth, flores Cervifia, or the Flower of Ale or Beer, and Cervifix they derive from Ceres, the Goddess of Corn, who first taught the sowing of Wheat and Barly, and of Drinks from thence : fo that in Norfolk where it is called Gods-good it may well be alluded to the spirit of that Goddess's Good which she infused into it, as a firmentation: but more properly to be attributed to God himself, for communicating fo great a Secret for the Benefit of Mankind: for without Fermentation scarce any useful thing is perfectly attained unto, and that Motion doth operate not only in the terrestrial Orb, both by sea and Land, but on the Elements and celestial Orbs. See Litarge.

YELLIM, which is an auguout made

dello by Intree, walled in water, then made into some and to into an Oyatmeer, which is commonly called Out.

mentum Partient or Oal of Tuttee.

zu De zu

ZUITTER, 1.4. c. 11, 12, and 13. explaind to be Tin well beaten, and its not only thus with Metals which must be beaten, (that the Advantages may redound to themselves in a more refined temper, and make them useful to the World) but we see that Corn must be thrashid, and ground for food: Grapes and other fruits contused to make Liquors more acceptable, and man himself must undergo Oppressions to make him happy, which I here mention as my Conclusion, in Imitation of Erclern his Zeal for God's Glory, wherewith he concludes the last page of his five Books; for according to the Maxim of the Rosy Crucians (and best Chimists) Excellentissima dona absque Pietate vana: which may be rendred thus, By true Piety the bravest Sciences are accomplished.

FINIS.

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LITTER, Later, and is not original to be which must be beaten, and is not original and which must be beaten, (that the advantages may redepund to themselves in a more refined temper, and appealed as a felial to the World) but we see that Cota must be themselved and ground for feel: Graper and other finite conducted to make Liquois more acceptable, and than himself must undergo oppression in historian happy, which I here mention as my Conclusion, in historianion of Erdera like Leal for Cod's for according to the Maxim of the list page of his five In ole; for according to the Maxim of the Kely Gravitary (and both may be rendred that. By thus Thepate want to when accomplished that, By thus Thepate want to when accomplished.

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