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Contributors

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$$\frac{32}{52} = \frac{10}{6} = \frac{8}{14}$$

$$\begin{array}{r} 52 \overline{)364} \\ 364 \\ \hline 0 \end{array}$$


Saturnus
Jupiter
Mars
Proserpina
Ceres et
Venus
Mercurius
Omnibus de caloremq
lucem
motum
Sua fovent
Mundo se illuminant
Universu ornant
Quid si sic?
Unam et alæ
Hic eius oculi
A Discourse
concerning
A NEW
World
&
Another Planet
In 2 Books
London
Printed in ye year
of our Lord 1708
The 5 Edition
N. Copernicus
Galilæus
Keplar



Effigies Reverendi admodum veri
Johannis Wilkins nuper Episcopi
Cestriensis.

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THE Norgans

Mathematical and *Philoſophical*

WORKS

Of the Right Reverend

JOHN WILKINS,

Late Lord Biſhop of *CHESTER.*

CONTAINING,

I. The Diſcovery of a New World: Or, a Diſcourſe tending to prove, that 'tis probable there may be another Habitable World in the Moon. With a Diſcourſe of the Poſſibility of a Paſſage thither.

II. That 'tis probable our Earth is One of the Planets.

III. *Mercury:* Or, *The Secret and Swift Meſſenger.* Shewing how a Man may with Privacy and Speed communicate his Thoughts to a Friend at any Diſtance.

IV. *Mathematical Magick:* Or the Wonders that may be perform'd by *Mechanical Geometry.*

V. An Abſtract of his Eſſay towards a *Real Character,* and a *Philoſophical Language.*

To which is prefix'd the AUTHOR's LIFE, and an Account of his Works.

LONDON:

Printed for *J. Nicholſon,* at the *King's-Arms* in *Little Britain*; *A. Bell,* at the *Croſs-Keys* in *Cornhill*; *B. Tooke,* at the *Middle-Temple-Gate* in *Fleetſtreet*; and *R. Smith* under the *Piazza's* of the *Royal-Exchange.* M DCC VIII.

1708

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THE LIFE of the AUTHOR: AND AN Account of his WRITINGS.

HE *was Son to* Walter Wilkins, *Citizen and Goldſmith of* Oxford; *was born at* Fawlſly, *near* Daventry, *in* Northamptonſhire, *in the Houſe of the Reverend and well known Mr.* John Dod, *who wrote upon the Commandments, he ing his Grandfather by the Mother's ſide. He was taught s* Latin *and* Greek *by* Edward Sylveſter, *a noted* Gre- an, *who kept a Private School in the Pariſh of* All Saints Oxford: *His Proficiency was ſuch, that at Thirteen Years Age he entred a Student in* New-Inn, *in* Eaſter-Term, 627. *He made no long ſtay there, but was remov'd to* Magdalen-Hall, *under the Tuition of Mr.* John Tombes, *d there he took his Degrees in Arts. He afterwards en- ed into Orders, and was firſt Chaplain to* William *Lord* ay, *and then to* Charles *Count Palatine of the* Rhine, *d Prince Elector of the Empire, with whom he continu- for ſome time.*

Upon the breaking out of the Civil War, he join'd with e Parliament, and took the Solemn League and Cove- nt. *He was afterwards made Warden of* Wadham Col- *e by the Committee of Parliament appointed for Reform- g the Univerſity; and being created Batchelor of Divinity,* pril 12. 1648. *was the Day following put in poſſeſſion of s Wardenſhip. Next Year he was created Doctor of Di- nity, and about that time took the* Engagement *then en- in'd by the Powers in being.*

In 1656. *he married* Robina, *the Widow of* Peter rench, *formerly Canon of* Chriſt-Church, *Siſter to* O- er, *then Lord Protector. In* 1659. *he was by* Richard *e Protector made Head of* Trinity *College in* Cambridge, *e beſt Preferment in that Univerſity.*

SO HE WOULD BE BORN 1614

After King Charles *the* IId's *Reſtoration, he was ejected from thence, and became Preacher to the Honourable Society of* Grays-Inn, *and Miniſter of St.* Lawrence Jury, London, *in the room of Dr.* Ward. *About this Time he became a Member of the* Royal Society, *was choſen one of their Council, and prov'd one of their moſt Eminent Members, and Chief Benefactors. Soon after this he was made Dean of* Rippon, *and by the Intereſt of the late Duke of* Buckingham, *he was created Biſhop of* Cheſter, *and conſecrated in the Chappel of* Ely-*Houſe in* Holbourn, *the* 15*th of* November, 1668. *by Dr.* Coſin, *Biſhop of* Durham, *Dr.* Laney, *Biſhop of* Ely; *and Dr.* Ward, *Biſhop of* Saliſbury; *on which Occaſion Dr.* Tillotſon, *afterwards Archbiſhop of* Canterbury, *preach'd an Excellent Sermon.*

He was a Perſon of great Natural Endowments, and by his Indefatigable Study attain'd to an Univerſal Inſight into all, or at leaſt moſt Parts of Uſeful Learning. He was a great Mathematician, and very much advanc'd the Study of Aſtronomy, *both while he was Warden of* Wadham *College in* Oxford, *and at* London, *when he was a Member of the* Royal Society. *He was as well ſeen in Mechanicks and Experimental Philoſophy as any Man in his Time, and was a great Promoter of them. In Divinity, which was his main Buſineſs, he excelled, and was a very Able Critick; his Talent of Preaching was admirable, and more ſuited to profit than to pleaſe his Hearers; he affected an Apt and Plain Way of Speech, and expreſs'd his Conceptions in a Natural Style. In his Writings he was Judicious and Plain, and valued not Circumſtances ſo much as the Subſtance. This appear'd evident in whatever Subject he undertook, which he always made eaſier for thoſe that came after him.*

He treated ſometimes on Matters that did not properly belong to his Profeſſion; but always with a Deſign to make Men wiſer and better; which was his chief End in promoting Univerſal Knowledge, and one of the main Reaſons for his entring into the Royal Society. *His Virtues and Graces were very uncommon; at leaſt as to that Degree of*

ther

hem to which he attain'd: His Prudence was very remark-
ible, and ſeldom fail'd him; but he was ſo Openhearted
nd Sincere himſelf, that he was ready (except he knew
ome Cauſe to the contrary) to think other Men to be ſo
oo; by which he was ſometimes impos'd on.

His Greatneſs of Mind was evident to all that knew
ny thing of him, nor was the Depth of his Judgment
leſs diſcernible. He never was eager in Purſuit of Dig-
nities; but was advanc'd to them by his Merit. He con-
temn'd Riches as much as others admir'd them; and ſpent
his Eccleſiaſtical Revenues in the Service of the Church
from which he receiv'd them; and being ſecur'd againſt
Want, he would often ſay, That he would be no Richer: *And his Conduct made it evident that he was as good as his word.*

He was a Stranger to Revenge, and yet not unſenſible of Perſonal Injuries, eſpecially ſuch as reflected on his Good Name, if they proceeded from ſuch as had a good Reputation of their own. The Reproaches of others he deſpis'd; but frequently wiſh'd he had been better underſtood by the former: He bore it, however, patiently, as his Misfortune; never requited them with the like meaſure; but always mention'd them with Reſpect, and laid hold on all Opportunities to oblige and do them good.

His Converſation was profitable and pleaſant; and his Diſcourſe was commonly of uſeful Things; without occaſioning Trouble or Wearineſs in thoſe that converſed with him. He cultivated that moſt neceſſary (but too much neglected) Part of Friendſhip, To give ſeaſonable Reproof, and wholſome Advice, upon Occaſion. This he did with a great deal of Freedom; but with ſo much Calmneſs and Prudence, that it ſeldom gave Offence.

He was particularly careful of the Reputation of his Friends; and would ſuffer no Blot to lye upon the Good Name or Memory of any of them, if he could help it.

His Enemies, who were Strangers to Moderation themſelves, made that Virtue in which he excell'd, the chief Subject of their Reproaches, as if he had been a Perſon of

unſteddy

unſteddy Principles, and not fixed in Matters of Religion; this drew ſevere Cenſures upon him from Archbiſhop Sheldon, *Biſhop* Fell, *and Archbiſhop* Dolben, *&c. without conſidering that he could not but have a great deal of Charity for Diſſenters, by reaſon of his Education under Mr.* John Dod *his Grandfather, a truly Pious and Learned Man; who diſſented in many Things from the Church of* England *long before the Separation which afterwards follow'd upon Archbiſhop* Laud's *Severities and new Impoſitions.*

And as his ſaid Grandfather never approv'd of the Extremities on the other Side, but continu'd Loyal to the laſt, and adviſ'd others to continue in their Allegiance; in like manner Doctor Wilkins, *(tho' he had Clearneſs when the Government was diſſolv'd, to ſubmit to the Powers then in Being, by which he procur'd an Intereſt and a Share in the Government of both Univerſities;) was always a Friend to thoſe who were Loyal, and continu'd well affected to the Church of* England, *and protected ſeveral of 'em by the Intereſt he had in the then Government.*

After the Reſtoration he conform'd himſelf to the Church of England, *and ſtood up for her Government and Liturgy; but diſlik'd Vehemence in little and unneceſſary Things, and freely cenſur'd it as Fanataciſm on both ſides.*

Having thus conform'd to the Church himſelf, he was very willing to bring over others: In which he was not without Succeſs, eſpecially in his own Dioceſe; where the Extremes on both Sides were as remarkable, as in moſt Parts of the Nation. Being a Perſon of Extenſive Charity himſelf, he was for an Indulgence and a Comprehenſion, in order to have brought our Diviſions in Matters of Religion to a Concluſion; which drew upon him the Hatred and Obloquy of thoſe who were for contrary Meaſures.

His indefatigable Pains in Study brought the Stone upon him; which prov'd incurable. He had for many days a Proſpect of Death; which he view'd in its Approaches, and gradual Advances upon him: And a few days before his Diſſolution, he frequently ſaid, That he found a Sen-

tence

tence of Death within himself. But in the height of his Pain and Apprehensions of Death, he shewed no Dismay or Surprize, nor was ever heard to utter a Word unbecoming a Wise Man, or a true Christian. And thus he concluded his Days with Constancy of Mind, Contempt of the World, and chearful Hopes of a Blessed Eternity, through Faith in our Lord Jesus Christ. He died in the House of his Friend Dr. Tillotson, *in* Chancery-lane *in* London, *on the 19th of* November, 1672. *and was buried on the 12th of* December *following, under the* North *Wall of the Chancel of the Church of St.* Lawrence Jewry, *where he had formerly been Minister. His Funeral Sermon was preach'd by Dr.* William Lloyd, *then Dean of* Bangor, *(now Lord Bishop of* Worcester*) at the* Guild-hall-Chappel *in* London; *by which, those who are Curious may be satisfy'd, that every Part of the Character here given him, may be justify'd to Advantage.*

As a further Proof of it, and particularly of his unwearied Endeavours to promote Universal Knowledge, 'tis proper to subjoin a Catalogue of his Works.

1. *The first was entitled,* The Discovery of a New World; or, A Discourse tending to prove, That ('tis probable) there may be another Habitable World in the Moon. *Printed at* London *in* 4to. 1638. *and had Four Editions, the last in* 1684.

2. Discourse concerning the Possibility of a Passage to the World in the Moon. *Printed with the* Discovery.

3. Discourse concerning a New Planet; tending to prove, That ('tis probable) our Earth is one of the Planets. *London,* 1640, *in* 8vo.

The Author's Name is put to none of the Three; but they were so well known to be his, that Langrenus, *in his Map of the Moon, (Dedicated to the King of* Spain*) calls one of the Spots of his Selenographick Map after his Name.*

4. *Mercury*; or, The Secret Messenger: Shewing how a Man may with Privacy and Speed communicate

cate his Thoughts to his Friend at any Diſtance. *London*, 1641. *The Publication of this was occaſion'd by the writing of a little thing, call'd* Nuncius Inanimatus, *by* Francis Goodwin.

5. Mathematical Magick; or, The Wonders that may be perform'd by Mechanical Geometry. In Two Books. *Printed at* London, *in* 1648. *and* 1680. *in* 8vo.

All theſe Five are entire in this Volume; Printed from the beſt Editions Corrected by the Author's own Hand.

6. *Eccleſiaſtes*; or, A Diſcourſe of the Gift of Preaching, as it falls under the Rules of Art. *London*, 1646, 47, 51, 53, *and* 75. 8vo.

7. Diſcourſe concerning the Beauty of Providence, in all the rugged Paſſages of it. *London*, 49. in 12o; *and in* 77. *the Fifth Edition, in* 8vo.

8. Diſcourſe concerning the Gift of Prayer; ſhewing what it is; wherein it conſiſts; and how far it is attainable by Induſtry, *&c.* *London*, 1653, *and* 1674. 8vo.

9. Of the Principles and Duties of Natural Religion. Two Books. *London*, 1675. 8vo. *Publiſhed by* John Tillotſon, *D. D.*

10. Sermons preach'd upon ſeveral Occaſions: *London*, 1682. 8vo. *They are in number Fifteen, publiſhed by Dr.* Tillotſon.

11. Eſſay towards a Real Character, and a Philoſophical Language. *London*, 1668. *Fol.*

An Alphabetical Dictionary: Wherein all *Engliſh* Words, according to their various Significations, are either referred to their Places in the Philoſophical Tables, or explain'd by ſuch Words as are in thoſe Tables. *This is printed with the* Eſſay.

This Book is mentioned in the laſt place, tho' it be not the laſt in Order of Time; becauſe the Deſign being extraordinary and very curious, and printed by Order of the Royal Society, *'twas thought proper to give an Abſtract of it at the End of this Volume.*

THE

The FIRST BOOK.

THE DISCOVERY OF A NEW WORLD.

OR,

A Discourse tending to prove, *That* ('tis probable) *there may be another Habitable World in the Moon.*

With a Discourse concerning the Possibility of a Passage thither.

The Fifth Impression; Corrected and Enlarged.

Quid tibi inquis ista proderunt? Si nihil aliud, hoc certè, sciam omnia hìc angusta esse. Seneca Præf. ad 1. Lib. Nat. Quæst.

By the Right Reverend Father in God, *JOHN WILKINS*, late Lord Bishop of *CHESTER*.

LONDON:

Printed for *John Nicholson* at the *King's-Arms* in *Little Britain*; *Benj. Tooke* at the *Middle Temple Gate* in *Fleetstreet*; *And. Bell* at the *Cross Keys and Bible* in *Cornhill*; and *Ralph Smith* under the *Piazza* of the *Royal-Exchange*. MDCCVII.

To the Reader.

IF amongſt thy Leiſure Hours, thou canſt ſpare any for the Peruſal of this Diſcourſe, and doſt look to find ſomewhat in it which may ſerve for thy Information and Benefit; let me then adviſe thee to come unto it with an equal Mind, not ſwayed by Prejudice, but indifferently reſolved to aſſent unto that Truth which upon deliberation ſhall ſeem moſt probable unto thy Reaſon; and then I doubt not, but either thou wilt agree with me in this Aſſertion, or at leaſt not think it to be as far from Truth, as it is from common Opinion.

Two Cautions there are, which I would willingly admoniſh thee of in the Beginning:

1. That thou ſhouldſt not here look to find an exact accurate Treatiſe; ſince this Diſcourſe was but the Fruit of ſome lighter Studies, and thoſe too huddled up in a ſhort time; being firſt thought of and finiſhed in the ſpace of one few Weeks; and therefore you cannot in reaſon expect that it ſhould be ſo poliſh'd, as perhaps the Subject would require, or the Leiſure of the Author might have given it.

2. To remember that I promiſe only probable Arguments for the Proof of this Opinion; and therefore you muſt not look that every Conſequence ſhould be of an undeniable Dependance; or that the Truth of each Argument ſhould be meaſured by its Neceſſity. I grant, that ſome Aſtronomical Appearances may poſſibly be ſolved otherwiſe than here they are: But the thing I aim at is this; that probably they may ſo be ſolved, as I have here ſet them down. Which, if it be granted (as I think it muſt) then I doubt not, but the indifferent Reader will find ſome Satisfaction in the Main Thing that is to be proved.

To the Reader.

Many ancient Philoſophers of the better Note, have formerly defended this Aſſertion which I have here laid down; and it were to be wiſhed, that ſome of us would more apply our Endeavours unto the Examination of theſe old Opinions; which, tho' they have for a long time lien neglected by others, yet in them may you find many Truths well worthy your Pains and Obſervation. 'Tis a falſe Conceit, for us to think that amongſt the ancient Variety and Search of Opinions, the beſt hath ſtill prevailed. Time (ſaith the Learned Verulam*) ſeems to be of the nature of a River or Stream; which carrieth down to us that which is light, or blown up, but ſinketh that which is weighty and ſolid.*

It is my deſire, that by the Occaſion of this Diſcourſe, I may raiſe up ſome more active Spirit to a Search after other hidden and unknown Truths: Since it muſt needs be a great Impediment unto the Growth of Sciences, for Men ſtill ſo to plod on upon beaten Principles, as to be afraid of entertaining any thing that may ſeem to contradict them. An Unwillingneſs to take ſuch things into Examination, is one of thoſe Errors of Learning, in theſe Times obſerved by the Judicious Verulam. *Queſtionleſs there are many ſecret Truths which the Ancients have paſſed over, that are yet left to make ſome of our Age famous for their Diſcovery.*

If by this Occaſion I may provoke any Reader to an Attempt of this Nature, I ſhall think my ſelf happy, and this Work ſucceſsful.

Farewell.

The

The Propoſitions that are proved in this Diſcourſe.

Propoſition I.

THat *the Strangeneſs of this Opinion is no ſufficient Reaſon why it ſhould be rejected; becauſe other cer-ain Truths have been formerly eſteemed ridiculous, and reat Abſurdities entertained by common Conſent.* By vay of Preface.

Prop. II.

That a Plurality of Worlds does not contradict any Principle of Reaſon or Faith.

Prop. III.

That the Heavens do not conſiſt of any ſuch pure Mat-er which can privilege them from the like Change and Corruption, as theſe Inferior Bodies are liable unto.

Prop. IV.

That the Moon is a Solid, Compacted, Opacous Body.

Prop. V.

That the Moon hath not any Light of her own.

Prop. VI.

That there is a World in the Moon, hath been the di-rect Opinion of many ancient, with ſome modern Mathe-maticians; and may probably be deduced from the Tenents of others.

Prop.

Prop. VII.

That those Spots and brighter Parts, which by our Sight may be distinguished in the Moon, do shew the Difference betwixt the Sea and Land in that other World.

Prop. VIII.

That the Spots represent the Sea, and the brighter Parts the Land.

Prop. IX.

That there are High Mountains, Deep Vallies, and Spacious Plains in the Body of the Moon.

Prop. X.

That there is an Atmo-Sphæra, or an Orb of gross vaporous Air, immediately encompassing the Body of the Moon.

Prop. XI.

That as their World is our Moon, so our World is their Moon.

Prop. XII.

That 'tis probable there may be such Meteors belonging to that World in the Moon, as there are with us.

Prop. XIII.

That 'tis probable there may be Inhabitants in this other World; but of what kind they are, is uncertain.

Prop. XIV.

That 'tis possible for some of our Posterity to find out a Conveyance to this other World; and, if there be Inhabitants there, to have Commerce with them.

The

The First Book.

That the Moon may be a World.

The first Propoſition, by way of Preface.

hat the Strangeneſs of this Opinion is no ſufficient Reaſon why it ſhould be rejected; becauſe other certain Truths have been formerly eſteem'd ridiculous, and great Abſurdities entertain'd by common Conſent.

THERE is an Earneſtneſs and Hungering after Novelty, which doth ſtill adhere unto all our Natures; and it is part of that Priitive Image, that wide Extent and infinite Capaty at firſt created in the Heart of Man. For this, ice its Depravation in *Adam*, perceiving it ſelf algether emptied of any good, doth now catch after ery new thing, conceiving that poſſibly it may d Satisfaction among ſome of its Fellow Creatures. t our Enemy the Devil (who ſtrives ſtill to pert our Gifts, and beat us with our own Weapons) th ſo contrived it, that any Truth doth now ſeem taſteful for that very reaſon, for which Error is tertain'd; Novelty. For let but ſome upſtart Heie be ſet abroach, and preſently there are ſome t of a curious Humour; others, as if they watchan occaſion of Singularity, will take it up for anonical, and make it part of their Creed and ofeſſion; whereas ſolitary Truth cannot any

where find ſo ready Entertainment; but the ſame Novelty which is eſteemed the Commendation of Error, and makes that acceptable; is counted the Fault of Truth, and cauſes that to be rejected.

How did the incredulous World gaze at *Columbus*, when he promiſed to diſcover another Part of the Earth? And he could not for a long time, by his Confidence or Arguments, induce any of the Chriſtian Princes, either to aſſent unto his Opinion, or go to the Charges of an Experiment. Now if he, who had ſuch good Grounds for his Aſſertion, could find no better Entertainment among the wiſer Sort, and upper End of the World; 'tis not likely then that this Opinion which I now deliver, ſhall receive any thing from the Men of theſe Days; eſpecially our Vulgar Wits, but Misbelief or Deriſion.

It hath always been the Unhappineſs of new Truths in Philoſophy, to be derided by thoſe that are ignorant of the Cauſes of Things; and rejected by others, whoſe Perverſeneſs ties them to the contrary Opinion; Men whoſe envious Pride will not allow any new Thing for Truth, which they themſelves were not the firſt Inventors of. So that I may juſtly expect to be accuſed of a pragmatical Ignorance, and bold Oſtentation; eſpecially, ſince for this Opinion *Xenophanes*, a Man whoſe Authority was able to add ſome Credit to his Aſſertion, could not eſcape the like Cenſure from others. For *Natale Comes* ſpeaking of that Philoſopher, and this his Opinion, ſaith thus; *Nonnulli ne nihil ſciſſe videantur aliqua nova monſtra in Philoſophiam introducunt, ut alicujus rei inventores fuiſſe appareant.* "Some there are "who leſt they might ſeem to know nothing, will "bring up monſtrous Abſurdities in Philoſophy "that ſo afterward they may be famed for the In"vention of ſomewhat." The ſame Author doth alſo in another Place accuſe *Anaxagoras* of Folly for the

Mythol. lib. 3. c. 17.

Lib. 7. c. 1.

ne ſame Opinion. *Eſt enim non ignobilis gradus ſtultiæ, vel ſi neſcias quid dicas, tamen velle de rebus propoſitis hanc vel illam partem ſtabilire.* "'Tis none of the worſt kinds of Folly, boldly to affirm one ſide or other, when a Man knows not what to ſay. If theſe Men were thus cenſur'd, I may juſtly nen expect to be derided by moſt, and to be beeved by few or none; eſpecially ſince this Opinin ſeems to carry in it ſo much Strangeneſs, and Contradiction to the General Conſent of others. ut however, I am reſolv'd that this ſhall not be ay Diſcouragement, ſince I know that it is not comnon Opinion that can either add or detract from ne Truth. For,

1. Other Truths have been formerly eſteemed algether as ridiculous as this can be.

2. Groſs Abſurdities have been entertained by geeral Opinion.

I ſhall give an Inſtance of each, that ſo I may ne better prepare the Reader to conſider Things ithout a Prejudice; when he ſhall ſee that the comnon Oppoſition againſt this which I affirm, cannot ny way derogate from its Truth.

1. Other Truths have been formerly accounted ridiculous as this. I ſhall ſpecify that of the *Antipodes*, which have been denied, and laught at by nany wiſe Men and great Scholars; ſuch as were *Herodotus*, *Chryſoſtom*, *Auſtin*, *Lactantius*, the venerale *Bede*, *Lucretius* the Poet, *Procopius*, and the voluminous *Abulenſis*, together with all thoſe Fathers or ther Authors who denied the Roundneſs of the Heavens. *Herodotus* counted it ſo horrible an Abirdity, that he could not forbear laughing to think f it. Γελῶ ὁρῶν γῆς περιόδους γράψαντας, πολλοὺς ἤδη κἀ ἀλόγους λέγοντας ἐξηγησάμενον δὲ Ὠκεανόντε ῥέοντα γράφουσι, πέριξ τιὼ τε γαῖαν ἔδειαν κυκλοτερέα ὡς ἀπὸ τόρνου. "I cannot chuſe but laugh, (ſaith he) to ſee ſo many Men venture to deſcribe the Earths Compaſs,

Vid. Joſep. Acoſta. de nat. novi orbis, l. 1. cap. 1.

" rela-

"relating thoſe things that are without all Senſe
"as that the Sea flows about the World, and that the
"Earth it ſelf is round as an Orb." But this great Ignorance is not ſo much to be admired in him, as in thoſe learneder Men of later Times, when all Sciences began to flouriſh in the World. Such were St. *Chryſoſtom*, who in his 14th *Homily* upon the Epiſtle to the *Hebrews*, does make a Challenge to any Man that ſhall dare to defend that the Heavens are round, and not rather as a Tent. Thus likewiſe St. *Auſtin*, who cenſures that Relation of the *Antipodes* to be an incredible Fable; and with him agrees the Eloquent *Lactantius*. *Quid illi qui eſſe contrarios veſtigiis noſtris Antipodes putant? num aliquid loquuntur? aut eſt quiſpiam tam ineptus, qui credat eſſe homines, quorum veſtigia ſunt ſuperiora quam capita? aut ibi quæ apud nos jacent inverſa pendere? fruges & arbores deorſum verſus creſcere, pluvias & nives, & grandinem ſurſum verſus cadere in terram? & miratur aliquis hortos penſiles inter ſeptem mira narrari, quum Philoſophi, & agros & maria, & urbes & montes penſiles faciunt, &c.*" What (ſaith he) are they that think there are "Antipodes, ſuch as walk with their Feet againſt ours? "do they ſpeak any likelihood; or is there any one "ſo fooliſh as to believe that there are Men whoſe "Heels are higher than their Heads? that things "which with us do lie on the Ground, do hang "there? that the Plants and Trees grow down-"wards, that the Hail, and Rain, and Snow fall up-"wards to the Earth? and do we admire the hang-"ing Orchards amongſt the Seven Wonders, where-"as here the Philoſophers have made the Fields and "Seas, the Cities and Mountains hanging?" What ſhall we think (ſaith he in *Plut.*) that Men do cling to that Place like Worms, or hang by their Claws as Cats? or if we ſuppoſe a Man a little beyond the Center, to be digging with a Spade, is it likely (as it muſt be according to this Opinion) that the Earth which he

De civit. Dei l. 16. cap. 9.

Inſtitut. l. 3. c. 24.

looſened, ſhould of it ſelf aſcend upwards? Or
e ſuppoſe two Men with their Middles about the
nter, the Feet of the one being placed where the
ad of the other is, and ſo two other Men croſs
m; yet all theſe Men thus ſituated, according to
s Opinion ſhould ſtand upright; and many other
h groſs Conſequences would follow (ſaith he)
ich a falſe Imagination is not able to fancy as
ſible. Upon which Conſiderations, *Bede* alſo de-
s the Being of any Antipodes, *Neque enim Anti-*
larum ullatenus eſt Fabulis accommodandus aſſenſus.
Nor ſhould we any longer aſſent to the Fable of
Antipodes." So alſo *Lucretius* the Poet ſpeaking
the ſame Subject, ſays,

Sed vanus ſtolidis hæc omnia finxerit error.
That ſome idle Fancy feigned theſe for Fools to
ieve. Of this Opinion was *Procopius Gazæus*;
t he was perſuaded to it by another kind of Rea-
n; for he thought that all the Earth under us was
nk in the Water, according to the Saying of the
lmiſt, He hath founded the Earth upon the Seas; and
erefore he accounted it not inhabited by any.
y, *Toſtatus*, a Man of later Years and general
arning, doth alſo confidently deny that there are
y ſuch Antipodes, though the Reaſon which he
ges for it be not ſo abſurd as the former; for the
oſtles, ſaith he, travelled through the whole ha-
able World, but they never paſſed the Equinocti-
l: And if you anſwer, that they are ſaid to go
rough all the Earth, becauſe they went through
the known World; he replies, That this is not
fficient, ſince Chriſt would have all Men to be
red, and come to the knowledge of his Truth,
d therefore 'tis requiſite that they ſhould have tra-
lled thither alſo, if there had been any Inhabi-
nts; eſpecially ſince he did expreſly command
em to go and teach *all Nations*, and preach the
aſpel through the *whole World*: And therefore he
thinks,

De ratione temporum, Cap. 32.

De nat. rerum Lib. 1.

Comment. in 1. *Cap. Gen.*

Pſal. 24. 2.

Comment. in 1 *Geneſ.*

1 Tim. 2. 4.

Matt. 28. 19.

thinks, that as there are no Men, ſo neither a there Seas, or Rivers, or any other Convenienc for Habitation. 'Tis commonly related of one *Vi gilius*, that he was Excommunicated and Condem ed for a Heretick by *Zachary* Biſhop of *Rome*, b cauſe he was not of the ſame Opinion. But *Baro us* ſays, it was becauſe he thought there was an ther Habitable World within ours. However, y may well enough diſcern in theſe Examples, ho confident many of theſe great Scholars were in groſs an Error; how unlikely, what an incredib thing it ſeemed to them, that there ſhould be a Antipodes; and yet now this Truth is as certain a plain, as Senſe or Demonſtration can make This then which I now deliver, is not to be jected, though it may ſeem to contradict the co mon Opinion.

Aventinus Annal. Boiorum. lib. 3.

Annal. Eccleſ. A. D. 748.

2. Groſs Abſurdities have been entertained by g neral Conſent. I might inſtance in many remark ble Examples, but I will only ſpeak of the ſuppoſ Labour of the Moon in her Eclipſes, becauſe thi neareſt to the chief Matter in Hand, and was ceived as a common Opinion amongſt many of t Ancients; inſomuch, that from hence they ſtil Eclipſes by the Name of πάθη *Paſſions*, or in t Phraſe of the Poets,

Solis lunæq; labores.

And therefore *Plutarch* ſpeaking of a Lunary Eclip relates, that at ſuch times 'twas a Cuſtom amon the *Romans*, (the moſt Civil and Learned People the World) to ſound Braſs Inſtruments, and h great Torches toward the Heaven. Τῶν δ' Ρωμαίων (ὥσ ὄξιν ἐνομισμένον) χαλκᾶ τε πατάγοις ἀναπαλαιμένων τὸ φῶς αὐτῆ πυρὰ πολλὰ δαλοῖς καὶ δαισὶν ἀνεχόντων πρὸς τὸν ἔρανον. For this means they ſuppoſed the Moon was much eaſed her Labours; and therefore *Ovid* calls ſuch loud I ſtruments, the Auxilaries or Helps of the Moon,

In vita Paul Æmil.

Metam. Lib. 4.

Cum fruſtra reſonant æra auxiliaria Lunæ.

A

nd therefore the Satyriſt too, deſcribing a loud cold, ſays, She was able to make Noiſe enough to eliver the Labouring Moon.

Una laboranti poterit ſuccurrere Lunæ. *Juven. Sat. 6.*

Now the reaſon of all this their Ceremony, was, ecauſe they feared the World would fall aſleep, hen one of its Eyes began to wink, and therefore ey would do what they could by loud Sounds to uze it from its Drowſineſs, and keep it awake; by ight Torches, to beſtow that Light upon it which began to loſe.

Some of them thought hereby to keep the Moon her Orb, whereas otherwiſe ſhe would have fallen own upon the Earth, and the World would have ſt one of its Lights; for the credulous People be-eved that Inchanters and Witches could bring the Moon down; which made *Virgil* ſay,

Cantus & è cœlo poſſunt deducere Lunam.

nd thoſe Wizards knowing the times of her Eclip-s, would then threaten to ſhew their Skill, by pul-ng her out of her Orb. So that when the ſilly ultitude ſaw that ſhe began to look red, they reſently feared they ſhould loſe the Benefit of her ight, and therefore made a great noiſe that ſhe ight not hear the ſound of thoſe Charms, which ould otherwiſe bring her down; and this is ren-ed for a Reaſon of this Cuſtom by *Pliny* and *Pro-rtius*: *Nat. Hiſt. Lib. 2. c. 12.*

Cantus & è curru lunam deducere tentant,
Et facerent, ſi non æra repulſa ſonent.

Plutarch gives another Reaſon of it; and he ſays, s becauſe they would haſten the Moon out of the rk Shade wherein ſhe was involv'd, that ſo ſhe ight bring away the Souls of thoſe Saints that in-bit within her, which cry out by reaſon they are en deprived of their wonted Happineſs, and can-ot hear the Muſick of the Spheres; but are forced behold the Torments and Wailings of thoſe Damn-

ed

ed Souls which are repreſented to them as they a
tortured in the Region of the Air. But wheth
this, or whatever elſe was the meaning of this S
perſtition, yet certainly 'twas a very ridiculous C
ſtom, and bewrayed a great Ignorance of thoſe a
cient Times; eſpecially ſince it was not only r
ceived by the Vulgar, ſuch as were Men of l
Note and Learning, but believed alſo by the mo
Famous and Wiſer Sort; ſuch as were thoſe gre
Poets, *Steſichorus* and *Pindar*: And not only among
the more ſottiſh Heathens, who might account th
Planet to be one of their Gods, but the Primiti
Chriſtians alſo were in this kind guilty; which ma
St. *Ambroſe* ſo tartly to rebuke thoſe of his tim
when he ſaid, *Tum turbatur carminibus Globus Lun
quando calicibus turbantur & oculi.* "When yo
"Heads are troubled with Cups, then you thi
"the Moon to be troubled with Charms."

Turinenſ. Epiſc. And for this Reaſon alſo did *Maximus* a Biſho
write a Homily againſt it, wherein he ſhewed th
Abſurdity of that fooliſh Superſtition. I rememb
that *Ludovicus Vives* relates a more ridiculous Sto
of a People that impriſon'd an Aſs for drinking u
the Moon, whoſe Image appearing in the Wate
was covered with a Cloud as the Aſs was drinking
for which the poor Beaſt was afterward brought
the Bar, to receive a Sentence according to his D
ſerts; where the grave Senate being ſet to examin
the Matter, one of the Counſel (perhaps wiſer tha
the reſt) riſes up, and out of his deep Judgmen
thinks it not fit that their Town ſhould loſe its Moo
but that rather the Aſs ſhould be cut up, and th
taken out of him; which Sentence being approve
by the reſt of thoſe Politicians, as the ſubtileſt wa
for the concluſion of the Matter, was according
performed. But whether this Tale were true or n
I will not queſtion; however, there is Abſurdity
nough in that former Cuſtom of the Ancients, th

ma

nay confirm the Truth to be proved, and plainly eclare the Inſufficiency of common Opinion to dd true Worth or Eſtimation unto any thing. So hat from that which I have ſaid, may be gathered hus much.

1. That a new Truth may ſeem abſurd and im-oſſible, not only to the Vulgar, but to thoſe alſo who are otherwiſe wiſe Men and excellent Scholars: And hence it will follow, that every new thing which ſeems to oppoſe common Principles, is not reſently to be rejected, but rather to be pry'd into with a diligent Enquiry, ſince there are many things which are yet hid from us, and reſerv'd for future Diſcovery.

2. That it is not the Commonneſs of an Opinion hat can privilege it for a Truth; the wrong way ſometimes a well-beaten Path, whereas the right ay (eſpecially to hidden Truths) may be leſs trod-en and more obſcure.

True indeed, the ſtrangeneſs of this Opinion will etract much from its Credit; but yet we ſhould now that nothing is in it ſelf ſtrange, ſince every Natural Effect has an equal dependance upon its Cauſe, and with the like neceſſity doth follow from ; ſo that 'tis our Ignorance which makes things ppear ſo: And hence it comes to paſs, that many ore evident Truths ſeem incredible, to ſuch who now not the cauſes of Things. You may as ſoon erſuade ſome Country Peaſants that the Moon is ade of Green Cheeſe, (as we ſay) as that 'tis big-er than his Cart-wheel, ſince both ſeem equally to ontradict his ſight, and he has not Reaſon enough lead him farther than his Senſes. Nay, ſuppoſe (ſaith *Plutarch*) a Philoſopher ſhould be educated in ch a ſecret Place, where he might not ſee either ea or River, and afterwards ſhould be brought out here one might ſhew him the great Ocean, tel-ng him the Quality of that Water, that it is brack-iſh,

iſh, ſalt, and not potable, and yet there were many vaſt Creatures of all Forms living in it, which make uſe of the Water as we do of the Air; queſtionleſs he would laugh at all this, as being monſtrous Lyes and Fables, without any Colour of Truth. Juſt ſo will this Truth which I now deliver appear unto others, becauſe we never dreamt of any ſuch Matter as a World in the Moon; becauſe the State of that Place hath as yet been vailed from our knowledge, therefore we can ſcarcely aſſent to any ſuch Matter. Things are very hardly received, which are altogether ſtrange to our Thoughts and our Senſes. The Soul may with leſs difficulty be brought to believe any Abſurdity, when as it has formerly been acquainted with ſome Colours and Probabilities for it; but when a new, and an unheard-of Truth ſhall come before it, though it have good Grounds and Reaſons, yet the Underſtanding is afraid of it as a Stranger, and dares not admit it into his Belief without a great deal of Reluctancy and Trial. And beſides, things that are not manifeſted to the Senſes, are not aſſented unto without ſome Labour of Mind, ſome Travel and Diſcourſe of the Underſtanding; and many lazy Souls had rather quietly repoſe themſelves in an eaſy Error, than take pains to ſearch out the Truth. The ſtrangeneſs then of this Opinion which I now deliver, will be a great hindrance to its Belief; but this is not to be reſpected, by reaſon it cannot be helped. I have ſtood the longer in the Preface, becauſe that Prejudice which the meer Title of the Book may beget, cannot eaſily be removed without a great deal of Preparation; and I could not tell otherwiſe how to rectify the Thoughts of the Reader, for an impartial Survey of the following Diſcourſe.

I muſt needs confeſs, though I had often thought with my ſelf that it was poſſible there might be a World in the Moon, yet it ſeemed ſuch an uncouth

Opini

pinion, that I never durſt diſcover it, for fear of ing counted ſingular and ridiculous; but after-ard, having read *Plutarch*, *Galileus*, *Keplar*, with ne others, and finding many of mine own noughts confirmed by ſuch ſtrong Authority, I then ncluded that it was not only poſſible there might , but probable that there was another Habitable orld in that Planet. In the proſecuting of this ſertion, I ſhall firſt endeavour to clear the way m ſuch Doubts as may hinder the ſpeed or eaſe farther Progreſs. And becauſe the Suppoſitions ply'd in this Opinion, may ſeem to contradict the inciples of Reaſon or Faith, it will be requiſite at I firſt remove this Scruple, ſhewing the Con-rmity of them to both theſe, and proving thoſe ruths that may make way for the reſt; which I ll labour to perform in the ſecond, third, fourth, d fifth Chapters, and then proceed to confirm ch Propoſitions which do more directly belong to e main Point in hand.

PROP. II.

at a Plurality of Worlds doth not contradict any Principle of Reaſon or Faith.

IS reported of *Ariſtotle*, that when he ſaw the Books of *Moſes*, he commended them for ſuch Majeſtick Stile as might become a God; but with-he cenſured that manner of Writing to be very fitting for a Philoſopher; becauſe there was no-ing proved in them, but Matters were delivered as they would rather command than perſuade Belief. nd 'tis obſerved, that he ſets down nothing himſelf, t he confirms it by the ſtrongeſt Reaſons that may

be found, there being ſcarce an Argument of fo
for any Subject in Philoſophy, which may not
picked out of his Writings; and therefore 'tis lik
if there were in Reaſon a neceſſity of one o
World, that he would have found out ſome ſuch
ceſſary Proof as might confirm it; eſpecially ſi
he labours for it ſo much in two whole Chapt
But now all the Arguments which he himſelf ur
De Cælo l. 1. c. 8, 9. in this Subject, are very weak, and far enough fr
having in them any convincing Power. Theref
'tis likely that a Plurality of Worlds doth not c
tradict any Principle of Reaſon. However, I
ſet down the two chief of his Arguments from
own Works, and from them you may gueſs the fo
of the other.

Ibid. The Firſt is this: Since every heavy Body d
naturally tend downwards, and every light Body
wards, what a huddling and confuſion muſt there
if there were two Places for Gravity, and two
ces for Lightneſs? for it is probable that the Ea
of that other World would fall down to this Cen
and ſo mutually the Air and Fire here aſcend
thoſe Regions in the other; which muſt needs m
derogate from the Providence of Nature, and ca
De operibus Dei, par. 2. lib. 2. cap. 2. a great Diſorder in his Works. But *ratio hæc eſt nimè firma*, (ſaith *Zanchy.*) And if you well co
der the Nature of Gravity, you will plainly ſee th
is no Ground to fear any ſuch Confuſion; for H
vineſs is nothing elſe but ſuch a Quality as cauſe
Propenſion in its Subject to tend downwards tow
its own Centre: So that for ſome of that Earth
come hither, would not be ſaid a Fall, but an Aſc
ſion, ſince it is moved from its own Place; and
would be impoſſible (ſaith *Ruvio*) becauſe aga
De Cælo l. 1. c. 9. q. 1. Nature, and therefore no more to be feared t
the falling of the Heavens.

If you reply, that then according to this, there ıuſt be more Centres of Gravity than one; I anwer, 'Tis very probable there are; nor can we well onceive what any piece of the Moon would do, beıg ſevered from the reſt in the free and open Air, ut only return unto it again.

Another Argument he had from his Maſter *Plato*, hat there is but one World, becauſe there is but ne firſt Mover, God. *Metaphyſ. l. 12. c. 8. Diog. Laert. lib. 3.*

Infirma etiam eſt hæc ratio (ſaith *Zanchy*); and we ıay juſtly deny the Conſequence, ſince a Plurality f Worlds doth not take away the unity of the firſt Iover, *Ut enim forma ſubſtantialis, ſic primum efficiens pparentem ſolummodo multiplicitatem induit per ſignatam ıateriam* (ſaith a Countryman of ours.) As the ſubtantial Form, ſo the efficient Cauſe hath only an ppearing Multiplicity from its particular Matter. 'ou may ſee this Point more largely handled, and heſe Arguments more fully anſwered by *Plutarch* in is Book, *Why Oracles are Silent*, and *Jacob Carpenrius* in his Comment on *Alcinous*. *Nic. Hill. de Philoſoph. Epic. part. tic. 379*

But our Oppoſites, the Interpreters themſelves, who too often do *jurare in verba magiſtri*) will rant that there is not any ſtrength in theſe Conſeuences; and certainly then ſuch weak Arguments ould not convince that wiſe Philoſopher, who in is other Opinions was wont to be ſwayed by the trength and power of Reaſon; wherefore I ſhould ather think that he had ſome by-reſpect, which ıade him firſt aſſent to this Opinion, and afterwards rive to prove it. Perhaps it was becauſe he feared o diſpleaſe his Scholar *Alexander*; of whom 'tis reıted, that he wept to hear a Diſputation of another Vorld, ſince he had not then attained the Monarhy of this; his reſtleſs wide Heart would have eeemed this Globe of Earth not big enough for him, f there had been another; which made the Satyriſt ay of him, *Plutarch. de tranq. anim.*

Juvenal. *Æſtuat infœlix anguſto limite mundi.*

" That he did vex himſelf, and ſweat in his Deſires " as being penn'd up in a narrow Room, when he " was confin'd but to one World." Before, he thought to ſeat himſelf next the Gods, but now when he had done his beſt, he muſt be content with ſome equal, or perhaps ſuperior Kings.

It may be, that *Ariſtotle* was moved to this Opinion, that he might thereby take from *Alexander* the occaſion of this Fear and Diſcontent; or elſe, perhaps, *Ariſtotle* himſelf was as loth to hold the Poſſibility of a World which he could not diſcover, as *Alexander* was to hear of one which he could not conquer. 'Tis likely that ſome ſuch by-reſpect moved him to this Opinion, ſince the Arguments he urges for it are confeſs'd by his zealous Followers and Commentators, to be very ſlight and frivolous; and they themſelves grant, what I am now to prove that there is not any Evidence in the Light of Natural Reaſon, which can ſufficiently manifeſt that there is but one World.

But however, ſome may object, Would it not be inconvenient and dangerous to admit of ſuch Opinions that do deſtroy thoſe Principles of *Ariſtotle* which all the World hath ſo long followed?

Apologia pro Galilæo. This Queſtion is much controverted by ſome of the *Romiſh* Divines: *Campanella* hath writ a Treatiſe in Defence of it, in whom you may ſee many things worth the Reading and Notice.

To it I anſwer, That this Poſition in Philoſophy doth not bring any Inconveniency to the reſt, ſince 'tis not *Ariſtotle*, but Truth, that ſhould be the Rule of our Opinions; and if they be not both found together, we may ſay to him, as he ſaid to his Maſter *Plato*,

Ethic. l. 1. c. 6. " Though *Plato* were his Friend, yet he would rather adhere to Truth than him.

I mu

I muſt needs grant, that we are all much beholden to the Induſtry of the ancient Philoſophers, and more eſpecially to *Ariſtotle*, for the greater part of our Learning; but yet 'tis not Ingratitude to ſpeak againſt him, when he oppoſeth Truth; for then many of the Fathers would be very guilty, eſpecially *Juſtin*, who hath writ a Treatiſe purpoſely againſt him. But ſuppoſe this Opinion were falſe, yet 'tis not againſt the Faith, and ſo it may ſerve for the better Confirmation of that which is true; the Sparks of Error being forc'd out by oppoſition, as the Sparks of Fire by the ſtriking of the Flint and Steel. But ſuppoſe too that it were Heretical, and againſt the Faith, yet may it be admitted with the ſame Privilege as *Ariſtotle*, from whom many more dangerous Opinions have proceeded: As that the World is Eternal; that God cannot have while to look after theſe inferior Things; that after Death there is no Reward or Puniſhment, and ſuch like Blaſphemies; which ſtrike directly at the Fundamentals of our Religion.

So that it is juſtly to be wonder'd, why ſome ſhould be ſo ſuperſtitious in theſe Days, as to ſtick cloſer unto him, than unto Scripture, as if his Philoſophy were the only Foundation of all Divine Truths.

Upon theſe Grounds, both St. *Vincentius* and *Seraſinus de Firmo* (as I have ſeen them quoted) think that *Ariſtotle* was the Viol of God's Wrath, which was poured out upon the Waters of Wiſdom by the third Angel: But for my part, I think the World is much beholden to him for all his Sciences. But yet 'twere a ſhame for theſe later Ages, to reſt our ſelves meerly upon the Labours of our Fore fathers, as if they had informed us of all things to be known; and when we are ſet upon their Shoulders, not to ſee further than they themſelves did. 'Twere a ſuperſtitious, a lazy Opinion, to think *Ariſtotle*'s Works the Bounds and Limits of all Human Invention, be- Rev. 16. 4.

yond which there could be no poſſibility of reaching. Certainly there are yet many things left to Diſcovery, and it cannot be any Inconveniency for us to maintain a new Truth, or rectifie an ancient Error.

But the Poſition (ſay ſome) is directly againſt Scripture; for,

1. *Moſes* tells us but of one World, and his Hiſtory of the Creation had been very imperfect, if God had made another.

2. St. *John* ſpeaking of God's Works, ſays, he made the World, in the ſingular Number, and therefore there is but one. 'Tis the Argument of *Aquinas*, and he thinks that none will oppoſe it, but ſuch who with *Democritus* eſteem ſome blind Chance, and not any wiſe Providence, to be the Framer of all Things.

Part 1. Q. 47. *Art.* 3.

3. The Opinion of more Worlds has in ancient Times been accounted a Hereſie; and *Baronius* affirms that for this very Reaſon *Virgilius* was caſt out of his Biſhoprick, and Excommunicated from the Church.

Annal. Eccl. A. D. 748.

4. A fourth Argument there is urged by *Aquinas*: If there be more Worlds than one, then they muſt either be of the ſame, or of a diverſe Nature; but they are not of the ſame kind; for this were needleſs, and would argue an Improvidence, ſince one would have no more perfection than the other: Not of divers kinds; for then one of them could not be called the World or Univerſe, ſince it did not contain univerſal Perfection. I have cited this Argument, becauſe it is ſo much ſtood upon by *Julius Cæſar la Galla*, one that has purpoſely writ a Treatiſe againſt this Opinion which I now deliver; but the Dilemma is ſo blunt, that it cannot cut on either ſide, and the Conſequences ſo weak, that I dare truſt them without an Anſwer: And (by the way) you may ſee this later Author in that place, where he endea-

Ibid.

De Phenom. in orbe Lunæ.

ıdeavours to prove a Neceſſity of one World, doth ave the chief Matter in hand, and take much need-ſs Pains to diſpute againſt *Democritus*, who thought at the World was made by the caſual Concourſe of *toms* in a great *Vacuum*. It ſhould ſeem that either s Cauſe or his Skill was weak, or elſe he would have ntured upon a ſtronger Adverſary. Theſe Argu-ents which I have ſet down are the chiefeſt which have met with againſt this Subject; and yet the eſt of theſe hath not force enough to endanger the ruth that I have delivered.

Unto the two firſt it may be anſwered, that the egative Authority of Scripture is not prevalent in hoſe things which are not the Fundamentals of Re-gion.

But you'll reply, though it do not neceſſarily con-lude, yet 'tis probable if there had been another Vorld, we ſhould have had ſome notice of it in cripture.

I anſwer, 'tis as probable that the Scripture ſhould ave informed us of the Planets, they being very emarkable Parts of the Creation; and yet neither *Moſes*, nor *Job*, nor the *Pſalms* (the Places moſt requent in Aſtronomical Obſervations) nor any o-her Scripture mention any of them but the Sun and Moon. Becauſe the Difference betwixt them and he other Stars, was known only to thoſe who were earned Men, and had Skill in *Aſtronomy*. As for hat Expreſſion in *Job* כוכבי בקר *the Stars of the Morning*, it is in the Plural Number, and therefore cannot properly be applied to *Venus*. And for that n *Iſaiah* הילל, 'tis confeſſed to be a Word of obſcure Interpretation, and therefore is but by gueſs tranſla-ed in that Senſe. It being a true and common Rule, hat *Hebræi rei ſideralis minime curioſi cœleſtium nominum penuriâ laborant*. The *Jews* being but little skilled in Aſtronomy, their Language does want proper Ex-preſſions for the Heavenly Bodies; and therefore they are

Job 38.7. Iſa.14.12. *Fromond. Veſta t.* 3. *cap.* 2. So 2 Reg. 23.5. מזלות Which is interpreted both for the Planets & for the 12 Signs.

are fain ſometimes to attribute the ſame Name unt divers Conſtellations.

Now if the Holy Ghoſt had intended to reveal ur to us any natural Secrets, certainly he would neve have omitted the mention of the Planets, *Quorum m tu nihil eſt quod de Conditoris ſapientiâ teſtatur evidenti apud eos qui capiunt.* Which do ſo evidently ſet fort the Wiſdom of the Creator. And therefore you mu know that 'tis beſides the Scope of the Old Teſtamen or the New, to diſcover any thing unto us concern ing the Secrets of Philoſophy. 'Tis not his intent i the New Teſtament, ſince we cannot conceive hov it might any way belong either to the Hiſtorical, Ex egetical, or Prophetical Parts of it: Nor is it hi intent in the Old Teſtament, as is well obſerved b our Country-man Maſter *Wright*. *Non Moſis aut Pr phetarum inſtitutum fuiſſe videtur Mathematicas aliqua aut Phiſicas ſubtiltates promulgare ſed ad vulgi captum & loquendi morem, quemadmodum nutrices infantulis ſolent ſeſe accommodare.* " 'Tis not the Endeavour of *Moſe* " or the Prophets to diſcover any Mathematical o " Philoſophical Subtilties; but rather to accommodat " themſelves to Vulgar Capacities, and ordinary " Speech, as Nurſes are wont to uſe their Infants." True indeed, *Moſes* is there to handle the Hiſtory o the Creation. But 'tis certain (ſaith *Calvin*) that hi Purpoſe is to treat only of the viſible Form of the World, and thoſe Parts of it which might be moſt eaſily underſtood by the ignorant and ruder Sort o People, and therefore we are not thence to expect the Diſcovery of any natural Secret. *Artes reconditas aliunde diſcat qui volet; hic ſpiritus Dei omnes ſimul ſine exceptione docere voluit.* As for more hidden Arts, they muſt be looked for elſewhere; the Holy Ghoſt did here intend to inſtruct all without Exception. And therefore 'tis obſerved, that *Moſes* does not any where meddle with ſuch Matters as were very hard to be conceived; for being to inform the common

Keplar. introduct. in Mart.

In Epiſt. ad Gilbert.

Calvin in 1. Gen.

Peo-

eople as well as others, he does it after a Vulgar
'ay, as it is commonly noted, declaring the Origi-
al chiefly of thoſe things which are obvious to the
enſe; and being ſilent of other things which then
ould not well be apprehended. And therefore *Pe-* *Com. in*
rius propoſing the Queſtion, why the Creation of *1. Gen. 11.*
lants and Herbs is mentioned, but not of Metals
nd Minerals?

Anſwers: *Quia iſtarum rerum generatio eſt vulgo oc-*
lta & ignota: Becauſe theſe things are not ſo com-
only known as the other; and he adds, *Moſes non*
nnia, ſed manifeſta omnibus enarranda ſuſcepit. Moſes
id not intend to relate unto us the Beginnings of all
ings, but thoſe only which were moſt evident un-
o all Men. And therefore too, *Aquinas* obſerves, *Part 1. Q.*
hat he writes nothing of the Air; becauſe that be- *68. Art. 3.*
g inviſible, the People knew not whether there
ere any ſuch Body or no. And for this very rea-
on St. *Jerom* alſo thinks that there is nothing expreſt *Epiſt. 139.*
oncerning the Creation of Angels; becauſe the *ad Cypri.*
ude and ignorant Vulgar were not ſo capable of So *Pererius in 2 Gen.*
pprehending their Natures. And yet notwithſtand-
g, theſe are as remarkable Parts of the Creation,
nd as fit to be known as another World. And there-
ore the Holy Ghoſt too, uſes ſuch vulgar Expreſſi-
ns, which ſet things forth rather as they appear
han as they are, as when he calls the Moon *one of* Gen. 1. 16.
e greater Lights, whereas 'tis the leaſt that we can
e in the whole Heavens. So afterwards ſpeaking Gen. 11.
f the great Rain which drowned the World; he Mal. 3. 10.
ys, The Windows of Heaven were opened, be-
auſe it ſeemed to come with that Violence, as if it
ere poured out from Windows in the Firma- Sir *Walter*
ent. *Rawl. c. 7.*
Sect. 6.

And in reference to this, a Drowth is deſcribed in *Deut. 11.*
ndry other * Places by *the Heavens being ſhut up.* So 17.
hat the Phraſes which the Holy Ghoſt uſes concern- 1 Reg. 3.
g theſe things, are not to be underſtood in a literal 55.
Luk. 4. 25.
Senſe;

Senſe; but rather as vulgar Expreſſions; and th
Rule is ſet down by St. *Auſtin*, where ſpeaking cor
L. 2. in Gen. Pſa. 136. 6. cerning that in the *Pſalm*, *who ſtretched the ear upon the waters*, he notes, that when the Words Scripture ſhall ſeem to contradict common Sen or Experience, there are they to be underſtood in qualified Senſe, and not according to the Lette And 'tis obſerved, that for want of this Rule, ſom
Hexamer lib. 2. Item Baſil. Hom. 3. in Geneſ. of the Ancients have faſten'd ſtrange Abſurdities u
Wiſd. 2. 4. 17. 5. Ecclus. 43. 3, 4. on the Words of the Scripture. So St. *Ambro*
Com. in c. 1. Gen. eſteemed it a Hereſy to think that the Sun and Sta were not very hot, as being againſt the Words Scripture, *Pſalm* 19. 6. where the *Pſalmiſt* ſays, th there is nothing that is hid from the Heat of the Su So others there are that would prove the Heaven not to be round, out of that Place, *Pſal.* 104. 2. *H ſtretched out the heavens like a curtain.* So *Procopius* a ſo was of Opinion, that the Earth was founded u on the Waters; nay, he made it part of his Faith proving it out of *Pſal.* 24. 2. *He hath founded t earth upon the ſeas, and eſtabliſhed it upon the floods* Theſe and ſuch like Abſurdities have followed, whe Men look for the Grounds of Philoſophy in th Words of Scripture. So that, from what hath been ſaid I may conclude that the Silence of Scripture concern ing any other World, is not ſufficient Argument t prove that there is none. Thus for the 2 firſt Argument

Unto the third, I may anſwer, that this very Ex ample is quoted by others, to ſhew the Ignorance thoſe Primitive Times, who did ſometimes condem what they did not underſtand; and have often cen ſur'd the lawful and undoubted Parts of Mathema ticks for Heretical, becauſe they themſelves coul not perceive a Reaſon of it. And therefore thei Practice in this particular is no ſufficient Teſtimo ny againſt us.

But laſtly, I anſwer to all the above-named Ob jections, that the Term (*World*) may be taken in

doubl

ible Senſe, more generally for the whole Uniſe, as it implies in it the Elementary and Æthel Bodies, the Stars and the Earth. Secondly, re particularly for an inferior World, conſiſting of ements.

Now the main drift of all theſe Arguments, is to nfute a Plurality of Worlds in the firſt Senſe; and there were any ſuch, it might (perhaps) ſeem nge, that *Moſes* or St. *John* ſhould either not ow, or not mention its Creation. And *Virgilius* s condemned for this Opinion, becauſe he held *d ſit alius mundus ſub terrâ, aliuſque Sol & Luna,* *Baronius)* that within our Globe of Earth, there s another World, another Sun and Moon, and ſo might ſeem to exclude this from the Number of other Creatures.

But now, there is no ſuch danger in this Opinion, ich is here delivered; ſince this World is ſaid to in the Moon, whoſe Creation is particularly exeſs'd.

So that in the firſt Senſe, I yield that there is but e World, which is all that the Arguments do ove; but underſtand it in the ſecond Senſe, and I affirm there may be more, nor do any of the ove-named Objections prove the contrary.

Neither can this Opinion derogate from the Divine ſdom (as *Aquinas* thinks) but rather advance it, wing a *compendium* of Providence, that could ke the ſame Body a World, and a Moon; a World Habitation, and a Moon for the uſe of others, and Ornament of the whole Frame of Nature. For the Members of the Body ſerve not only for the eſervation of themſelves, but for the Uſe and nveniency of the whole, as the Hand protects Head as well as ſaves it ſelf; ſo is it in the Parts the Univerſe, where each one may ſerve as well the Conſervation of that which is within it, as Help of others without it.

Cuſanus de doct. ignor. l. 2. c. 12.

Mer-

Comment. in Gen. Qu. 19. Art. 2.

Merſennus a late Jeſuit, propoſing the Queſti whether or no the Opinion of more Worlds than o be heretical and againſt the Faith? He anſwers it n gatively ; becauſe it does not contradict any Expr Place of Scripture, or Determination of the Chur And though (ſaith he) it ſeems to be a raſh Opi on, as being againſt the Conſent of the Fathers ; y if this Controverſy be chiefly Philoſophical, th their Authorities are not of ſuch Weight. Un this it may be added, that the Conſent of the Fath is prevalent only in ſuch Points as were firſt co troverted amongſt them, and then generally decid one way, and not in ſuch other Particulars as nev fell under their Examination and Diſpute.

I have now in ſome meaſure, ſhewed that a P rality of Worlds does not contradict any Princi of Reaſon or Place of Scripture ; and ſo cleared t firſt part of that Suppoſition which is implied in t Opinion.

It may next be enquired, whether 'tis poſſi there may be a Globe of Elements in that which call the Æthereal Parts of the Univerſe ; for if t (as it is according to the common Opinion) be p vileged from any Change or Corruption, it will in vain then to imagine any Element there ; and we will have another World, we muſt then ſeek o ſome other Place for its Situation. The Third Pr poſition therefore ſhall be this.

PRO

PROP. III.

at the Heavens do not conſiſt of any ſuch pure Matter, which can privilege them from the like Change and Corruption as theſe Inferior Bodies are liable unto.

T hath been often queſtioned amongſt the ancient Fathers and Philoſophers, what kind of Matter t ſhould be of which the Heavens are framed. ne think that they conſiſt of a fifth Subſtance di-ct from the four Elements, as *Ariſtotle* holds, and th him ſome of the late Schoolmen; whoſe ſubtil ains could not be content to attribute to thoſe vaſt orious Bodies, but common Materials, and there-e they themſelves had rather take pains to prefer em to ſome extraordinary Nature; whereas not-thſtanding, all the Arguments they could invent, re not able to convince a Neceſſity of any ſuch atter, as is confeſs'd by their own * ſide. It were ch to be deſired, that theſe Men had not in other ſes, as well as this, multiplied things without Ne-ſity; and, as if there had not been enough to be own in the Secrets of Nature, have ſpun out new bjects from their own Brains, to find more Work future Ages. I ſhall not mention their Arguments, ce 'tis already confeſs'd, that they are none of them any neceſſary Conſequence; and beſides, you may them ſet down in any of the Books *de Cælo*.

De Cælo li. 1. cap. 2.

** Colleg. Conimb. de cælo. l. 1. c. 2. q. 6. art. 3.*

But it is the general Conſent of the Fathers, and Opinion of *Lombard*, that the Heavens conſiſt of ſame Matter with theſe Sublunary Bodies. St. *Am-ſe* is ſo confident of it, that he eſteems the contrary Hereſie. True indeed, they differ much among emſelves, ſome thinking them to be made of Fire, ers of Water, and others of both; But herein they generally

In Hexam. lib. 4.

Enarrat in Geneſ. art. 10.

generally agree, That they are all framed of ſome lement or other; which *Dionyſius Carthuſianus* colle from that Place in *Geneſis*, where the Heavens a mentioned in their Creation, as divided only in ſtance from the Elementary Bodies, and not as bei made of any new Matter. To this purpoſe othe cite the Derivation of the *Hebrew* Word מים *quaſi* שם *ibi &* מים *aquæ* or *quaſi* אש *ignis &* מים *aqu* Becauſe they are framed out of theſe Elements. B concerning this, you may ſee ſundry Diſcourſes mo at large in *Ludovicus Molina*, *Euſebius Nirembergius*, wi

In operc. 6. dierum. diſput. 5.

divers others. The Venerable *Bede* thought the Plan to conſiſt of all the four Elements; and 'tis like that the other Parts of it are of an Aereous Subſtanc

In lib. de Mundi conſtit.

as will be ſhewed afterward: However, I cannot no ſtand to recite the Arguments for either; I have on urged theſe Authorities to countervail *Ariſtotle* and t Schoolmen, and the better to make way for a Pro of their Corruptibility.

2Pet. 3. 12.

The next thing then to be enquired after, is, Wh ther they be of a Corruptible Nature; not wheth they can be deſtroyed by God; for this Scriptu puts out of doubt.

By Doctor *Hakewill. Apol. lib. 2.*

Nor whether or no in a long time they would we away and grow worſe, for from any ſuch fear the have been lately privileged. But whether they are c pable of ſuch Changes and Viciſſitudes, as this infer or World is liable unto.

The two chief Opinions concerning this, have bo erred in ſome Extremity, the one ſide going ſo f from the other, that they have both gone beyond t right; whilſt *Ariſtotle* hath oppoſed the Truth as we as the Stoicks.

Some of the Ancients have thought, that the He venly Bodies have ſtood in need of Nouriſhment fro the Elements, by which they were continually fe and ſo had divers Alterations by reaſon of their Foo This is fathered on *Heraclitus*, followed by that gre

Nat

ſateraliſt *Pliny*, and in general attributed to all the toicks. You may ſee *Seneca* expreſly to this purpoſe n theſe Words. *Ex illa alimenta omnibus animalibus, mnibus ſatis, omnibus ſtellis dividuntur; hinc profertur uo ſuſtineantur tot Sidera tam exercitata, tam avida, per iem, noctemque, ut in opera, ita in paſtu.* Speaking of he Earth, he ſays, from thence it is that Nouriſhent is divided to all the Living Creatures, the Plaets and the Stars; hence were ſuſtained ſo many Conſtellations, ſo laborious, ſo greedy, both Day nd Night, as well in their Feeding as Working. Thus alſo *Lucan* ſings,

Plutarch de plac. Philoſ. l. 2. c. 17.
Nat. Hiſt. l. 2. c, 9.
Nat. queſt. lib. 2. cap. 5.

Necnon Oceano paſci Phœbumque polumque Credimus.

Unto theſe, *Ptolomy* alſo, that Learned *Egyptian*, eemed to agree, when he affirms that the Body of he Moon is moiſter and cooler than any of the other Planets, by reaſon of the Earthly Vapours that are xhaled unto it. You ſee theſe Ancients thought the Heavens to be ſo far from this imagined Incorruptiility, that rather like the weakeſt Bodies they ſtood n need of ſome continual Nouriſhment, without vhich they could not ſubſiſt.

1. Apoſtol.

But *Ariſtotle* and his Followers were ſo far from his, that they thought thoſe Glorious Bodies could ot contain in them any ſuch Principles as might make hem liable to the leaſt Change or Corruption; and heir chief Reaſon was, becauſe we could not in ſo ong a ſpace diſcern any Alteration amongſt them. But unto this I anſwer:

De Cælo l. 1. c. 3.

1. Suppoſing we could not, yet would it not hence ollow that there were none, as he himſelf in effect loth confeſs in another place; for ſpeaking concernng our Knowledge of the Heavens, he ſays, 'Tis vey imperfect and difficult, by reaſon of the vaſt diſtance of thoſe Bodies from us, and becauſe the Changes which may happen unto them, are not either big enough, or frequent enough to fall within the Apprehenſion and Obſervation of our Senſes; no wonder

De cælo, l. 2. cap. 5.

then,

then, if he himſelf be deceived in his Aſſertions cor cerning theſe Particulars. But yet, in this he implie that if a Man were nearer to theſe Heavenly Bodie he would be a fitter Judge to decide this Controverſi than himſelf. Now it is our Advantage, that by th help of *Galileus*'s Glaſs, we are advanced nearer unt them, and the Heavens are made more preſent to u than they were before. However, as it is with u where there be many Viciſſitudes and Succeſſions o Things, though *the Earth abideth for ever*; ſo likewiſ may it be amongſt the Planets; in which, thoug there ſhould be divers Alterations, yet they themſelve may ſtill continue of the ſame Quantity and Light.

2. Though we could not by our Senſes ſee ſuch Al terations, yet our Reaſon might perhaps ſufficientl convince us of them. Nor can we well conceive hov the Sun ſhould reflect againſt the Moon, and yet no produce ſome Alteration of Heat. *Diogenes* the Philo ſopher was hence perſuaded, that thoſe ſcorchin Heats had burnt the Moon into the form of a Pumice ſtone.

3. I anſwer, That there have been ſome Alterati ons obſerved there; witneſs thoſe Comets which hav been ſeen above the Moon; as alſo thoſe Spots o Clouds that encompaſs the Body of the Sun; amongſ which, there is a frequent Succeſſion by a Corruptio of the old, and a Generation of new. So that tho *Ariſtotle*'s Conſequence were ſufficient, when he pro ved that theHeavens were notCorruptible,becauſe ther have not any Changes been diſcovered in it; yet thi by the ſame Reaſon muſt be as prevalent, that th Heavens are Corruptible, becauſe there have been ſ many Alterations obſerved there. But of theſe, to gether with a farther Confirmation of this Propoſiti on, I ſhall have occaſion to ſpeak afterwards: In th mean ſpace, I will refer the Reader to that Work o *Scheiner*, a late Jeſuit, which he Titles his *Roſa Urſina* where he may ſee this Point concerning the Corrupti bilit

Lib.4. par. 2. cap. 24. 35.

ity of the Heavens largely handled, and ſufficiently nfirmed.

There are ſome other things, on which I might re take an occaſion to enlarge my ſelf; but becauſe y are directly handled by many others, and do not mediately belong to the chief Matter in hand, I ll therefore refer the Reader to their Authors, and it any large Proof of them my ſelf, as deſiring all ſſible Brevity.

1. The firſt is this: That there are no ſolid Orbs. there be a Habitable World in the Moon, (which ow affirm) it muſt follow, that her Orb is not ſo- as *Ariſtotle* ſuppoſed; and if not hers, why any of other? I rather think that they are all of a fluid rhaps aereous) Subſtance. St. *Ambroſe* and St. *Baſil* endeavour to prove this out of that Place in *Iſaiah*, ere they are compared to Smoak, as they are both oted by *Rhodiginus*. *Euſebius Nierembergus* doth like- e from that place, confute the Solidity and Incor- tibility of the Heavens, and cites for the ſame In- pretation the Authority of *Euſtachius* of *Antioch*; l St. *Auſtin*, I am ſure, in one Place ſeems to aſ- t unto this Opinion, though he does often in his er Works contradict it.

Iſa. 51. 6. *Ant. lect.* *l.* 1. *c.* 4. *Hiſt. nat.* *l.* 2. *c.* 11. 13. *In lib. ſup. Gen. ad lit.*

f you eſteem the *Teſtimony* of the Ancient Fathers, e of any great Force or Conſequence in a Philoſo- cal Diſpute, you may ſee them to this purpoſe in *us Senenſis*, *Lib.* 5. *Biblioth. Annot.* 14. The chief aſons that are commonly urged for the Confirmati- of it, are briefly theſe Three.

1. From the Altitude of divers Comets, which have n obſerved to be above the Planets; through whoſe bs (if they had been ſolid) there would not have n any Paſſage. To theſe may be added thoſe leſ- Planets lately diſcovered about *Jupiter* and *Sa-*, for which Aſtronomers had not yet framed Orbs. 1.

2. 2. From that uncertainty of all Aſtronomical Ob ſervations, which will follow upon the Suppoſition ſuch ſolid Spheres. For then we ſhould never diſcer any Star, but by a Multitude of Refractions, and conſequently we could not poſſibly find their true S tuations, either in reſpect of us, or in regard of ot another: Since whatever the Eye diſcerns by a refr cted Beam, it apprehends to be in ſome other Pla than wherein it is. But now this would be ſuch a Inconvenience, as would quite ſubvert the Groun and whole Art of Aſtronomy, and therefore is by n Means to be admitted.

Unto this it is commonly anſwered, That all tho Orbs are equally Diaphanous, though not of a cont nued Quantity. We reply, That ſuppoſing the were, yet this cannot hinder them from being th Cauſes of Refraction which is produced as well b the Diverſity of Superficies, as the different Perſpicu ty of Bodies. Two Glaſſes put together, will cau a diverſe Refraction from another ſingle one, that but of equal Thickneſs and Perſpicuity.

3. 3. From the different height of the ſame Planet ſeveral times. For, if according to the uſual *Hyp theſis*, there ſhould be ſuch diſtinct, ſolid Orbs, then would be impoſſible that the Planets ſhould intren upon one another's Orbs, or that two of them at ſev ral times ſhould be above one another, which notwit ſtanding hath been proved to be ſo by later Experienc *Tycho* hath obſerved, that *Venus* is ſometimes nearer us than the *Sun* or *Mercury*, and ſometimes farther o than both: Which Appearances *Regiomontanus* himſe does acknowledge, and withal, does confeſs that the cannot be reconciled to the common *Hypotheſis*.

But for your better ſatisfaction herein, I ſhall ref you to the above-named *Scheiner*, in his *Roſa Urſina*, whom you may ſee both Authorities and Reaſon ve largely and diſtinctly ſet down for this Opinion. F the better Confirmation of which, he adjoins al

Lib.4.p.11. 2.c.7.26. 30.

ſom

me Authentical Epiſtles of *Fredericus Cæſius Lynceus*, Noble Prince, written to *Bellarmine*, containing di-rs Reaſons to the ſame purpoſe. You may alſo ſee e ſame Truth ſet down by *Johannes Pena*, in his Pre-ce to *Euclid*'s *Opticks*, and *Chriſtoph. Rothmannus*, both no thought the Firmament to be only Air; and tho' e noble *Tycho* do diſpute againſt them, yet he him-f holds, *Quod propius ad veritatis penetralia accedit hæc nio, quam Ariſtotelica vulgariter approbata, quæ cœlum ribus realibus atque imperviis orbibus citra rem replevit.* That this Opinion comes nearer to the Truth, than that common one of *Ariſtotle*, which hath to no purpoſe filled the Heavens with ſuch real and im-pervious Orbs. *De ſtell.* 1. 15, 72. *l.* 2. *c.* 9.

2. There is no Element of Fire, which muſt be d with this Opinion here delivered; for if we ſup-ſe a World in the Moon, then it will follow, that Sphere of Fire either is not there, where 'tis uſu-y placed in the Concavity of his Orb, or elſe that re is no ſuch thing at all; which is moſt probable, ce there are not any ſuch ſolid Orbs, that by their ft Motion might heat and enkindle the adjoining , which is imagined to be the reaſon of that Ele-nt. The Arguments that are commonly urged to purpoſe, are theſe.

1. That which was before alledged concerning the fractions which will be cauſed by a different Me-m. For if the Matter of the Heavens be of one ckneſs, and the Element of Fire another, and the er Region of Air diſtinct from both theſe, and the er Region ſeveral from all the reſt; there will n be ſuch a Multiplicity of Refractions, as muſt eſſarily deſtroy the Certainty of all Aſtronomical ſervations. All which Inconveniences might be a-ded, by ſuppoſing (as we do) that there is only Orb of Vaporous Air which encompaſſes our th, all the reſt being *Æthereal*, and of the ſame ſpicuity.

2. 2. The Situation of this Element does no way a gree with *Ariſtotle*'s own Principles, or that commo Providence of Nature, which we may diſcern in o dinary Matters. For if the Heavens be without a Elementary Qualities, as is uſually ſuppoſed, then would be a very incongruous thing for the Element Fire to be placed immediately next unto it; ſince th heat of this is the moſt powerful and vigorous Qual ty that is among all the reſt: And Nature in h Works, does not join Extremes, but by ſomethin of a middle Diſpoſition. So in the very Frame our Bodies, the Bones which are of a hard Subſtanc and the Fleſh of a ſoft, are not joined together but b the Interceſſion of Membranes and Griſles, ſuch as b ing of a middle Nature may fitly come betwixt.

3. 3. 'Tis not conceiveable for what Uſe or Benef there ſhould be any ſuch Element in that place; an certain it is, that Nature does not do any thing i vain.

4. 4. Betwixt two Extreams there can be but one Me dium; and therefore between thoſe two oppoſite El ments of Earth and Water, it may ſeem more conve nient to place only the Air, which ſhall partake middle Qualities different from both.

5. 5. Fire does not ſeem ſo properly and directly to b oppoſed to any thing as Ice; and if the one be no an Element, why ſhould the other?

If you object, that the Fire which we commonl uſe does always tend upwards; I anſwer, This canno prove that there is a Natural Place for ſuch an Ele ment, ſince our Adverſaries themſelves do grant, tha *Culinary* and *Elementary* Fire are of different kinds The one does burn, ſhine, and corrupt its Subject the other diſagrees from it in all theſe Reſpects. An therefore from the Aſcent of the one, we canno properly infer the Being or Situation of the other.

But for your farther Satisfaction herein, you ma peruſe *Cardan*, *Johannes Pena*, that Learned *French*

ma

n the Noble *Tycho*, with divers others who have rpoſely handled this Propoſition.

3. I might add a Third, *viz.* That there is no Mu- 3.
k of the Spheres; for if they be not ſolid, how n their Motion cauſe any ſuch Sound as is conceid? I do the rather meddle with this, becauſe *Plu-ch* ſpeaks as if a Man might very conveniently hear at Harmony, if he were an Inhabitant in the oon. But I gueſs that he ſaid this out of Incogi-ncy, and did not well conſider thoſe neceſſary Con-quences which depend upon his Opinion. However, e World would have no great loſs in being depriv'd this Muſick, unleſs at ſome times we had the privi-ge to hear it: Then indeed *Philo* the *Jew* thinks it *De ſomniis.* ould ſave us the Charges of Diet, and we might e at an eaſy rate by feeding at the Ear only, and ceiving no other Nouriſhment; and for this very eaſon (ſays he) was *Moſes* enabled to tarry Forty ays and Forty Nights in the Mount without eating y thing, becauſe he there heard the Melody of the eavens. ——*Riſum teneatis.* I know this Muſick th had great Patrons, both Sacred and Prophane uthors, ſuch as *Ambroſe*, *Bede*, *Boetius*, *Anſelm*, *Pla-* *Cicero*, and others; but becauſe it is not now, I nk, affirmed by any, I ſhall not therefore beſtow her Pains or Time in arguing againſt it.

It may ſuffice that I have only named theſe three t, and for the two more neceſſary, have referred e Reader to others for ſatisfaction. I ſhall in the xt place proceed to the Nature of the Moon's Body, know whether that be capable of any ſuch Condi-ns, as may make it poſſible to be inhabited, and at thoſe Qualities are wherein it more nearly agrees th our Earth.

PROP. IV.

That the Moon is a Solid, Compacted, Opacous Body.

I Shall not need to ſtand long in the proof of this Propoſition, ſince it is a Truth already agreed on by the general Conſent of the moſt and the beſt Philoſophers.

[1. 1. It is ſolid, in oppoſition to fluid, as is the Air; for how otherwiſe could it beat back the Light which it receives from the Sun?

But here it may be queſtion'd, whether or no the Moon beſtow her Light upon us by the Reflection of the Sun-beams from the Superficies of her Body, or elſe by her own Illumination? Some there are who affirm this latter Part. So * *Averroes*, † *Cælius Rhodiginus*, ⁂ *Julius Cæſar, &c.* And their Reaſon is, becauſe this Light is diſcerned in many Places, whereas thoſe Bodies which give Light by Reflexion, can there only be perceived where the Angle of Reflexion is equal to the Angle of Incidence, and this is only in one Place; as in a Looking-glaſs, thoſe Beams which are reflected from it, cannot be perceived in every Place where you may ſee the Glaſs, but only there where your Eye is placed on the ſame Line whereon the Beams are reflected.

* *De cælo l. 2. com. 49.*
† *Ant. lection. l. 20. c. 4.*
⁂ *De phænom. Lunæ. c. 11.*

But to this I anſwer, That the Argument will not hold of ſuch Bodies whoſe Superficies is full of unequal Parts and Gibboſities, as the Moon is. Wherefore it is as well the more probable as the more common Opinion, that her Light proceeds from both theſe Cauſes, from Reflexion and Illumination; nor doth it herein differ from our Earth, ſince that alſo hath ſome Light by Illumination: For how other-

wiſe

iſe would the Parts about us in a Sun-ſhine Day ap-
ear ſo bright, when as the Rays of Reflexion cannot
nter into our Eye?

For the better illuſtration of this, we may conſider
he ſeveral ways whereby diversBodies are enlightned.
ither as Water by admitting the Beams into its Sub-
ance; or as Air and Thin Clouds, by tranſmitting
he Rays quite thorough their Bodies; or as thoſe
hings that are of an opacous Nature, and ſmooth Su-
erficies, which reflect the Light only in one place;
r elſe as thoſe things which are of an opacous Na-
ure, and rugged Superficies, which by a kind of
ircumfluous Reflection, are at the ſame time diſ-
ernible in many Places, as our Earth and the
Moon.

2. It is compact, and not a ſpungy and porous ubſtance. But this is denied by * *Diogenes*, † *Vitellio*, nd ∴ *Reinoldus*, and ſome others, who held the Moon to be of the ſame kind of Nature as a Pumice-tone; and this, ſay they, is the Reaſon why in the un's Eclipſes, there appears within her a Duskiſh Ruddy Colour, becauſe the Sun-Beams being efracted in paſſing through the Pores of her Bo-ly, muſt neceſſarily be repreſented under ſuch a Colour. 2.

* *Plut. de pla. Phil. l.* 2. *c.* 13.
† *Opt. l.* 4.
∴ *Com. Purbac. Theo. p.* 164.

But I reply, if this be the cauſe of her Redneſs, hen why doth ſhe not appear under the ſame Form when ſhe is about a Sextile Aſpect, and the darkned art of her Body is diſcernible? for then alſo do the ame Rays paſs through her, and therefore in all like-ihood ſhould produce the ſame Effect; and notwith-tanding thoſe Beams are then diverted from us, that hey cannot enter into our Eyes by a ſtraight Line, yet muſt the Colour ſtill remain viſible in her Body. And beſides, according to this Opinion, the Spots would not always be the ſame, but diverſe as the arious diſtance of the Sun requires. Again, if the Sun-beams did paſs through her, why then hath ſhe not

Soaliger Exercit. 80. *Sect.* 13.

not a Tail (ſaith *Scaliger*) as the Comets? Why dot ſhe appear in ſuch an exact Round? and not rathe attended with a long Flame, ſince it is meerly thi Penetration of the Sun-beams that is uſuall attributed to be the cauſe of Beards in Blazin Stars.

3. *Plut. de facie Lunæ.*

3. It is opacous, not tranſparent or diaphanou like Chryſtal or Glaſs, as *Empedocles* thought, wh held the Moon to be a Globe of pure congeale Air, like Hail encloſed in a Sphere of Fire; ſo then,

1. Why does ſhe not always appear in th Full? ſince the Light is diſperſed through all he Body?

Thucid. Livii. Plut. de facie Lunæ.

2. How can the Interpoſition of her Body ſo dark- en the Sun, or cauſe ſuch great Eclipſes as have turn- ed Day into Night; that have diſcover'd the Stars and frighted the Birds with ſuch a ſudden Darkneſs that they fell down upon the Earth? as it is related in divers Hiſtories. And therefore *Herodotus* telling o an Eclipſe which fell in *Xerxes*'s Time, deſcribes i thus: ὁ ἥλιος ἐκλιπὼν τὴν ἐν τῷ οὐρανῷ ἕδρην ἀφανὴς ἦν. The Sun leaving his wonted Seat in the Heavens, vaniſh'd away: All which argues ſuch a great Darkneſs as could not have been, if her Body had been perſpicu- ous. Yet ſome there are who interpret all theſe Re- lations to be Hyperbolical Expreſſions; and the no- ble *Tycho* thinks it naturally impoſſible that any Eclipſe ſhould cauſe ſuch Darkneſs, becauſe the Body of the Moon can never totally cover the Sun. However, in this he is ſingular, all other Aſtronomers (if I may believe *Keplar*) being on the contrary Opinion, by reaſon the Diameter of the Moon does for the moſt part appear bigger to us than the Diameter of the Sun.

Herodot. l. 7. c. 37.

But here *Julius Cæſar* once more puts in to hinder our Paſſage. The Moon (ſaith he) is not altogether opacous, becauſe 'tis ſtill of the ſame Nature with

De phænom. Lunæ. c. 11.

the

Heavens, which are incapable of total Opacity : d his Reaſon is, becauſe Perſpicuity is an inſepa- le Accident of thoſe purer Bodies ; and this he nks muſt neceſſarily be granted; for he ſtops re, and proves no further ; but to this I ſhall defer Anſwer till he hath made up his Argument.

We may frequently ſee, that her Body does ſo ipſe the Sun, as our Earth doth the Moon. And ides, the Mountains that are obſerved there, do t a dark Shadow behind them, as ſhall be ſhewed Prop. 9. erwards. Since then the like Interpoſition of them h, doth produce the like Effect, they muſt neceſ- y be of the like Natures, that is, alike opacous, ich is the thing to be ſhewed ; and this was the aſon (as the Interpreters gueſs) why *Ariſtotle* af- *In. l. de animalib.* ned the Moon to be of the Earth's Nature, be- ſe of their Agreement in Opacity ; whereas all other Elements, ſave that, are in ſome meaſure rſpicuous.

But the greateſt Difference which may ſeem to ke our Earth altogether unlike the Moon, is, be- ſe the one is a bright Body, and hath Light of its n, and the other a groſs dark Body which cannot ne at all. 'Tis requiſite therefore that in the next ce I clear this doubt, and ſhew that the Moon h no more Light of her own than our Earth.

PROP. V.

That the Moon hath not any Light of her own.

Was the Fancy of ſome of the *Jews*, and more eſpecially of *Rabbi Simeon*, that the Moon *Toſtatus in 1 Gen.* nothing elſe but a contracted Sun ; and that *Hyeron. de Sancta fide* h thoſe Planets at their firſt Creation, were equal *Hebræo-* h in Light and Quantity. For, becauſe God did *maſt. l. 2.* then *c. 4.*

then call them both great Lights, therefore they i
ferred that they muſt be both equal in Bigneſs. B
a while after (as the Tradition goes) the ambitio
Moon put up her Complaint to God againſt the Su
ſhewing that it was not fit there ſhould be Two ſu
great Lights in the Heavens; a Monarchy would b
become the Place of Order and Harmony. Up
this, God commanded her to contract her ſelf in
a narrower Compaſs; but ſhe being much diſco
tented hereat, replies, What! becauſe I have ſpok
that which is Reaſon and Equity, muſt I therefo
be diminiſhed? This Sentence could not chuſe b
much trouble her; and for this reaſon was ſhe
great Diſtreſs and Grief for a long Space; but th
her Sorrow might be ſome way pacified, God b
her be of good Cheer, becauſe her Privileges a
Charter ſhould be greater than the Sun's; he ſhou
appear in the day time only, ſhe both in the D
and Night; but her Melancholy being not ſatisfi
with this, ſhe replied again, That that alas was
Benefit; for in the day time ſhe ſhould be either n
ſeen, or not noted. Wherefore, God to comfo
her up, promiſed, that his People the *Iſraelites* ſhou
celebrate all their Feaſts and Holidays by a Co
putation of her Months; but this being not able
content her, ſhe has looked very melancholy ev
ſince; however, ſhe hath ſtill reſerved much Lig
of her own.

Others there were, that did think the Moon to
a round Globe; the one half of whoſe Body was
a Bright Subſtance, the other half being dark; a
the divers Converſions of thoſe ſides towards o
Eyes, cauſed the Variety of her Appearances. (
this Opinion was *Beroſus*, as he is cited by * *Vitruv*
us; and † St. *Auſtin* thought it was probable enoug
But this Fancy is almoſt equally abſurd with t
former, and both of them ſound rather like Fable

th

* *Lib. 9. Architect.*
† *Narrat. Pſalm. item ep. 119.*

n Philoſophical Truths. You may commonly ſee
v this latter does contradict frequent and eaſie Ex-
ience ; for 'tis obſerved , that that Spot which is
ceived about her middle when ſhe is in the In-
aſe, may be diſcern'd in the ſame Place when
is in the Full : Whence it muſt follow, that the
ıe part which was before darkned,is after enlight-
d, and that the one part is not always dark , and
other light of it ſelf. But enough of this; I
uld be loth to make an Enemy, that I may af-
wards overcome him, or beſtow time in proving
t which is already granted ; I ſuppoſe now, that
ther of them hath any Patrons, and therefore
d no Confutation.

Tis agreed upon by all ſides, that this Planet re-
ves moſt of her Light from the Sun ; but the chief
ntroverſy is, whether or no ſhe hath any of her
n ? The greater Multitude affirm this. *Cardan* a-
ngſt the reſt, is very confident of it ; and he
nks that if any of us were in the Moon at the
ıe of her greateſt Eclipſe, *Lunam aſpiceremus non*
s ac innumeris cereis ſplendidiſſimis accenſis, atque in
oculis defixis cæcutiremus ; " We ſhould perceive ſo
reat a Brightneſs of her own, that would blind
ıs with the meer Sight, and when ſhe is enlighten-
d by the Sun, then no Eagles Eye (if there were
ny there) is able to look upon her." This *Car-*
ſays, and he doth but ſay it , without bringing
Proof for its Confirmation. However, I will ſet
wn the Arguments that are uſually urged for this
inion, and they are taken either from Scripture or
aſon ; from Scripture is urged that Place, 1 *Cor.* 15.
ere it is ſaid, *There is one glory of the Sun, and ano-*
glory of the Moon. Ulyſſes Albergettus urges that in
tth. 24. 29. ἡ σελήνη οὐ δώσει τὸ φέγγος αὐτῆς, *The*
on ſhall not give her light : Therefore (ſays he) ſhe
h ſome of her own.

De Subtil. l. 3.

But

But to theſe we may eaſily anſwer, that the Glory and Light there ſpoken of, may be ſaid to be hers, though it be derived, as you may ſee in many other Inſtances.

The Arguments from Reaſon are taken either,

1. From that Light which is diſcerned in her when there is a total Eclipſe of her own Body, or of the Sun.

2. From the Light which is diſcerned in the darker Part of her Body, when ſhe is but a little diſtant from the Sun.

1. For when there are any total Eclipſes, there appears in her Body a great Redneſs, and many times Light enough to cauſe a remarkable Shade, as common Experience doth ſufficiently manifeſt: But this cannot come from the Sun, ſince at ſuch times either the Earth or her own Body ſhades her from the Sun-beams; therefore it muſt proceed from her own Light.

2. Two or three Days after the New Moon, we may perceive Light in her whole Body, whereas the Rays of the Sun reflect but upon a ſmall part of that which is viſible; therefore 'tis likely that there is ſome Light of her own.

In anſwering to theſe Objections, I ſhall firſt ſhew that this Light cannot be her own; and then declare that which is the true Reaſon of it.

That it is not her own, appears,

1. Becauſe then ſhe would always retain it; but ſhe has been ſometimes altogether inviſible, when a notwithſtanding ſome of the fixed Stars of the fourth or fifth Magnitude might eaſily have been diſcerned cloſe by her: As it was in the Year 1620.

Keplar. ep. Aſtron. cop. l. 6. p. 5. Sect. 2,

2. This may appear likewiſe from the Variety of it at divers times; for 'tis commonly obſerved that ſometimes 'tis of a brighter, ſometimes of a darker Appearance; now redder, and at another time of

more

more duskiſh Colour. The Obſervation of this Variety in divers Eclipſes, you may ſee ſet down by *Keplar* and many others. But now this could not be, if that Light were her own, that being conſtantly the ſame, and without any reaſon of ſuch an Alteration: So that thus I may argue. *Opt. Aſtron. c. 7. num. 3.*

If there were any Light proper to the Moon, then would that Planet appear brighteſt when ſhe is eclipſed in her *Perige*, being neareſt to the Earth; and ſo conſequently more obſcure and duskiſh when ſhe is in her *Apoge* or fartheſt from it; the reaſon is, becauſe the nearer any enlightned Body comes to the Sight, by ſo much the more ſtrong are the Species, and the better perceived. This Sequel is granted by ſome of our Adverſaries, and they are the very Words of noble *Tycho*; *Si Luna genuino gauderet lumine, atque cum in umbra terræ eſſet, illud non amitteret, ſed* [illegible] *evidentius exereret; omne enim lumen in tenebris, plus ſplendet cum alio majore fulgore non præpeditur.* If the Moon had any Light of her own, then would ſhe not loſe it in the Earth's Shadow, but rather ſhine more clearly; ſince every Light appears greater in the dark, when it is not hinder'd by a more perſpicuous Brightneſs. *De nova ſtella. l. 1. c. 10.*

But now the Event falls out clean contrary, (as Obſervation doth manifeſt, and our Oppoſites themſelves do grant) the Moon appearing with a more reddiſh and clear Light when ſhe is eclipſed, being in her *Apoge* or fartheſt Diſtance, and a more blackiſh Iron Colour when ſhe is in her *Perige* or neareſt to us, therefore ſhe hath not any Light of her own. Nor may we think that the Earth's Shadow can cloud the proper Light of the Moon from appearing, or take away any thing from her inherent Brightneſs; for this were to think a Shadow to be a Body, an Opinion altogether misbecoming a Philoſopher, as *Tycho* grants in the fore-cited Place, *Nec umbra terræ corporeum quid eſt, aut denſa aliqua ſub-* Reinold *Comment. in Purb. Theor. p. 164.*

Subſtantia, ut Lunæ lumen obtenebrare poſſit, atque id viſui noſtro præripere, ſed eſt quædam privatio luminis ſolaris, ob interpoſitum opacum corpus terræ. Nor is the Earth's Shadow any corporeal Thing, or thick Subſtance, that it can cloud the Moon's Brightneſs, or take it away from our Sight; but it is a meer Privation of the Sun's Light by reaſon of the interpoſition of the Earth's Opacous Body.

3. If ſhe had any Light of her own, then that would in it ſelf be either ſuch a ruddy Brightneſs as appears in the Eclipſes, or elſe ſuch a Leaden duskiſh Light, as we ſee in the darker Parts of her Body, when ſhe is a little paſt the Conjunction. (That it muſt be one of theſe, may follow from the oppoſite Arguments;) but it is neither of theſe, therefore ſhe hath none of her own.

1. 'Tis not ſuch a ruddy Light as appears in Eclipſes; for then why can we not ſee the like Redneſs, when we may diſcern the obſcurer Parts of the Moon?

You will ſay, perhaps, That then the Nearneſs of that greater Light takes away that Appearance.

I reply, This cannot be. For then, why does *Mars* ſhine with his wonted Redneſs, when he is near the Moon? Or why cannot her greater Brightneſs make him appear white, as the other Planets? Nor can there be any Reaſon given, why that greater Light ſhould repreſent her Body under a falſe Colour.

2. 'Tis not ſuch a duskiſh Leaden Light, as we ſee in the darker Part of her Body, when ſhe is about a Sextile Aſpect diſtant from the Sun; for then, why does ſhe appear red in the Eclipſes; ſince mere Shade cannot cauſe ſuch a Variety? For 'tis the Nature of Darkneſs, by its Oppoſition, rather to make Things appear of a more white and clear Brightneſs, than they are in themſelves. Or, if it be the Shade, yet thoſe Parts of the Moon are

then

then in the Shade of her Body, and therefore in reason should have the like Redness. Since, then, neither of these Lights are hers; it follows, that she hath none of her own. Nor is this a singular Opinion, but it hath had many Learned Patrons: Such was *Macrobius*, who being for this quoted of *Rhodiginus*, he calls him, *Vir reconditissimæ Scientiæ*, a Man who knew more than ordinary Philosophers; thus commending the Opinion in the Credit of the Author. To him assents the Venerable *Bede*, upon whom the Gloss hath this Comparison: As the Looking-Glass represents not any Image within it self, unless it receive some from without; so the Moon hath not any Light, but what is bestowed by the Sun. To these agreed * *Albertus Magnus*, † *Scaliger*, || *Mæslin*, *Keplar*, and more especially ∴ *Mulapertius*; whose Words are more pat to the purpose than others, and therefore I shall set them down as you may find them in his Preface to his Treatise concerning the *Austriaca Sydera*: *Luna, Venus, & Mercurius, terrestres & humidæ sunt Substantiæ; ideoque de suo non lucere, sicut nec Terra.* The Moon, *Venus*, and *Mercury*, (saith he) are of an earthly and moist Substance; and therefore have no more Light of their own, than the Earth hath. Nay, some there are who think, (tho' without ground) that all the other Stars do receive that Light whereby they appear visible to us, from the Sun. So *Ptolomy*, * *Isidore Hispalensis*, † *Albertus Magnus*, and || *Bede*: Much more then, must the Moon shine with a borrowed Light.

Somn. Scip. l. 1. c. 20. Lect. antiq. l. 1. c. 15.

In lib. de nat. rer.

* *De 4. Coævis. Q. 4. Art. 21.*
† *Exercit. 62.*
|| *Epitom. Astron l. 4. p. 2.*
∴ *Epit. Astron. Cop. l. 6. part 2. sect. 2.*

* *Origin. l. 3. c. 60.*
† *De Cælo, l. 2.*
|| *De ratione temp. c. 4.*
Item Plin. l. 2. c. 6.
Hugo de Sancto Victore. Annot. in Gen. 6.

But enough of this. I have now sufficiently shewed what at the first I promised; That this Light is not proper to the Moon. It remains in the next place, that I tell you the true Reason of it. And here, I think 'tis probable, that the Light which appears in the Moon at the Eclipses, is nothing else but the second Species of the Sun's Rays, which pass

paſs through the Shadow unto her Body: And from a Mixture of this ſecond Light with the Shadow, ariſes that Redneſs which at ſuch times appears unto us. I may call it *Lumen Crepuſculinum*, the *Aurora* of the Moon, or ſuch a kind of bluſhing Light that the Sun cauſes when he is near his Riſing, when he beſtows ſome ſmall Light upon the thicker Vapours. Thus we ſee commonly the Sun being in the Horizon, and the Reflection growing weak, how his Beams make the Waters appear very red.

2 King. 3. 22. 2. *Quæſt. in hoc cap.*

The *Moabites*, in *Jehoram*'s time, when they roſe early in the Morning, and beheld the Waters afar off, miſtook them for Blood. *Et cauſa hujus eſt, quia radius ſolaris in Aurora contrahit quondam rubedinem, propter Vapores combuſtos manentes circa ſuperficiem terræ, per quos radii tranſeunt; & ideo cum repercutiantur in aqua ad oculos noſtros, trahunt ſecum eundem ruborem, & faciunt apparere locum aquarum, in quo eſt repercuſſio, eſſe rubrum*; ſaith *Toſtatus*. The Reaſon is, becauſe of his Rays; which being in the lower Vapours, thoſe do convey an imperfect mixed Light upon the Waters. Thus the Moon being in the Earth's Shadow, and the Sun-beams which are round about it not being able to come directly unto her Body; yet ſome ſecond Rays there are, which paſſing through the Shadow, make her appear in that ruddy Colour: So that ſhe muſt appear brighteſt, when ſhe is eclipſed, being in her *Apoge* or greateſt Diſtance from us; becauſe then the Cone of the Earth's Shadow is leſs, and the Refraction is made through a narrower Medium. So on the contrary, ſhe muſt be repreſented under a more dark and obſcure Form when ſhe is eclipſed, being in her *Perige*, or neareſt to the Earth; becauſe then ſhe is involved in a greater Shadow, or bigger part of the Cone; and ſo the Refraction paſſing through a greater Medium, the Light muſt needs

be

weaker which doth proceed from it. If you k now, What the Reaſon may be of that Light hich we diſcern in the darker Part of the New loon? I anſwer; 'Tis reflected from our Earth; hich returns as great a Brightneſs to that Planet, it receives from it. This I ſhall have occaſion to ove afterward.

I have now done with theſe Propoſitions, which ere ſet down to clear the Paſſage, and confirm e Suppoſitions implied in the Opinion. I ſhall in e next place proceed to a more direct Treating the chief Matter in hand.

PROP. VI.

hat there is a World in the Moon, hath been the direct Opinion of many Ancient, with ſome Modern Mathematicians; and may probably be deduced from the Tenents of others.

SInce this Opinion may be ſuſpected of Singularity, I ſhall therefore firſt confirm it by ſufficient Authority of divers Authors, both ancient d modern; that ſo I may the better clear it om the Prejudice either of an upſtart Fancy, or obſolete Error. This is by ſome attributed to *rpheus*, one of the moſt ancient *Greek* Poets. Who eaking of the Moon, ſays thus; ἡ πολλ' ἔρεα ἔχει, λ' ἄστεα, πολλα μέλαθρα, That it hath many Mountins, and Cities, and Houſes in it. To him aſnted *Anaxagoras*, *Democritus*, and *Heraclides*; all ho thought it to have firm ſolid Ground, like to r Earth; containing in it many large Fields, hampion Grounds, and divers Inhabitants.

Of this Opinion likewiſe was *Xenophanes*, as he cited for it by *Lactantius*; tho' that Father (perhaps)

Plut. de plac. phil. l. 2. c. 13.

Ibid. c. 25.

Diog. Laert. l. 2. & l. 9.

Div. Inſt. l. 3. c. 23.

haps) did miſtake his Meaning, whilſt he relates thus: *Dixit Xenophanes, intra concavum Lunæ eſſe al am terram, & ibi aliud genus hominum, ſimili modo v vere ſicut nos in hac terra,* &c. As if he had conce ved the Moon to be a great hollow Body, in th midſt of whoſe Concavity, there ſhould be anoth Globe of Sea and Land, inhabited by Men, as ou Earth is: Whereas, it ſeems to be more likely b the Relation of others, that this Philoſopher's Op nion is to be underſtood in the ſame Senſe as it here to be proved. True indeed, the Father con demns this Aſſertion, as an equal Abſurdity to th of *Anaxagoras*, who affirmed the Snow to be black But no wonder; for in the very next Chapter it that he does ſo much deride the Opinion of tho who thought there were *Antipodes*. So that his I norance in that particular, may perhaps diſable hi from being a competent Judge in any other th like Point of Philoſophy. Unto theſe agreed *P thagoras*, who thought that our Earth was but on of the Planets which moved round about the Su (as *Ariſtotle* relates it of him;) and the *Pythagorea* in general did affirm that the Moon alſo was Terr ſtrial, and that ſhe was inhabited as this lower World That thoſe living Creatures and Plants which are her, exceed any of the like kind with us in the ſam Proportion, as their Days are longer than our *Viz.* by Fifteen Times. This *Pythagoras* w eſteemed by all, of a moſt Divine Wit, as appea eſpecially by his Valuation amongſt the *Roman* who being commanded by the Oracle to erect Statue to the Wiſeſt *Grecian*, the Senate determin *Pythagoras* to be meant; preferring him in the Judgments before the Divine *Socrates*, whom the Gods pronounc'd the Wiſeſt. Some think him *Jew* by Birth; but moſt agree that he was mu converſant amongſt the learneder Sort and Prie of that Nation, by whom he was informed of m

De Cælo, l. 2. c. 13.

Plut. ibid. cap. 30.

Plin. Nat. Hiſt. l. 34. cap. 6.

y Secrets; and (perhaps) this Opinion which he ented afterwards in *Greece*, where he was much opposed by *Aristotle* in some worded Disputations, but ever confuted by any solid Reason.

To this Opinion of *Pythagoras* did *Plato* also assent, hen he considered that there was the like Eclipse made y the Earth; and this, that it had no Light of its wn, that it was so full of Spots. And therefore we ay often read in him and his Followers, of an *aerea terra*, and *lunares populi*, an Æthereal Earth, and habiters in the Moon; but afterwards this was ixed with many ridiculous Fancies: For some of em considering the Mysteries implied in the Number Three, concluded that there must necessarily be Trinity of Worlds, whereof the first is this of ours; e second in the Moon, whose Element of Water represented by the Sphere of *Mercury*, the Air by *enus*, and the Fire by the Sun. And that the whole niverse might the better end in Earth as it began; ey have contrived it, that *Mars* shall be a Sphere of e Fire, *Jupiter* of Air, *Saturn* of Water; and above all these, the *Elysian* Fields, spacious and pleasant laces appointed for the Habitation of those unspotd Souls, that either never were imprisoned in, or se now have freed themselves from any Commerce ith the Body. *Scaliger* speaking of this *Platonick* ancy, *quæ in tres trientes mundum quasi assem divisit*, inks 'tis Confutation enough, to say, 'tis *Plato*'s. owever, for the first part of this Assertion, it was ented unto by many others, and by reason of the rosness and Inequality of this Planet, 'twas frently called *quasi terra cœlestis*, as being esteemed the diment and more imperfect Part of those purer odies; you may see this proved by *Plutarch*, in that elightful Work which he properly made for the onfirmation of this particular. With him agreed *Icinous* and *Plotinus*, later Writers.

Plat. de conviviis. Macrob. Somn. Scip. l. 1. c. 11.

Exerc. 62.

De facie Lunæ.

Instit. ad discip. plat. Cæl. Rhodig. l. 1. c. 4.

Thus *Lucian* alſo in his Diſcourſe of a Journey the Moon, where though he does ſpeak many thin out of Mirth and in a jeſting Manner; yet in t Beginning of it he does intimate that it did conta ſome ſerious Truths concerning the real Frame of t Univerſe.

Cuſa. de doct. ign. l. 2. cap. 12.

The Cardinal *Cuſanus* and *Jornandus Brunus*, he a particular World in every Star; and therefore o of them defining our Earth, he ſays, it is *ſtella qu dam nobilis, quæ lunam & calorem & influentiam ha aliàm, & diverſam ab omnibus aliis ſtellis*; "a nob "Star, having a diſtinct Light, Heat, and Influen "from all the reſt. Unto this *Nicholas Hill*, a Cou tryman of ours, was inclined, when he ſaid *Aſtr terræ natura probabilis eſt*: "That 'tis probable t "Earth hath a ſtarry Nature.

Philoſ. Epicur. par. 434.

But the Opinion which I have here delivered, w more directly proved by * *Mæſlin*, † *Keplar*, and *Galilæus*; each of them late Writers, and famo Men for their ſingular Skill in Aſtronomy. *Kep* calls this World by the Name of *Levania*, from t *Hebrew* Word לבנה which ſignifies the Moon, a our Earth by the Name of *Volva, a volvendo*; becau it does by reaſon of its diurnal Revolution appear u to them conſtantly to turn round; and therefo he ſtiles thoſe who live in that Hemiſphere which towards us, by the Title of *Subvolvani*, becauſe th enjoy the Sight of this Earth; and the others *Priv vani, quia ſunt privati conſpectu volvæ*, becauſe th are deprived of this Priviledge. But *Julius Cæſa* whom I have above quoted, ſpeaking of their Teſt mony whom I cite for this Opinion, *viz. Keplar* a *Galilæus*, affirms that to his Knowledge they did b jeſt in thoſe things which they write concerning th and as for any ſuch World, he aſſuredly knows th never ſo much as dreamt of it. But I had rath believe their own words, than his pretended Knov ledge.

* *In Theſibus.*
† *Diſſertatio cum Nunc. Nuncius Sydereus. Somn. Aſtr.*

Dephænom. Lunæ. c. 4.

T

'Tis true indeed, in ſome things they do but trifle, but for the main Scope of thoſe Diſcourſes, 'tis as manifeſt they ſeriouſly meant it, as any indifferent Reader may eaſily diſcern: As for *Galilæus*, 'tis evident that he did ſet down his own Judgment and Opinion in theſe Things; otherwiſe ſure *Campanella* (a Man as well acquainted with his Opinion, and perhaps his Perſon, as *Cæſar* was) would never have writ an Apology for him. And beſides, 'tis very likely if it had been but a Jeſt, *Galilæus* would never have ſuffered ſo much for it, as Report ſaith afterwards he did.

And as for *Keplar*, I will only refer the Reader to his own Words, as they are ſet down in the Preface to the Fourth Book of his *Epitom*; where his Purpoſe is to make an Apology for the Strangeneſs of thoſe Truths that he was there to deliver, amongſt which there are divers things to this Purpoſe concerning the Nature of the Moon. He profeſſes that he did not publiſh them either out of a Humour of Contradiction, or a Deſire of Vain-glory, or in a jeſting Way to make himſelf or others merry, but after a conſiderate and ſolemn Manner for the Diſcovery of the Truth.

Now as for the Knowledge which *Cæſar* pretends to the contrary, you may gueſs what it was by his ſtrange Confidence in other Aſſertions, and his boldneſs in them may well derogate from his Credit in this. For ſpeaking of *Ptolemy's Hypotheſis*, he pronounces this Verdict, *Impoſſibile eſt excentricorum & epicyclorum poſitio, nec aliquis eſt ex Mathematicis adeo ſtultus qui veram illam exiſtimet.* "The Poſition of *Excentricks* and *Epicycles* is altogether impoſſible, nor is there any Mathematician ſuch a Fool as to think it true." I ſhould gueſs he could not have Knowledge enough to maintain any other *Hypotheſis*, who was ſo ignorant in Mathematicks as to deny that any good Author held this. For I would fain know *Cap.* 7.

whether there were never any that thought the He vens to be ſolid Bodies, and that there were ſu kinds of Motion as is by thoſe fained Orbs ſupplied if ſo, *Cæſar la Galla* was much miſtaken. I think l Aſſertions are equally true, that *Galilæus* and *Kep* did not hold this; and that there were none whi ever held that other. Thus much for the Teſtimo of thoſe who were directly of this Opi on.

But, in my following Diſcourſe, I ſhall moſt in on the Obſervation of *Galilæus*, the Inventor of t famous Perſpective, whereby we may diſcern the He vens hard by us; whereby thoſe things which oth have formerly gueſs'd at, are manifeſted to the E and plainly diſcovered beyond Exception or Doub of which admirable Invention, theſe latter Ages the World may juſtly boaſt, and for this expect to celebrated by Poſterity. 'Tis related of *Eudoxus*, t he wiſhed himſelf burnt with *Phaeton*, ſo he mig ſtand over the Sun to contemplate its Nature; h he lived in theſe Days, he might have enjoyed Wiſh at an eaſier Rate; and ſcaling the Heavens this Glaſs, might plainly have diſcerned what ſo much deſired. *Keplar* conſidering thoſe ſtran Diſcoveries which this Perſpective had made, co not chuſe but cry out in a περιστοποιία and Rapture Admiration, *O multiſcium & quovis ſceptro pretio perſpicillum! an qui te dextrâ tenet, ille non dominus c ſtituatur operum Dei?* And *Johannes Fabricius*, an elega Writer, ſpeaking of the ſame Glaſs, and for this I vention preferring our Age before thoſe former tim of greater Ignorance, ſays thus: *Adeo ſumus ſuperi veteribus, ut quam illi carminis magici pronunciatu dem ſam repreſentaſſe putantur, nos non tantum innocenter dem tamus, ſed etiam familiari quodam intuitu ejus quaſi con tionem intucamur.* "So much are we above the An "ents, that whereas they were fain by their Magi "Charms to repreſent the Moon's Approach,

De macula in ſol obſer.

Ca

" cannot only bring her lower with a greater Inno-
" cence, but may alſo with a more familiar View
" behold her Condition." And becauſe you ſhall have no occaſion to queſtion the truth of thoſe Experiments which I ſhall afterwards urge from it, I will therefore ſet down the Teſtimony of an Enemy; and ſuch a Witneſs hath always been accounted prevalent: You may ſee it in the above-named *Cæſar la Galla*, whoſe Words are theſe. *Mercurium caduceum geſtantem, cœleſtia nunciare, & mortuorum animas ab inferis revocare ſapiens finxit antiquitas. Galilæum vero novum Jovis interpretem Teleſcopio caduceo inſtructum Sydera aperire, & veterum Philoſophorum manes ad ſuperos revocare ſolers noſtra ætas videt & admiratur.* " Wiſe An-
" tiquity fabled *Mercury* carrying a Rod in his hand
" to relate News from Heaven, and call back the
" Souls of the Dead; but it hath been the Happineſs
" of our induſtrious Age, to ſee and admire *Galilæus*,
" (the new Ambaſſador of the Gods) furniſhed with
" his Perſpective to unfold the Nature of the Stars,
" and awaken the Ghoſts of the ancient Philoſo-
" phers." So worthily and highly did theſe Men eſteem of this excellent Invention. *De phænom. cap. 1.*

Now if you would know what might be done by this Glaſs, in the ſight of ſuch things as were nearer at hand, the ſame Author will tell you, when he ſays, That by it thoſe things which could ſcarce at all be diſcerned by the Eye, at the diſtance of a Mile and a half, might plainly and diſtinctly be perceived for 16 *Italian* Miles, and that as they were really in themſelves, without any Tranſpoſition or Falſifying at all. So that what the ancient Poets were fain to put in a Fable, our more happy Age hath found out in a Truth; and we may diſcern as far with theſe Eyes which *Galilæus* hath beſtowed upon us, as *Lynceus* could with thoſe which the Poets attributed unto him. But if you yet doubt whether all theſe Obſervations were true, the ſame Author may confirm you, when he ſays *Ibid. c. 6.*

Cap. 1. says they were shewed, *Non uni aut alteri, sed quamplurimis, neq; gregariis hominibus, sed præcipuis atq; disciplinis omnibus, necnon Mathematicis & Opticis præceptis optime instructis sedulâ ac diligenti inspectione.* "Not to one "or two, but to very many, and those not ordinary "Men, but to those who were well vers'd in Mathe"maticks and Opticks; and that not with a mee"Glance, but with a sedulous and diligent Inspecti"on." And left any Scruple might remain unanswered, or you might think the Men who beheld all this, though they might be skilful, yet they came with credulous Minds, and so were more easie to be deluded: He adds that it was shewed, *Viris qui ad experimenta hæc contradicendi animo accesserant.* "To such "as were come with a great deal of Prejudice, and "an intent of Contradiction." Thus you may see the Certainty of those Experiments which were taken by this Glass. I have spoken the more concerning it because I shall borrow many things in my further Discourse, from those Discoveries which were made by it.

Cap. 5.

I have now cited such Authors both Ancient and Modern, who have directly maintained the same Opinion. I told you likewise in the Proposition, that it might probably be deduced from the Tenents of others: Such were *Aristarchus*, *Philolaus*, and *Copernicus*, with many other later Writers, who assented to their Hypothesis; so *Joach. Rhelicus*, *David Origanus Lansbergius*, *Guil. Gilbert*; and, (if I may believe *Campanella*) *Innumeri alii Angli & Galli*; Very many others, both *English* and *French*, all who affirmed our Earth to be one of the Planets, and the Sun to be the Center of all, about which the Heavenly Bodies did move. And how horrid soever this may seem at the first, yet is it likely enough to be true, nor is there any Maxim or Observation in *Opticks* (saith *Pena*) that can disprove it.

See the Second Book. 1. Prop.

Apologia pro Galilæo.

Now

Now if our Earth were one of the Planets (as it is according to them) then why may not another of the Planets be an Earth?

Thus have I ſhewed you the Truth of this Propoſition. Before I proceed farther, 'tis requiſite that I inform the Reader what Method I ſhall follow in the proving of this chief Aſſertion, *That there is a World in the Moon.*

The Order by which I ſhall be guided, will be that which *Ariſtotle* uſes in his Book *De Mundo* (if that Book were his.)

Firſt, περὶ τῶν ἐν αὐτῇ, of thoſe chief Parts which are in it; not the Elementary and Æthereal (as he doth there) ſince this does not belong to the preſent Queſtion, but of the Sea and Land, *&c.* Secondly, περὶ αὐτῷ παθῶν, of thoſe things which are Extrinſical to it, as the Seaſons, Meteors, and Inhabitants.

PROP. VII.

That thoſe Spots and brighter Parts, which by our Sight may be diſtinguiſhed in the Moon, do ſhew the Difference betwixt the Sea and Land in that other World.

FOR the clear Proof of this Propoſition, I ſhall firſt reckon up and refute the Opinions of others concerning the Matter and Form of thoſe Spots, and then ſhew the greater Probability of this preſent Aſſertion, and how agreeable it is to that Truth which is moſt commonly received. As for the Opinions of others concerning theſe, they have been very many: I will only reckon up thoſe which are common and remarkable.

Some there are that think thoſe Spots do not ariſe from any Deformity of the Parts, but a Deceit of the Eye,

Eye, which cannot at ſuch a Diſtance diſcern an equ Light in that Planet: But theſe do but only ſay and ſhew not any Reaſon for the Proof of their Op nion. Others think that there are ſome Bodies b twixt the Sun and Moon, which keeping off the Lig in ſome Parts, do by their Shadow produce theſe Spo which we there diſcern.

So *Bede* in *l. de Mund. conſtit.*

Others would have them to be the Figure of t Seas or Mountains here below, repreſented there as a Looking-Glaſs. But none of thoſe Fancies can true, becauſe the Spots are ſtill the ſame, and not v ried according to the difference of Places; and b ſides, *Cardan* thinks it is impoſſible that any Ima ſhould be conveyed ſo far, as there to be repreſent unto us at ſuch a diſtance. But 'tis commonly relat of *Pythagoras*, that he by writing what he pleaſed in Glaſs, by the Reflexion of the ſame Species wou make thoſe Letters to appear in the Circle of the Moo where they ſhould be legible by any other, who mig at that time be ſome Miles diſtant from him. * *grippa* affirms this to be poſſible, and the way of pe forming it not unknown to himſelf, with ſome othe in his time. It may be, that Biſhop *Godwin* did the like Means perform thoſe ſtrange Concluſion which he profeſſes in his *Nuncius Inanimatus*; whe he pretends, that he can inform his Friends of wh he pleaſes, though they be an hundred Miles diſtan *forte etiam, vel milliare milleſimum*, (they are his ow Words) and perhaps a thouſand; and all this in little ſpace, quicker than the Sun can move.

De ſubtil. lib. 3.

* *Occulta Philoſ. l.* 1. *cap.* 6.

Now, what Conveyance there ſhould be for ſpeedy a Paſſage, I cannot conceive, unleſs it be ca ried with the Light, than which we know not an thing quicker. But of this only by the way. Hov ever, whether thoſe Images can be repreſented ſo not, yet certain it is, thoſe Spots are not ſuch Repr ſentations. Some think that when God had at fi created too much Earth to make a perfect Globe, n

know

knowing well where to beſtow the reſt, he placed it in the Moon, which ever ſince hath ſo darkned it in ſome Parts: But the Impiety of this is ſufficient Confutation, ſince it ſo much detracts from the Divine Power and Wiſdom.

The * Stoicks held that Planet to be mixed of Fire and Air; and in their Opinion, the Variety of its Compoſition cauſed her Spots: Being not aſhamed to ſtile the ſame Body a Goddeſs, calling it *Diana*, *Minerva*, &c. and yet affirm it to be an impure Mixture of Flame and Smoak, and fuliginous Air. —But this Planet cannot conſiſt of Fire, ſaith *Plutarch*, becauſe there is not any Fewel to maintain it. And the Poets have therefore fained *Vulcan* to be Lame, becauſe he can no more ſubſiſt without Wood or other Fewel, than a Lame Man without a Staff.

* *Plut. de placit. phil. l. 2. c. 25.*

Anaxagoras thought all the Stars to be of an Earthly Nature, mixed with ſome Fire; and as for the Sun, he affirmed it to be nothing elſe but a fiery Stone: For which latter Opinion, the *Athenians* ſentenc'd him to Death; thoſe zealous Idolaters counting it a great Blaſphemy to make their God a Stone; whereas notwithſtanding, they were ſo ſenſeleſs in their Adoration of Idols, as to make a Stone their God. This *Anaxagoras* affirmed the Moon to be more Terreſtrial than the other Planets, but of a greater Purity than any thing here below; and the Spots he thought were nothing elſe but ſome Cloudy Parts intermingled with the Light which belonged to that Planet; but I have above deſtroyed the Suppoſition on which this Fancy is grounded. *Pliny* thinks they ariſe from ſome Droſſy Stuff, mixed with that Moiſture which the Moon attracts unto her ſelf; but he was of their Opinion who thought the Stars were nouriſhed by ſome Earthly Vapours; which you may commonly ſee refuted in the *Commentators* on the Books *de Cœlo*.

Joſephus l. 2. con. App. Auguſt. de Civit. Dei. l. 18. c. 41

Nat. Hiſt. l. 2. c. 9.

Fitell.o

Vitellio and *Reinoldus* affirm the Spots to be the thick-
Opt. lib. 9. Comment. in Purb. p. 164. er Parts of the Moon, into which the Sun cannot in-
fuſe much Light; and this (ſay they) is the Reaſon
why in the Sun's Eclipſes the Spots and brighter Parts
are ſtill in ſome meaſure diſtinguiſhed, becauſe the
Sun-Beams are not able ſo well to penetrate through
thoſe thicker, as they may through the thinner Parts
of that Planet. Of this Opinion alſo was *Cæſar de*
Galla, whoſe Words are theſe; "The Moon doth
Ex qua parte luna eſt tranſpicua non ſolum ſecundum ſuperficiem, ſed etiam ſecundum ſubſtantiam, eatenus clara, ex qua autem parte opaca eſt, eatenus obſcura videtur. De Phænom. cap. 11.
"there appear cleareſt, where ſhe is tranſpicuous, not
"only through the Superficies, but the Subſtance alſo
"ſo; and there ſhe ſeems ſpotted, where her Body is
"moſt opacous." The Ground of this his Aſſertion
was, becauſe he thought the Moon did receive and
beſtow her Light by Illumination only, and not at all
by Reflexion; but this, together with the ſuppoſed
penetration of the Sun-beams, and the perſpicuity of
the Moon's Body I have above anſwered and refuted.

Albert. mag. de Coævis. 2. 4. Art. 21. Colleg. Con.
The more common and general Opinion is, that
the Spots are the thinner parts of the Moon, which
are leſs able to reflect the Beams that they receive
from the Sun, and this is moſt agreeable to Reaſon;
for if the Stars are therefore brighteſt, becauſe they
are thicker and more ſolid than their Orbs, then it
will follow, that thoſe Parts of the Moon which
have leſs Light, have alſo leſs thickneſs. It was the
Providence of Nature (ſay ſome) that ſo contrived
that Planet to have theſe Spots within it; for ſince
that is neareſt to thoſe Lower Bodies which are ſo full
of Deformity, 'tis requiſite that it ſhould in ſome
meaſure agree with them; and as in this Inferior
World, the higher Bodies are the moſt compleat, ſo
alſo in the Heavens, Perfection is aſcended unto by
degrees, and the Moon being the loweſt, muſt be
the leaſt pure; and therefore *Philo* the *Jew* inter-
De Somniis. preting *Jacob's* Dream concerning the Ladder, doth
in an Allegory ſhew how that in the Fabrick of the
World,

World, all things grow perfecter as they grow higher; and this is the Reason (saith he) why the Moon doth not consist of any pure simple Matter, but is mix'd with Air, which shews so darkly within her Body.

But this cannot be a sufficient Reason; for tho' it were true that Nature did frame every thing perfecter as it was higher, yet is it as true that Nature frames every thing fully perfect for that Office to which she intends it. Now had she intended the Moon meerly to reflect the Sun-beams, and give Light, the Spots then had not so much argued her Providence, as her unskilfulness and oversight, as if in the hast of her Work she could not tell how to make that Body exactly fit for that Office to which she intended it. *Scalig. exercit. 62.*

'Tis likely then that she had some other end which moved her to produce this Variety; and this, in all probability, was her intent, to make it a fit Body for habitation, with the same Conveniences of Sea and Land, as this Inferior World doth partake of. For since the Moon is such a vast, such a solid and opacous Body, like our Earth (as was above proved) why may it not be probable that those thinner and thicker Parts appearing in her, do shew the difference betwixt the Sea and Land in that other World? And *Galilæus* doubts not, but that if our Earth were visible at the same distance, there would be the like appearance of it.

If we consider the Moon as another habitable Earth, then the Appearances of it will be altogether exact and beautiful, and may argue unto us that it is fully accomplish'd for all those Ends to which Providence did appoint it. But consider it barely as a Star or Light, and then there will appear in it much imperfection and deformity, as being of an impure dark Substance, and so unfit for the Office of that Nature.

As

As for the Form of thoſe Spots, ſome of the Vulgar think they repreſent a Man, and the Poets gueſs 'tis the Boy *Endymion*, whoſe Company ſhe loves ſo well, that ſhe carries him with her: Others will have it only to be the Face of a Man, as the Moon is uſually pictured; but *Albertus* thinks rather, that it repreſents a Lyon with his Tail towards the *Eaſt*, and his Head the *Weſt*; and * ſome others have thought it to be very much like a Fox; and certainly 'tis as much like a Lyon as that in the *Zodiack*, or as *Urſa Major* is like a Bear.

* *Euſebius Nieremb. Hiſt. Nat. l. 8. c. 15.*

I ſhould gueſs that it repreſents one of theſe as well as another, and any thing elſe as well as any of theſe, ſince 'tis but a ſtrong Imagination which fancies ſuch Images, as School-Boys uſually do in the Marks of a Wall, whereas there is not any ſuch Similitude in the Spots themſelves, which rather like our Sea, in reſpect of the Land, appears under a rugged and confuſed Figure, and doth not repreſent any diſtinct Image: So that both in reſpect of the Matter and the Form, it may be probable enough that thoſe Spots and brighter Parts may ſhew the diſtinction betwixt the Sea and Land in that other World.

PROP. VIII.

The Spots repreſent the Sea, and the Brighter Parts the Land.

WHEN I firſt compared the Nature of our Earth and Water with thoſe Appearances in the Moon, I concluded contrary to the Propoſition, that the Brighter Parts repreſented the Water, and the Spots the Land. Of this Opinion likewiſe was *Keplar* at the firſt. But my Second Thoughts, and the reading

Opt. Aſtro. c. 6. num. 9. Diſſert. cum nuncio Gal.

reading of others, have now convinced me (as after he was) of the Truth of thatPropoſition which I have now ſet down. Before I come to the confirmation of it, I ſhall mention thoſe Scruples which at firſt made me doubt the truth of this Opinion.

1. It may be objected, 'tis probable, if there be any ſuch Sea and Land as ours, that it bears ſome proportion and ſimilitude with ours: But now this Propoſition takes away all likeneſs betwixt them. For whereas the Superficies of our Earth is but the third part of the whole Surface in the Globe, two parts being overſpread with the Water (as *Scaliger* obſerves) yet here, according to this Opinion, the Sea ſhould be leſs than the Land, ſince there is not ſo much of the Beſpotted as there is of the Enlightned Parts; wherefore 'tis probable that there is no ſuch Thing at all, or elſe that the Brighter Parts are the Sea. *Exercit.* 38.

2. The Water, by reaſon of the ſmoothneſs of its Superficies, ſeems better able to reflect the Sun-beams than the Earth, which in moſt places is ſo full of ruggedneſs, of Graſs and Trees, and ſuch like Impediments of Reflexion; and beſides, Common Experience ſhews that the Water ſhines with a greater and more glorious Brightneſs than the Earth; therefore it ſhould ſeem that the Spots are the Earth, and the brighter Parts the Water. But to the firſt it may be anſwered.

1. There is no great probability in this Conſequence, that becauſe 'tis ſo with us, therefore it muſt be ſo with the Parts of the Moon; for ſince there is ſuch a difference betwixt them in divers other reſpects, they may not perhaps agree in this.

2. That Aſſertion of *Scaliger* is not by all granted for a Truth. *Fromondus* with others think that the Superficies of the Sea and Land, in ſo much of the World as is already diſcover'd, is equal and of the ſame extenſion. *De Meteoris, l.* 5. *c.* 1. *Art.* 1.

3. The

3. The Orb of Thick and Vaporous Air which encompaſſes the Moon, makes the brighter Parts of that Planet appear bigger than in themſelves they are as I ſhall ſhew afterwards.

To the Second it may be anſwered, That though the Water be of a ſmooth Superficies, and ſo may ſeem moſt fit to reverberate the Light, yet becauſe 'tis of a perſpicuous Nature, therefore the Beams muſt ſink into it, and cannot ſo ſtrongly and clearly be reflected. *Sicut in ſpeculo ubi plumbum abraſum fuerit,* (ſaith *Cardan*) as in Looking-Glaſſes, where part of the Lead is razed off, and nothing left behind to reverberate the Image, the Species muſt there paſs through, and not back again: So it is where the Beams penetrate and ſink into the ſubſtance of the Body, there cannot be ſuch an immediate and ſtrong Reflexion, as when they are beat back from the Superficies; and therefore the Sun cauſes a greater heat by far upon the Land, than upon the Water. Now as for that Experiment, where it is ſaid, That the Waters have a greater Brightneſs than the Land; I anſwer, 'Tis true only there where they repreſent the Image of the Sun, or ſome bright Cloud, and not in other Places; eſpecially if we look upon them at any great diſtance, as is very plain by common Obſervation.

And 'tis certain, that from any high Mountain the Land does appear a great deal brighter than any Lake or River.

This may yet be farther illuſtrated by the Similitude of a Looking-Glaſs hanging upon a Wall in the Sun ſhine; where, if the Eye be not placed in the juſt Line of Reflexion from the Glaſs, 'tis manifeſt that the Wall will be of a brighter Appearance than the Glaſs. True indeed, in the Line of Reflexion, the Light of the Glaſs is equal almoſt unto that which comes immediately from the Sun it ſelf; but now this is only in one particular Place, and ſo is not like

that

hat Brightneſs which we diſcern in the Moon; be-
auſe this does appear equally in ſeveral Situations,
ke that of the Wall, which does ſeem bright as well
om every Place, as from any one. And therefore
he roughneſs of the Wall, or (as it is in the Objection)
he ruggedneſs of our Earth, is ſo far from being an
indrance of ſuch a Reflexion as there is from the
loon, that it is rather required as a neceſſary Con-
ition unto it. We may conceive that in every rough
ody, there are, as it were, innumerable Superficies,
iſpoſed unto an innumerable Diverſity of Inclinati-
ns. *Ita ut nullus ſit locus, ad quem non pertingant pluri-*
i radii reflexi a plurimis ſuperficieculis, per omnem corporis
abri radiis luminoſis percuſſi ſuperficiem diſperſis. "So
that there is not any Place unto which there are
not ſome Beams reflected from theſe diverſe Super-
ficies, in the ſeveral Parts of ſuch a rugged Body."
ut yet (as I ſaid before) the Earth does receive a
reat part of its Light by Illumination, as well as by
eflexion.

Galilæus Syſtem. Coll. 1.

So that notwithſtanding thoſe Doubts, yet this Pro-
oſition may remain true, That the Spots may be the
ea, and the brighter Parts the Land. Of this Opi-
ion was *Plutarch*: Unto him aſſented *Keplar* and *Ga-*
læus, whoſe Words are theſe: *Si quis veterum Pytha-*
oreorum ſententiam exuſcitare velit, lunam ſcilicet eſſe quaſi
ellurem alteram ejus pars lucidior terrenam ſuperficiem, ob-
curior vero aqueam magis congruè repræſentet. Mihi au-
em dubium fuit nunquam terreſtris globi à longe conſpecti,
tque a radiis ſolaribus perfuſi, terream ſuperficiem clario-
em, obſcuriorem vero aqueam ſeſe in conſpectum daturam.
"If any Man have a mind to renew the Opinion of
the *Pythagoreans*, That the Moon is another Earth;
then her brighter Parts may fitly repreſent the
Earth's Superficies, and the darker part the Water:
And for my part, I never doubted but that our
Earthly Globe being ſhined upon by the Sun,
and beheld at a great diſtance, the Land would

De facie Lun. Diſſertatio Nunc. Syd.

" appear brighteſt, and the Sea more obſcurely. The Reaſons may be,

1. That which I urged about the foregoing Cha ter ; becauſe the Water is the thinner part, and ther fore muſt give leſs Light.

Since the Stars and Planets, by reaſon of the Brightneſs, are uſually concluded to be the thick Parts of their Orb.

In lib. de coloribs.

2. Water is in it ſelf of a blacker Colour (ſaith *riſtotle*) and therefore more remote from Light tha the Earth. Any Part of the Ground being moiſtn with Rain, does look much more darkly than when is dry ?

3. 'Tis obſerved that the Secondary Light of t Moon (which afterwards is proved to proceed fro our Earth) is ſenſibly brighter unto us, for two three Days before the Conjunction, in the Morni when ſhe appears Eaſtward, than about the ſame tir after the Conjunction, when ſhe is ſeen in the *We* The Reaſon of which muſt be this, becauſe that pa of the Earth which is oppoſite to the Moon in t *Eaſt*, has more Land in it than Sea. Whereas on t contrary, the Moon when ſhe is in the *Weſt*, is ſhin upon by that part of our Earth where there is mo Sea than Land ; from whence it will follow with goo probability, that the Earth does caſt a greater Lig than the Water.

4. Becauſe Obſervation tells us, that the Spott Parts are always ſmooth and equal, having eve where an equality of Light when once they are e lightned by the Sun ; whereas the brighter parts a full of rugged Gibboſities and Mountains, havi many Shades in them, as I ſhall ſhew more at large terwards.

That in this Planet there muſt be Seas, *Campane* endeavours to prove out of Scripture, interpreti *the Waters above the Firmament*, ſpoken in *Geneſis*, to meant of the Sea in this World. For (ſaith he)

Apologia pro Galilæo.

ot likely that there are any ſuch Waters above the
rbs to moderate that Heat which they receive from
eir ſwift Motion (as ſome of the Fathers think).
or did *Moſes* mean the Angels, which may be
ll'd Spiritual Waters, as *Origen* and *Auſtin* would
ve it, for both theſe are rejected by the General
onſent: Nor could he mean any Waters in the Se-
nd Region, as moſt Commentators interpret it.
r firſt there is nothing but Vapours, which though
ey are afterwards turned into Water, yet while they
main there, they are only the Matter of that Ele-
ent, which may as well be Fire, or Earth, or Air.
Thoſe Vapours are not above the Expanſum, but
it. So that he thinks there is no other way to ſalve
, but by making the Planets ſeveral Worlds with
a and Land, with ſuch Rivers and Springs as we
ve here below: Eſpecially ſince *Eſdras* ſpeaks of the
rings above the Firmament. But I cannot agree
th him in this, nor do I think that any ſuch thing
n be proved out of Scripture.

Vide Ieron. Epiſt. ad Pammachium. Confeſſion. l. 13. c. 32. Retracted lib. 2. Retr. cap. 6.

2 Eſdr. 4. 7.

Before I proceed to the next Poſition, I ſhall firſt
ſwer ſome Doubts which might be made againſt
e generality of this Truth, whereby it may ſeem
poſſible that there ſhould be either Sea or Land in
Moon: For ſince ſhe moves ſo ſwiftly as Aſtro-
mers obſerve, why then does there nothing fall
m her, or why doth ſhe not ſhake ſomething out
the celerity of her Revolution? I anſwer, You
ſt know that the inclination of every heavy Body
its proper Center, doth ſufficiently tye it unto its
ce; ſo that ſuppoſe any thing were ſeparated, yet
ſt it neceſſarily return again. And there is no
re danger of their falling into our World, than
re is fear of our falling into the Moon.

But yet there are many Fabulous Relations of ſuch
ings as have dropped thence. There is a Tale of
Nemean Lyon that *Hercules* ſlew, which firſt ruſh-
among the Herds out of his unknown Den in

Vide Guli. Nubrigenſ. de rebus Anglica. Lib. 1.

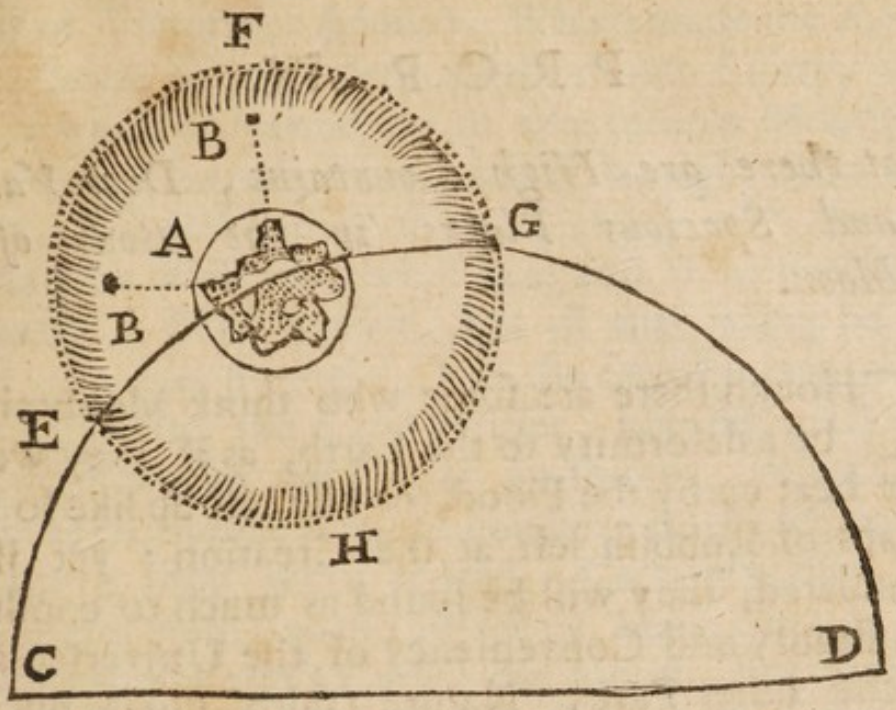
the Mountain of *Cytheron* in *Bœotia*, the Credul People thought he was ſent from their Goddeſs Moon. And if a Whirlwind did chance to ſna any thing up, and afterwards rain it down again, ignorant Multitude were apt to believe that it d from Heaven. Thus *Avicenna* relates the Story Calf which fell down in a Storm, the Behol thinking it a Moon-Calf, and that it fell thence. *Cardan* travelling upon the *Apennine* Mountains, a den Blaſt took off his Hat, which if it had b carried far, he thinks the Peaſants, who had per ved it to fall, would have ſworn it had rained H After ſome ſuch manner many of our Prodigies c to paſs, and the People are willing to believe thing which they may relate to others as a ſtrange and wonderful Event. I doubt not but *Trojan Palladium*, the *Roman Minerva*, and our La Church at *Loretto*, with many Sacred Relicks preſe by the *Papiſts*, might drop from the Moon as we any of theſe.

But it may be again objected, Suppoſe there we Bullet ſhot up in that World, would not the M run away from it before it could fall down, ſince Motion of her Body (being every Day round Earth) is far ſwifter than the other, and ſo the B muſt be left behind, and at length fall down to To this I anſwer,

1. If a Bullet could be ſhot ſo far till it came to Circumference of thoſe Things which belong to Center, then it would fall down to us.

2. Though there were ſome heavy Body a g Height in that Air; yet would the Motion of Magnetical Globe to which it did belong, by an tractive Virtue ſtill hold it within its convenien ſtance, ſo that whether their Earth moved or ſt ſtill, yet would the ſame Violence caſt a Body fro equally far. That I may the plainer expreſs my M ing, I will ſet down this Diagram.

Sup



Suppoſe this Earth were A, which was to move in he Circle C, D, and let the Bullet be ſuppoſed at B, vithin its proper Verge ; I ſay, whether this Earth did ſtand ſtill, or move ſwiftly towards D, yet the Bullet would ſtill keep at the ſame diſtance, by reaſon of that Magnetick Virtue of the Center (if I may ſo ſpeak) whereby all Things within its Sphere are attracted with it. So that the violence to the Bullet , being nothing elſe but that whereby 'tis removed from its Center, therefore an equal Violence can carry a Body from its proper Place but at an equal diſtance, whether or no this Earth where its Center is, does ſtand ſtill or move.

The Impartial Reader may find ſufficient ſatisfaction for this and ſuch other Arguments as may be urged againſt the Motion of that Earth, in the Writings of *Copernicus* and his Followers ; unto whom, for brevity ſake, I will refer them.

PROP. IX.

That there are High Mountains, Deep Vallie and Spacious Plains in the Body of t Moon.

THough there are ſome who think Mountains be a deformity to the Earth, as if they were ther beat up by the Flood, or elſe caſt up like ſo ma Heaps of Rubbiſh left at the Creation; yet if w conſidered, they will be found as much to conduce the Beauty and Conveniency of the Univerſe, as a of the other Parts. Nature (ſaith *Pliny*) purpoſ framed them for many excellent uſes; partly to ta the Violence of greater Rivers, to ſtrengthen certa Joints within the Veins and Bowels of the Earth, break the Force of the Seas Inundation, and for t ſafety of the Earth's Inhabitants, whether Beaſts Men. That they make much for the protection Beaſts, the Pſalmiſt teſtifies; *The higheſt Hills are a fuge for the Wild Goats, and the Rocks for Conies.* T Kingly Prophet had likewiſe learned the ſafety theſe by his own experience, when he alſo was fa to make a Mountain his Refuge from the Fury of Maſter *Saul*, who perſecuted him in the Wilde neſs.

Nat. Hiſt. l. 36. *c.* 5.

Pſal. 104. *v.* 18.

True indeed, ſuch Places as theſe keep their Neig bours poor, as being moſt barren, but yet they pr ſerve them ſafe, as being moſt ſtrong; witneſs o unconquered *Wales* and *Scotland*, whoſe greateſt Pr tection hath been the natural Strength of their Cou trey; ſo fortify'd with Mountains, that theſe ha always been unto them ſure Retreats from the Vi lence and Oppreſſion of others. Wherefore a go Author doth rightly call them Nature's Bulwarks, c

p at God Almighty's own Charges, the Scorns and Curbs of Victorious Armies. Which made the *Barbarians* in *Curtius* ſo confident of their own Safety, when hey were once retired to an inacceſſible Mountain; hat when *Alexander*'s Legate had brought them to a Parley, and perſwading them to yield, told them of is Maſter's Victories, what Seas and Wilderneſſes he ad paſſed; They replied that all that might be, but ould *Alexander* fly too? Over the Seas he might have hips, and over the Land Horſes, but he muſt have Vings before he could get up thither. Such Safety id thoſe barbarous Nations conceive in the Mountains vhereunto they were retired. Certainly then ſuch ſeful Parts were not the Effect of Man's Sin, or produced by the World's Curſe, the Flood; but rather at he firſt created by the Goodneſs and Providence of he Almighty.

This Truth is uſually concluded from theſe and the ke Arguments.

1. Becauſe the Scripture it ſelf, in the Deſcription f that general Deluge, tells us, it overflowed the igheſt Mountains.

2. Becauſe *Moſes* who writ long after the Flood, does et give the ſame Deſcription of Places and Rivers, as hey had before; which could not well have been if his had made ſo ſtrange an Alteration.

3. 'Tis evident that the Trees did ſtand as before. For otherwiſe, *Noah* could not ſo well have concluded, hat the Waters were abated, from this Reaſon, beauſe the Dove brought an Olive Leaf in her Mouth, vhen ſhe was ſent forth the Second Time: Whereas ad the Trees been rooted up, ſhe might have taken it he Firſt Time, from one of them as it was floating n the Top of the Waters. Now if the Motion of he Water was not ſo violent as to ſubvert the Trees, nuch leſs was it able to caſt up ſuch vaſt Heaps as the Mountains.

4. When the Scripture doth ſet forth unto us the

Power and Immenſity of God by the Variety or Uſe fulneſs of the Creatures which he hath made; among the reſt it doth often mention the Mountains. *Pſa.* 104. 8. *item*, 148. 9. *Iſa.* 40. 12. And therefor 'tis probable they were created at the firſt. Unt this I might add that in other Places, Divine Wiſdo in ſhewing of its own Antiquity, ſaith that he w *from the beginning, before the earth or the mountains we brought forth.*

Prov. 8. 25. Pſal. 90. 2.

Joſeph Ant. l. 1. cap. 3.

5. If we may truſt the Relations of Antiquit there were many Monuments left undefaced after th Flood.

So that if I intend to prove that the Moon is ſuc a habitable World as this is; 'tis requiſite that I ſhe it to have the ſame Conveniences of Habitation this hath. And here if ſome *Rabbi* or Chymick wer to handle the Point, they would firſt prove it out Scripture, from that Place in *Moſes* his Bleſſing, whe he ſpeaks of the Ancient Mountains and laſting Hill *Deut.* 33. ראשי קדם וגבעות עולם for having im mediately before mentioned thoſe Bleſſings whic ſhould happen unto *Joſeph* by the Influence of th Moon, he does preſently exegetically iterate them, i bleſſing him with the chief things of the ancien Mountains and laſting Hills; you may alſo ſee th ſame Expreſſion uſed in *Jacob's* Bleſſing of *Jo ſeph.*

Gen. 49. 26.

But however we may deal *pro* or *con* in Philoſophy yet we muſt not be too bold with Divine Truths, o bring Scripture to patronize any Fancy of our own though, (perhaps) it be a Truth. I am not of thei Mind, who think it a good Courſe to confirm Philo ſophical Secrets from the Letter of the Scripture, o by abuſing ſome obſcure Text in it. Methinks it ſa vours too much of that Melancholly Humor of th Chymicks, who, aiming in all their Studies at th making of Gold, do perſuade themſelves, that th moſt Learned and Subtile of the Ancient Authors, i

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all their obſcure Places do mean ſome ſuch Senſe as may make to their Purpoſe. And hence it is that they derive ſuch ſtrange Myſteries from the Fables of the Poets; and can tell you what great Secret it was, that Antiquity did hide under the Fiction of *Jupiter* being turned into a Shower of Gold: Of *Mercury*'s being made the Interpreter of the Gods: Of the *Moon*'s deſcending to the Earth for the Love of *Endymion*: With ſuch ridiculous Interpretations of theſe and the like Fables, which any reaſonable conſidering Man cannot conceive to proceed from any but ſuch as are diſtracted. No leſs fantaſtical in this kind are the *Jewiſh Rabbies*; amongſt whom, is not any Opinion, whether in Nature or Policy, whether true or falſe, but ſome of them, by a Cabaliſtical Interpretation can father it upon a dark Place of Scripture, or (if need be) upon a Text that is clean contrary. There being not any Abſurdity ſo groſs and incredible, for which theſe Abuſers of the Text, will not find out an Argument. Whereas, 'tis the more natural Way, and ſhould be obſerved in all Controverſies, to apply unto every thing the proper Proofs of it; and when we deal with Philoſophical Truths, to keep our ſelves within the Bounds of Human Reaſon and Authority.

But this by the way. For the better Proof of this Propoſition, I might here cite the Teſtimony of *Diodorus*, who thought the Moon to be full of rugged Places, *velut terreſtribus tumulis ſupercilioſam*; but he erred much in ſome Circumſtances of this Opinion, eſpecially where he ſays, there is an Iſland amongſt the *Hyperboreans*, wherein thoſe Hills may to the Eye be plainly diſcovered; and for this reaſon * *Cælius* calls him a fabulous Writer. But you may ſee more expreſs Authority for the Proof of this in the Opinions of *Anaxagoras* and *Democritus*, who held that this Planet was full of champion Grounds, Mountains and Vallies. And this ſeemed likewiſe probable unto *Auguſtinus Nifus*,

* *Lectaut.* l. 1. c. 15.

Plut. de plac. l. 2. c. 25.

De Cælo. l. 2. part. 49.

fus, whoſe Words are theſe : *Forſitan non eſt remotum d cere lunæ partes eſſe diverſas, veluti ſunt partes terræ, qu rum aliæ ſunt valloſæ, aliæ montoſæ, ex quarum differenti effici poteſt facies illa lunæ , nec eſt rationi diſſonum, nam l na eſt corpus imperfecte Sphæricum, cum ſit corpus ab ultim cælo elongatum, ut ſupra dixit Ariſtoteles.* "Perhaps, "would not be amiſs to ſay that the Parts of th "Moon were divers, as the Parts of this Earth, where "of ſome are Vallies, and ſome Mountains; from th "Difference of which, ſome Spots in the Moon may pro "ceed ; nor is this againſt Reaſon ; for that Plane "cannot be perfectly Spherical, ſince 'tis ſo remote "Body from the firſt Orb, as *Ariſtotle* had ſaid before. You may ſee this Truth aſſented unto by *Blancanus* th Jeſuit, and by him confirmed with divers Reaſon *Keplar* hath obſerved in the Moon's Eclipſes, that th Diviſion of her enlightned Part from the ſhaded, wa made by a crooked unequal Line, of which there can not be any probable Cauſe conceived, unleſs it did a riſe from the Ruggedneſs of that Planet ; for it can not at all be produc'd from the Shade of any Moun tains here upon Earth ; becauſe theſe would be ſo le ſened before they could reach ſo high in a conical Sha dow, that they would not be at all ſenſible unto u (as might eaſily be demonſtrated) ; nor can it be con ceived what reaſon of this Difference there ſhould b in the Sun. Wherefore there being no other Body tha hath any thing to do in Eclipſes, we muſt neceſſarily conclude, that it is cauſed by a Variety of parts in th Moon it ſelf; and what can theſe be but its Gibboſities Now if you ſhould ask a Reaſon why there ſhould b ſuch a Multitude of theſe in that Planet, the ſam *Keplar* ſhall jeſt you out an Anſwer. Suppoſing (ſaith he) that thoſe Inhabitants are bigger than any of us in the ſame Proportion as their Days are longer than ours, *viz.* by Fifteen Times; it may be, for want o Stones to erect ſuch vaſt Houſes as were requiſite fo their Bodies, they are fain to dig great and round Hol low

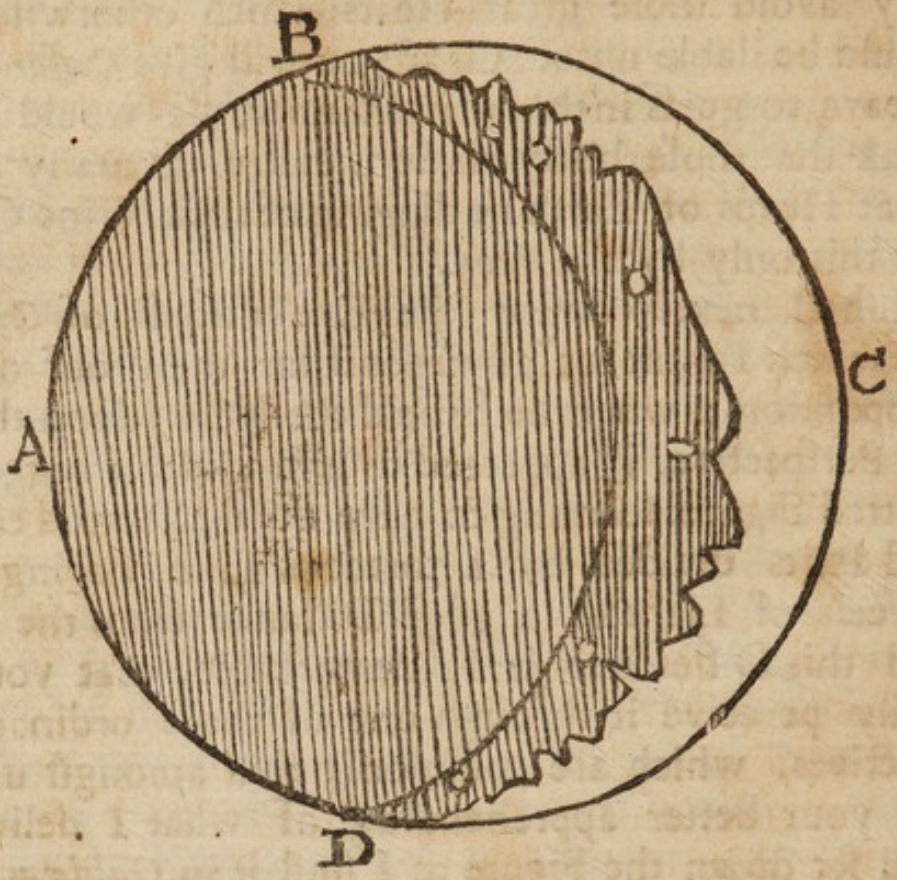
De Mundi fab. par. 3. c. 4.

Aſtron. Opt. c. 6. num. 9.

lows in the Earth, where they may both procure Water for their Thirſt, and turning about with the Shade, may avoid thoſe great Heats which otherwiſe they would be liable unto. Or if you will give *Cæſar la Galla* leave to gueſs in the ſame Manner, he would rather think that thoſe thirſty Nations caſt up ſo many and ſo great Heaps of Earth in digging of their Wine Cellars; but this only by the Way. *Kep. appen. Selenogra.*

I ſhall next produce the Eye-witneſs of *Galilæus*, on which I moſt of all depend for the Proof of this Propoſition; when he beheld the New Moon through his Perſpective, it appeared to him under a rugged and ſpotted Figure, ſeeming to have the darker and enlightned Parts divided by a tortuous Line, having ſome Parcels of Light at a good Diſtance from the other; and this Difference is ſo remarkable, that you may eaſily perceive it through one of thoſe ordinary Perſpectives, which are commonly ſold amongſt us; but for your better apprehending of what I deliver, I will ſet down the Figure as I find it in *Galilæus*. *Nuncius Sydereus.*

Sup-



Suppoſe *A B C D* to repreſent the Appearance of th Moon's Body being in a *Sextile*, you may ſee ſom brighter Parts ſeparated at a pretty Diſtance from th other, which can be nothing elſe but a Reflection o the Sun-beams upon ſome parts that are higher tha the reſt; and thoſe obſcure Gibboſities which ſtan out towards the enlightened Parts, muſt be ſuch hollo and deep Places whereto the Rays cannot reach. Bu when the Moon is got farther off from the Sun, an come to that Fulneſs as this Line *B D* doth repreſen her under; then do theſe Parts alſo receive an equa Light, excepting only that Difference which doth ap pear betwixt their Sea and Land. And if you do con ſider how any rugged Body would appear being en lightned, you would eaſily conceive that it muſt neceſſa rily ſeem under ſome ſuch gibbous unequal Form, a

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the Moon is here repreſented. Now for the Infallibility of theſe Appearances, I ſhall refer the Reader to that which hath been ſaid in the Sixth Propoſition.

But *Cæſar la Galla* affirms, that all theſe Appearances may conſiſt with a plain Superficies, if we ſuppoſe the Parts of the Body to be ſome of them *Diaphanous*, and ſome *Opacous*; and if you object that the Light which is convey'd to any Diaphanous Part in a plain Superficies, muſt be by a continued Line; whereas here there appear many brighter Parts among the obſcure at ſome Diſtance from the reſt: To this he anſwers, it may riſe from ſome ſecret Conveyances and Channels within her Body, that do conſiſt of a more Diaphanous Matter; which being covered over with an Opacous Superficies, the Light paſſing through them may break out a great way off; whereas the other Parts betwixt, may ſtill remain dark. Juſt as the River *Aretheuſa* in *Sicily*, which runs under Ground for a great way, and afterwards breaks out again. But, becauſe this is one of the chiefeſt Fancies, whereby he thinks he hath fully anſwered the Argument of this Opinion, I will therefore ſet down his Anſwer in his own Words, leſt the Reader might ſuſpect more in them than I have expreſſed. *Non eſt impoſſibile cæcos ductus diaphani & perſpicui corporis, ſed opaca ſuperficie protendi, uſque in diaphanam aliquam ex profundo in ſuperficiem emergentem partem, per quos ductus lumen longo poſt modum interſtitio erumpat, &c.* But I reply, if the Superficies betwixt theſe two enlightened Parts remain dark becauſe of its Opacity; then would it always be dark, and the Sun could not make it partake of Light more than it could of Perſpicuity. But this contradicts all Experience, as you may ſee in *Galilæus*, who affirms that when the Sun comes nearer to his Oppoſition, then that which is betwixt them both, is enlightened as well as either. Nay, this oppoſes his own Eye-witneſs; for he confeſſes himſelf that he ſaw this by the Glaſs. He had ſaid before, that he came to ſee thoſe ſtrange Cap. 11.

Sights

Sights di ſcovered by *Galilæus* his Glaſs, with an intent of Contradiction; and you may read that confirmed in the Weakneſs of this Anſwer, which rather bewrays an obſtinate, than a perſwaded Will; for otherwiſe ſure he would never have undertook to have deſtroyed ſuch certain Proof with ſo groundleſs a Fancy.

Syſt. mund. coll. 1. That Inſtance of *Galilæus*, would have been a better Evaſion, had this Author been acquainted with it; who might then have compared the Moon to that which we call Mother of Pearl, which though it be moſt exactly poliſhed in the Superficies of it; yet will ſeem unto the Eye as if there were divers ſwellings and riſings in its ſeveral Parts. But yet, this neither would not well have ſhifted the Experiment of the Perſpective. For theſe rugged Parts do not only appear upon one ſide of the Moon, but as the Sun does turn about in divers Places, ſo do they alſo caſt their Shadow. When the Moon is in her Increaſe, then do they caſt their Shadows to the *Eaſt*. When ſhe is in the Decreaſe, and the Sun on the other ſide of her, then likewiſe may we diſcover theſe brighter parts caſting their Shadows *Weſtward*. Whereas in the full Moon there are none of all theſe to be ſeen.

But it may be objected, that 'tis almoſt impoſſible, and altogether unlikely, that in the Moon there ſhould be any Mountains ſo high as thoſe Obſervations make them. For do but ſuppoſe according to the common Principles, that the Moon's Diameter unto the Earth's, is very near to the Proportion of Two to Seven. Suppoſe withal that the Earth's Diameter contains about 7000 *Italian* Miles, and the Moon's 2000 (as is commonly granted.) Now *Galilæus* hath obſerved, that ſome parts have been enlightned, when they were the Twentieth Part of the Diameter diſtant from the common Term of Illumination. From whence it muſt neceſſarily follow, that there may be ſome Mountains in the Moon ſo high, that they are able to caſt a Shadow

dow a Hundred Miles off. An Opinion that ſounds like a Prodigy or a Fiction; wherefore 'tis likely that either thoſe Appearances are cauſed by ſomewhat elſe beſides Mountains, or elſe thoſe are fallible Obſervations; from whence may follow ſuch improbable, inconceiveable Conſequences.

But to this I anſwer;

1. You muſt conſider the height of the Mountains is but very little, if you compare them to the length of their Shadows. Sir *Walter Rawleigh* obſerve that the Mount *Athos*, now called *Lacas*, caſts its Shadow 300 Furlongs, which is above 37 Miles; and yet that Mount is none of the higheſt. Nay *Solinus* (whom I ſhould rather believe in this kind) affirms that this Mountain gives his Shadow quite over the Sea, from *Macedon* to the Iſle of *Lemnos*, which is 700 Furlongs, or 84 Miles, and yet according to the common reckoning it doth ſcarce reach 4 Miles upwards in its perpendicular height.

Hiſt. l. 1. *cap.* 7. *ſect.* 11.

Poly. Hiſt. c. 21.

2. I affirm that there are very high Mountains in the Moon. *Keplar* and *Galilæus* think that they are higher than any which are upon our Earth. But I am not of their Opinion in this, becauſe I ſuppoſe they go upon a falſe Ground, whilſt they conceive that the higheſt Mountain upon the Earth is not above a Mile perpendicular.

Whereas 'tis the Common Opinion, and found true enough by obſervation, that *Olympus*, *Atlas*, *Taurus* and *Emus*, with many others, are much above this height. *Tenariffa* in the *Canary* Iſlands, is commonly related to be above 8 Miles perpendicular, and about this height (ſay ſome) is the Mount *Perjacaca* in *America*. * Sir *Walter Rawleigh* ſeems to think that the higheſt of theſe is near 30 Miles upright: Nay *Ariſtotle* ſpeaking of *Caucaſus* in *Aſia*, affirms it to be viſible for 560 Miles, as ſome Interpreters find by computation; from which it will follow, that it was 78 Miles perpendicularly high; as you may ſee confirmed by

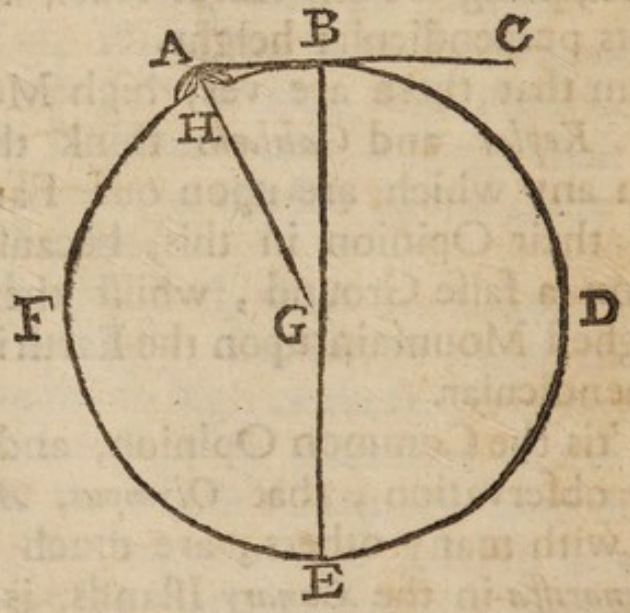
* *Hiſt. l.* 1. *c.* 7. *ſect.* 11. *Meteor. l.* 1. *c.* 11.

Jacobus

Comparatio Ariſt. cum. Platone, ſect. 3. *c.* 5. *Expoſt. in loc. Math. Arlis loc.* 148.

Jacobus Mazonius, and out of him in *Blancanus* th Jeſuit. But this deviates from the Truth more i exceſs than the other doth in defect. However though theſe in the Moon are not ſo high a ſome amongſt us; yet certain it is they are of great height, and ſome of them at the leaſt fou Miles perpendicular. This I ſhall prove from th obſervation of *Galilæus*, whoſe Glaſs can ſhew t the Senſes a Proof beyond exception; and cer tainly that Man muſt needs be of a moſt timo rous Faith, who dares not believe his own Eye.

By that Perſpective you may plainly diſcern ſom enlightned Parts (which are the Mountains) to b diſtant from the other about the twentieth part of th Diameter. From whence it will follow, that thoſ Mountains muſt neceſſarily be at the leaſt four *Italia* Miles in height.



For let B D E F be the Body of the Moon, A B will be a Ray or Beam of the Sun, which enlighte a Mountain at A, and B is the Point of Continge cy; the diſtance betwixt A and B muſt be ſuppoſe to be the twentieth part of the Diameter, which is a 100 Miles, for ſo far are ſome enlightened Parts ſ vered from the common Term of Illuminatio

No

ow the Aggregate of the Quadrate from A B a hun-ed, and B G 1000 will be 1010000; unto which e Quadrate ariſing from A G muſt be equal; ac-rding to the 47th Propoſition in the Firſt Book of E-ments. Therefore the whole Line A G is ſome-hat more than 1004, and the diſtance betwixt H A uſt be above 4 Miles, which was the Thing to be oved.

But it may be again objected, If there be ſuch rug-ed Parts, and ſo high Mountains, why then cannot e diſcern them at this diſtance? Why doth the Moon pear unto us ſo exactly round, and not rather as a Wheel with Teeth?

I anſwer, by reaſon of too great a diſtance; for the whole Body appear to our Eye ſo little, then oſe Parts which bear ſo ſmall a proportion to the hole, will not at all be ſenſible.

But it may be reply'd, if there were any ſuch re-arkable Hills, why does not the Limb of the Moon ppear like a Wheel with Teeth, to thoſe who look pon it through the great Perſpective, on whoſe Wit-eſs you ſo much depend? Or what Reaſon is there hat ſhe appears as exactly round through it, as ſhe oth to the bare Eye? Certainly then either there is o ſuch thing as you imagine, or elſe the Glaſs fails nuch in this Diſcovery.

To this I ſhall anſwer out of *Galilæus*.

1. You muſt know, that there is not meerly one ank of Mountains above the edge of the Moon, ut divers Orders, one Mountain behind another, nd ſo there is ſomewhat to hinder thoſe void ſpaces hich otherwiſe, perhaps, might appear.

Now, where there be many Hills, the Ground eems even to a Man that can ſee the tops of all. Thus when the Sea rages, and many vaſt Waves are lifted p, yet all may appear plain enough to one that ſtands t the Shore. So where there are ſo many Hills, the

inequality will be leſs remarkable, if it be diſcerne at a diſtance.

2. Though there be Mountains in that Part whic appears unto us to be the Limb of the Moon, well as in any other Place,-yet the bright Vapou hide their appearance; For there is an Orb of thic vaporous Air that doth immediately compaſs th Body of the Moon; which though it have not great opacity, as to terminate the Sight, yet beir once enlightned by the Sun, it doth repreſe the Body of the Moon under a greater Form and hinders our Sight from a diſtinct View her true Circumference. But of this in the ne Chapter.

Somn. Aſtr. not. 207. 3. *Keplar* hath obſerved, That in the Sola Eclipſes, when the Rays may paſs through this V porous Air, there are ſome Gibboſities to be diſcern ed in the Limb of the Moon.

I have now ſufficiently proved, that there a Hills in the Moon; and hence it may ſeem lik ly that there is alſo a World: For ſince Prov dence hath ſome ſpecial End in all its Works, ce tainly then theſe Mountains were not produced i vain; and what more probable Meaning can we con ceive there ſhould be, than to make that Place co venient for habitation.

PROP. X.

That there is an Atmo-ſphæra, or an Orb of Groſs Vaporous Air immediately encompaſſing the Bo of the Moon.

AS that Part of our Air which is neareſt to th Earth is of a thicker Subſtance than the othe by reaſon 'tis always mixed with ſome Vapours whic

ıre continually exhaled into it: So is it equally re-
quiſite, that if there be a World in the Moon, that
he Air about that ſhould be alike qualify'd with ours.
Now that there is ſuch an Orb of Groſs Air, was firſt
f all (for ought I can read) obſerved by *Meſlin*, af-
erwards aſſented unto by *Keplar* and *Galilæus*, and
ince by *Baptiſta Cittacus*, *Scheiner*, with others, all of
hem confirming it by the ſame Arguments; which I
hall only cite, and then leave this Propoſition.

Vide Euſeb. Nicrem. de Nat. Hiſt. l. 2. c. 11.

1. 'Tis not improbable that there ſhould be a Sphere
f Groſſer Air about the Moon; becauſe 'tis obſerv'd
hat there are ſuch kind of Evaporations which pro-
eed from the Sun it ſelf. For there are diſcovered di-
ers moveable Spots, like Clouds, that do encompaſs
is Body; which thoſe Authors who have been moſt
equently verſed in theſe kind of Experiments and
tudies, do conclude to be nothing elſe but Evapora-
ons from it. The probability and truth of which
)bſervations may alſo be inferred from ſome other
ppearances. As,

1. It hath been obſerved that the Sun hath ſome-
mes for the ſpace of four Days together, appear'd as
ıll and ruddy almoſt as the Moon in her Eclipſes;
ſomuch that the Stars have been ſeen at Mid-day.
ay, he hath been conſtantly darkned for almoſt a
hole Year, and never ſhined but with a kind of
eavy and duskiſh Light, ſo that there was ſcarce
eat enough to ripen the Fruits. As it was about
e Time when *Cæſar* was killed. Which was record-
by ſome of the Poets. Thus *Virgil*, ſpeaking of the
n.

So A. D. 1547. *April* 24 to the 28.

Ille etiam extincto miſeratus Cæſare Romam,
Cum caput obſcura nitidum ferrugine texit,
Impiaq; æternam timuerunt ſæcula Noctem.

Virgil, Georg. l. 1.

He pitying Rome *when as Great* Cæſar *dy'd,*
His Head within a Mourning Vail did hide.

And thus the Wicked Guilty World did fright
With doubtful Fears of an Eternal Night.

Ovid likewiſe ſpeaking of his Death,

Metam. lib. 15.

——— *Solis quoque triſtis imago*
Lurida ſollicitis præbebat lumina terris.

——— *The Sun's ſad Image then*
Did yield a lowring Light to fearful Men.

Now theſe Appearances could not ariſe from a lower Vapour: For then, 1. They would not ha been ſo univerſal as they were, being ſeen throu all *Europe*: Or elſe, 2. That Vapour muſt have c vered the Stars as well as the Sun, which yet notwit ſtanding were then plainly diſcerned in the Day tim You may ſee this Argument illuſtrated in another t like Caſe, Chap. 12. Hence then it will follow, th this fuliginous Matter, which did thus obſcure t Sun, muſt needs be very near his Body; and if then what can we more probably gueſs it to be th Evaporations from it?

2. 'Tis obſerved, that in the Sun's total Eclipſe when there is no part of his Body diſcernible, y there does not always follow ſo great a Darkneſs might be expected from his total abſence. Now probable that the Reaſon is, becauſe theſe thick Vapours being enlightened by his Beams, do conv ſome Light unto us, notwithſtanding the interp ſition of the Moon betwixt his Body and o Earth.

3. This likewiſe is by ſome gueſs'd to be t reaſon of the *crepuſculum*, or that Light which have before the Sun's riſing.

Now if there be ſuch Evaporations from the Su much more then from the Moon, which does con of a more groſs and impure ſubſtance. The oth

Argume

Arguments are taken from ſeveral Obſervations in the Moon her ſelf, and do more directly tend to the proof of this Propoſition.

2. 'Tis obſerved, that ſo much of the Moon as is enlightened, is always part of a bigger Circle than that which is darker. The frequent Experience of others hath proved this, and an eaſy Obſervation may quickly confirm it. But now this cannot proceed from any other Cauſe ſo probable as from this Orb of Air; eſpecially when we conſider how that Planet ſhining with a borrowed Light, doth not ſend forth any ſuch Rays as may make her Appearance bigger than her Body.

3. When the Moon being half enlightened, begins to cover any Star, if the Star be towards the obſcurer Part, then may it by the perſpective be diſcerned to be nearer unto the Center of the Moon than the outward Circumference of the enlightned part. But the Moon being in the Full, then does it ſeem to receive theſe Stars without its Limb.

4. Though the Moon do ſometime appear the firſt Day of her Change, when ſo much as appears enlightned cannot be above the 80th part of her diameter, yet then will the Horns ſeem at leaſt to be of a Finger's breadth in extenſion; which could not be, unleſs the Air about it were illuminated.

5. 'Tis obſerved in the Solary Eclipſes, that there is ſometimes a great trepidation about the Body of the Moon, from which we may likewiſe argue an Atmoſphæra, ſince we cannot well conceive what ſo probable Cauſe there ſhould be of ſuch an appearance as this, *Quod radii Solares à vaporibus Lunam ambientibus fuerint intercisi*, that the Sun-beams were broken and refracted by the Vapours that encompaſſed the Moon. *Scheiner. Roſ. Urſ. l. 4. part. 2. c. 27.*

6. I may add the like Argument taken from another Obſervation which will be eaſily try'd and granted. When the Sun is eclipſed, we diſcern the Moon as ſhe is in her own natural bigneſs; but then ſhe ap-

pears ſomewhat leſs than when ſhe is in the Full, t
ſhe be in the ſame place of her ſuppoſed Excentri
and Epicycle ; and therefore *Tycho* hath calculate
Table for the Diameter of the divers New Moo
But now there is no reaſon ſo probable to ſolve t
Appearance, as to place an Orb of thicker Air n
the Body of that Planet, which may be enlightn
by the reflected Beams, and through which the dir
Rays may eaſily penetrate.

But ſome may object, That this will not con
with that which was before delivered, where I ſa
that the thinneſt parts had leaſt Light.

If this were true, how comes it to paſs then t
this Air ſhould be as light as any of the other Par
when as 'tis the thinneſt of all?

I anſwer, If the Light be received by Reflecti
only, then the thickeſt Body hath moſt, becauſe it
beſt able to beat back the Rays ; but if the Light
received by Illumination (eſpecially if there be an
pacous Body behind, which may double the Bea
by reflexion) as it is here, then I deny not but a th
Body may retain much Light ; and perhaps ſome
thoſe Appearances which we take for Fiery Come
are nothing elſe but a Bright Cloud enlightned ;
that probable it is there may be ſuch Air without t
Moon : And hence it comes to paſs, that the grea
Spots are only viſible towards her middle Parts, a
none near the Circumference ; not but that there a
ſome as well in thoſe Parts as elſewhere, but they a
not there perceivable, by reaſon of thoſe brighter V
pours which hide them.

PRO

PROP. XI.

That as their World is our Moon, ſo our World is their Moon.

I Have already handled the firſt thing that I promiſed, according to the Method which *Ariſtotle* uſes in his Book *De Mundo*; and ſhew'd you the neceſſary Parts that belong to this World in the Moon. In the next Place 'tis requiſite that I proceed to thoſe things which are extrinſical unto it, as the Seaſons, the Meteors, and the Inhabitants.

1. Of the Seaſons;

And if there be ſuch a World in the Moon, 'tis requiſite then that their Seaſons ſhould be ſome way correſpondent unto ours, that they ſhould have Winter and Summer, Night and Day, as we have.

Now that in this Planet there is ſome Similitude of Winter and Summer, is affirmed by *Ariſtotle* himſelf; *Degen. anima. l.4.12.* ſince there is one Hemiſphere that hath always Heat and Light, and the other that hath Darkneſs and Cold. True indeed, their Days and Years are always of one and the ſame Length; (unleſs we make one of their Years to be 19 of ours, in which Space all the Stars do ariſe after the ſame Order.) Golden Number. But 'tis ſo with us alſo under the Poles, and therefore that great difference is not ſufficient to make it altogether unlike ours; nor can we expect that every thing there ſhould be in the ſame Manner as it is here below, as if Nature had no way but one to bring about her purpoſes. We have no Reaſon then to think it neceſſary that both theſe Worlds ſhould be altogether alike; but it may ſuffice if they be correſpondent in ſomething only. However, it may be queſtioned whether it doth not ſeem to be againſt the Wiſdom of Providence, to make the Night of ſo great a Length, when they have ſuch a long

long time unfit for Work? I anſwer, no; ſince 'tis ſ and more with us alſo under the Poles; and beſide the general Length of their Night is ſomewhat abat in the Bigneſs of their Moon, which is our Earth. F this returns as great a Light unto that Planet, as it r ceives from it. But for the better Proof of this, ſhall firſt free the Way from ſuch Opinions as migl otherwiſe hinder the Speed of a clearer Progreſs.

Plutarch one of the chief Patrons of this World i the Moon, doth directly contradict this Propoſition affirming, that thoſe who live there, may diſcern ou World, as the Dregs and Sediment of all other Cre tures; appearing to them through Clouds and fogg Miſts, and that altogether devoid of Light, being ba and unmoveable; ſo that they might well imagine th dark Place of Damnation to be here ſituate, and tha they only were the Inhabiters of the World, as bein in the midſt betwixt Heaven and Hell.

Plut. de fac. lunæ.

To this I may anſwer, 'tis probable that *Plutarc* ſpake this inconſiderately, and without a Reaſon which makes him likewiſe fall into another Abſurdity when he ſays our Earth would appear immoveable whereas queſtionleſs, though it did not, yet would ſeem to move, and theirs to ſtand ſtill, as the Lan doth to a Man in a Ship; according to that of the Po et:

Provehimur portu, terræque, urbeſque recedunt.

And I doubt not but that Ingenious Author woul eaſily have recanted, if he had been but acquainted wit thoſe Experiences which Men of later Times have foun out, for the Confirmation of this Truth.

2. Unto him aſſents *Macrobius*, whoſe Words ar theſe; *Terra accepto ſolis lumine clareſcit tantummodo, no relucet.* "The Earth is by the Sun-beams made bright "but not able to enlighten any thing ſo far." An his Reaſon is, becauſe this being of a thick and groſ Matter, the Light is terminated in its Superficies, an cannot penetrate into the Subſtance; whereas th

Somn. Scip. l. 1. c. 19.

Moo

Moon doth therefore ſeem ſo bright to us, becauſe it receives the Beams within it ſelf. But the Weakneſs of his Aſſertion, may be eaſily manifeſt by a common Experience; for poliſhed Steel (whoſe Opacity will not give any Admittance to the Rays) reflects a ſtronger Heat than Glaſs, and ſo conſequently a greater Light.

3. 'Tis the general Conſent of Philoſophers, that the Reflection of the Sun-beams from the Earth doth not reach much above half a Mile high, where they terminate the firſt Region; ſo that to affirm they might aſcend to the Moon, were to ſay, there were but one Region of Air, which contradicts the proved and received Opinion.

Unto this it may be anſwered:

That it is indeed the common Conſent, that the Reflexion of the Sun-beams reach only to the ſecond Region; but yet ſome there are, and thoſe too, Philoſophers of good Note, who thought otherwiſe. Thus *Plotinus* is cited by *Cælius*, *Si concipias te in ſublime quopiam mundi loco, unde oculis ſubjiciatur terræ moles aquis circumfuſa, & ſolis ſyderumque radiis illuſtrata, non aliam profecto viſam iri probabile eſt, quam qualis modo viſatur lunaris globi ſpecies.* "If you conceive your ſelf to be "in ſome ſuch high Place, where you might diſcern "the whole Globe of the Earth and Water, when it "was enlightned by the Suns Rays, 'tis probable it "would then appear to you in the ſame ſhape as the "Moon doth now unto us." So *Paulus Foſcarinus*. *Terra nihil aliud eſt quàm altera Luna, vel Stella, taliſque nobis appareret, ſi ex convenienti elongatione eminus conſpiceretur, in ipſaque obſervari poſſent eadem aſpectuum varietates, quæ in Luna apparent.* "The Earth is nothing elſe "but another Moon or Star, and would appear ſo un- "to us if it were beheld at a convenient diſtance with "the ſame Changes and Varieties as there are in the "Moon." Thus alſo *Carolus Malapertius*, whoſe Words are theſe: *Terra hæc noſtra, ſi in luna conſtituti eſſemus, ſplen-*

Ant. lect. l. 1. c. 4.

In ep. ad Sebaſt. fanton.

Præfat. ad Auſtriaca Syd. *ſplendida prorſus quaſi non ignobilis planeta, nobis apparere* "If we were placed in the Moon, and from thence "beheld this our Earth, it would appear unto us very "bright, like one of the nobler Planets." Unto theſe doth *Fromondus* aſſent, when he ſays, *Credo eque-*

Meteor. l. 1. c. 2. art. 2. *dem quod ſi oculus quiſpiam in orbe lunari foret, globum terræ & aquæ inſtar ingentis ſyderis à ſole illuſtrem conſpicere* "I believe that this Globe of Earth and Water would "appear like ſome great Star to any one, who ſhould "look upon it from the Moon." Now this could not be, nor could it ſhine ſo remarkably, unleſs the Beams of Light were reflected from it. And therefore the ſame *Fromondus* expreſly holds, that the firſt Region of Air is there terminated, where the Heat cauſed by Reflexion begins to languiſh, whereas the Beams themſelves do paſs a great way further. The chief Argument which doth moſt plainly manifeſt this Truth, is taken from a common Obſervation which may be eaſily tried.

If you behold the Moon a little before or after the Conjunction, when ſhe is in a *Sextile* with the Sun, you may diſcern not only the part which is enlightned, but the reſt alſo to have in it a kind of a duskiſh Light: but if you chuſe out ſuch a Situation, where ſome Houſe or Chimney (being ſome Seventy or Eighty Paces diſtant from you) may hide from your Eye the enlightned Horns, you may then diſcern a greater and more remarkable ſhining in thoſe parts unto which the Sun-beams cannot reach; nay, there is ſo great a Light, that by the Help of a good Perſpective you may diſcern its Spots. In ſo much that *Blancanus* the

De mundi fab. p. 3. c. 3. Jeſuit ſpeaking of it, ſays, *Hæc experientia ita me aliquando fefellit, ut in hunc fulgorem caſu ac repente incidens exiſtimarim novo quodam miraculo tempore adoleſcentis lunæ factum eſſe plenilunium.*" This Experiment did once ſo deceive me, that happening upon the Sight of this "Brightneſs upon a ſudden, I thought that by ſome "New Miracle the Moon had been got into her Full "a little after her Change. But

But now this Light is not proper to the Moon; it doth not proceed from the Rays of the Sun which doth penetrate her Body, nor is it cauſed by any other of the Planets and Stars. Therefore it muſt neceſſarily follow, that it comes from the Earth. The two firſt of theſe I have already proved, and as for the laſt, it is confidently affirmed by *Cælius*, *Quod ſi in diſquiſitionem evocet quis, an lunari ſyderi lucem fœnerent planetæ item alii, aſſeverantur aſtruendum non fœnerare.* "If any "ſhould ask whether the other Planets lend any Light "to the Moon? I anſwer, they do not." True indeed, the Noble *Tycho* diſcuſſing the Reaſon of this Light, attributes it to the Planet *Venus*; and I grant that this may convey ſome Light to the Moon; but that it is not the Cauſe of this whereof we now diſcourſe, is of it ſelf ſufficiently plain; becauſe *Venus* is ſometimes over the Moon, when as ſhe cannot convey any Light to that part which is turned from her.

Ant. Lect. l. 20. c. 5.

Progym. 1.

It doth not proceed from the fixed Stars; for then it would retain the ſame Light in Eclipſes, whereas the Light at ſuch times is more ruddy and dull. Then alſo the Light of the Moon would not be greater or leſſer, according to its diſtance from the Edge of the Earth's Shadow, ſince it did at all times equally participate this Light of the Stars.

In brief, this is neither proper to the Moon, nor does it proceed from any Penetration of the Sun's Rays, or the ſhining of *Venus*, or the other Planets, or the fixed Stars. Now becauſe there is no other Body in the whole Univerſe, ſave the Earth; it remains that this Light muſt neceſſarily be cauſed by that, which with a juſt Gratitude repays to the Moon ſuch Illumination as it receives from her.

And as loving Friends equally participate of the ſame Joy and Grief, ſo do theſe mutually partake of the ſame Light from the Sun, and the ſame Darkneſs from

from the Eclipſes, being alſo ſeverally helped by or another in their greateſt Wants: For when the Moo is in Conjunction with the Sun, and her upper pa receives all the Light, then her lower Hemiſphe (which would otherwiſe be altogether dark) is enlighte ed by the Reflexion of the Sun-beams from the Eart When theſe two Planets are in Oppoſition, then th part of the Earth which could not receive any Lig from the Sun-beams, is moſt enlightened by the Moo being then in her Full; and as ſhe doth moſt illum nate the Earth when the Sun-beams cannot, ſo th grateful Earth returns to her as great (nay greate Light when ſhe moſt wants it; ſo that always that vi ble part of the Moon which receives nothing from t Sun, is enlightened by the Earth, as is proved by G *lilæus*, with many more Arguments, in that Treati which he calls *Syſtema Mundi.* True indeed, whe the Moon comes to a *Quartile*, then you can neith diſcern this Light; nor yet the darker part of her B dy; and that for a double Reaſon;

1. Becauſe the nearer it comes to the Full, the le Light does it receive from the Earth, whoſe Illumina tion does always decreaſe in the ſame Proportion the Moon does increaſe.

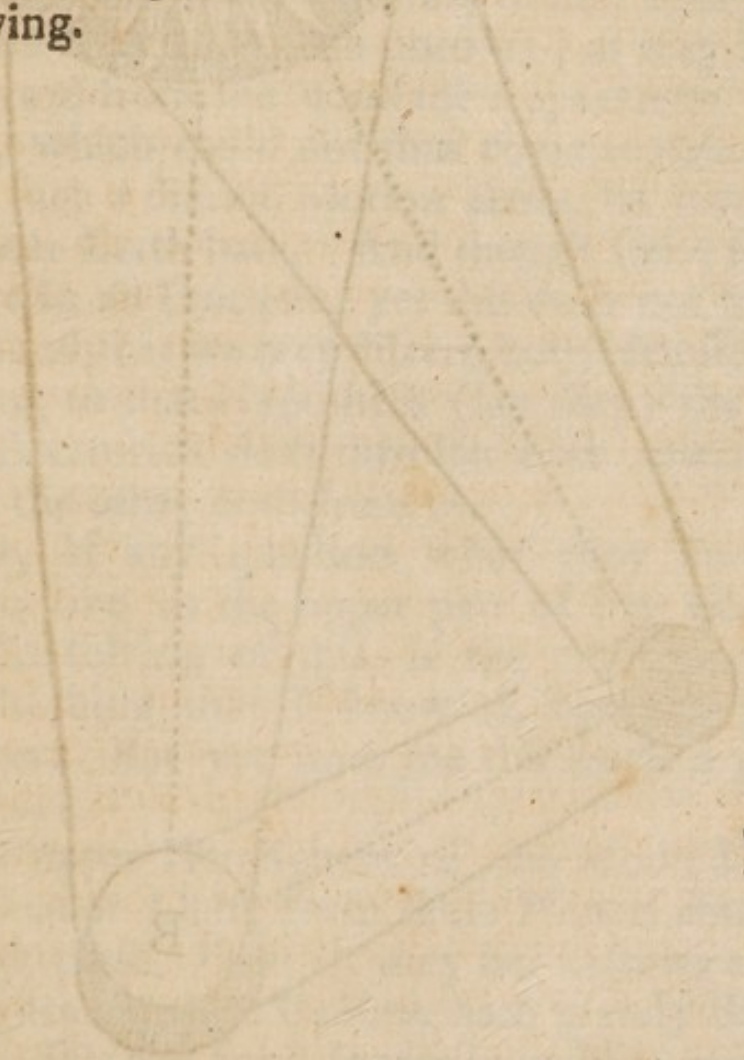
2. Becauſe of the Exuberancy of the Light in t other parts. *Quippe illuſtratum medium ſpeciem recipit v lentiorem*, the clearer Brightneſs involves the weaker; being with the Species of Sight, as it is with thoſe Sound; and as the greater Noiſe drowns the leſs, the brighter Object hides that which is more obſcur But as they do always in their mutual Viciſſitudes pa ticipate of one anothers Light; ſo alſo do they partak of the ſame Defects and Darknings; for when ou Moon is eclipſed, then is their Sun darkned; an when our Sun is eclipſed, then is their Moon deprive of its Light, as you may ſee affirmed by *Meſlin.* *Qu ſi terram nobis ex alto liceret intueri, quemadmodum defic entem lunam ex longinquo ſpectare poſſumus, videremus ter*

Scal. exerc. 62.

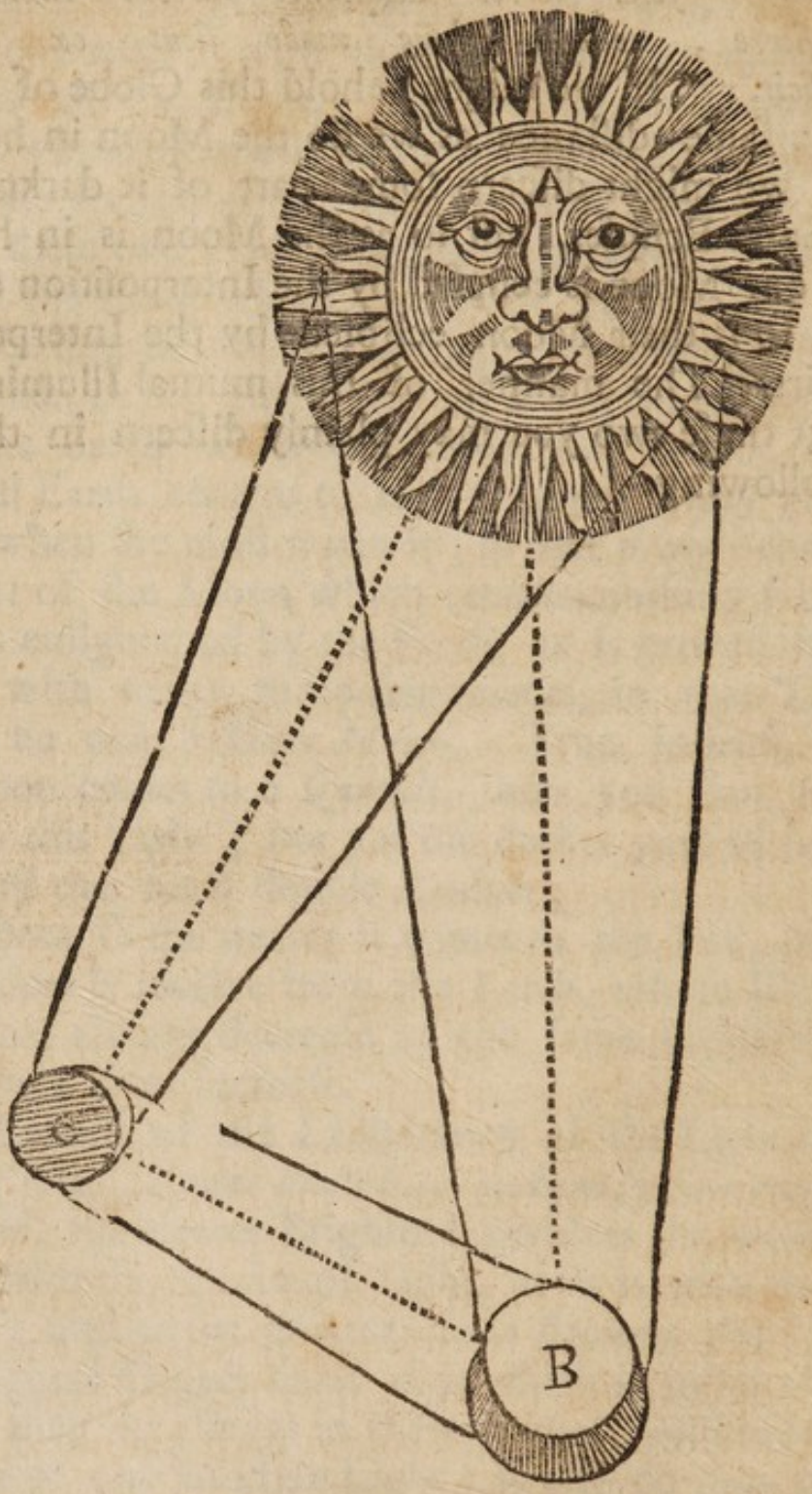
Epit. Aſtr. l. 4. part. 2.

po

ore eclipſis ſolis terræ aliquam partem lumine ſo-
is deficere, eodem plane modo ſicut ex oppoſito
ma deficit. "If we might behold this Globe of Earth
" at the ſame diſtance as we do the Moon in her De-
" fect, we might diſcern ſome part of it darkned in
" the Sun's Eclipſes, juſt ſo as the Moon is in hers."
For as our Moon is eclipſed by the Interpoſition of our
Earth, ſo is their Moon eclipſed by the Interpoſition
of theirs. The manner of this mutual Illumination
betwixt theſe two you may plainly diſcern in this Fi-
gure following.



Where



Where *A* repreſents the Sun, *B* the Earth, and *C* the Moon: Now ſuppoſe the Moon *C* to be in a *Sextile* of Increaſe, when there is only one ſmall part of her Body enlightened, then the Earth *B* will have ſuch a part

part of its visible Hemisphere darkned, as is proportionable to that part of the Moon which is enlightned; and as for so much of the Moon, as the Sun-beams cannot reach unto, it receives Light from a proportional part of the Earth which shines upon it, as you may plainly perceive by the Figure.

You see then that Agreement and Similitude which here is betwixt our Earth and the Moon. Now the greatest difference which makes them unlike, is this, that the Moon enlightens our Earth round about, whereas our Earth gives Light only to that Hemisphere of the Moon which is visible unto us; as may be certainly gathered from the constant Appearance of the same Spots, which could not thus come to pass, if the Moon had such a diurnal Motion about its own Axis as perhaps our Earth hath. And though some suppose her to move in an Epicycle, yet this doth not so turn her Body round, that we may discern both Hemispheres; or according to that Hypothesis (say they) the Motion of her Eccentrick doth turn her Face towards us, as much as the other doth from us.

But now, if any question what they do for a Moon, who live in the upper part of her Body? I answer, The solving of this, is the most uncertain and difficult thing that I know of, concerning this whole Matter. But yet unto me this seems a probable Conjecture.

That the upper Hemisphere of the Moon doth receive a sufficient Light from those Planets about it; and amongst these, *Venus* (it may be) bestows a more special brightness, since *Galilæus* hath plainly discerned that she suffers the same Increases and Decreases, as the Moon hath; and 'tis probable that this may be perceived there, without the help of a Glass, because they are far nearer it than we. When *Venus* (saith *Keplar*) lies down in the Perige or lower part of her supposed Epicycle, then is she in Conjunction with her Husband the Sun; from whom, after she

hath

hath departed for the ſpace of ten Months, ſhe ge *plenum uterum*, and is in the Full.

But you'll reply, Though *Venus* may beſtow ſom Light when ſhe is over the Moon, and in Conjunct on, yet being in Oppoſition, ſhe is not viſible to them and what ſhall they then do for Light?

I anſwer; Then they have none; nor doth th make ſo great a difference betwixt thoſe two Hemi ſpheres, as there is with us betwixt the Places unde the Poles and the Line. And beſides, 'tis conſidera ble that there are two kind of Planets.

1. Primary; ſuch whoſe proper Circle do encom paſs the Body of the Sun, whereof there are ſix; *Sa turn*, *Jupiter*, *Mars*, *Ceres*, or the *Earth*, *Venus*, *Mercur* As in the Frontiſpiece.

2. Secondary; ſuch whoſe proper Circles are no about the Sun, but ſome of the other primary Pla nets. Thus are there two about *Saturn*, four abou *Jupiter*, and thus likewiſe does the Moon encompa our Earth. Now 'tis probable that theſe leſſer ſe condary Planets, are not ſo accommodated with a Conveniencies of Habitation, as the others that ar more principal.

But it may ſeem a very difficult thing to conceiv how ſo groſs and dark a Body as our Earth, ſhou yield ſuch a clear Light as proceeds from the Moon and therefore the Cardinal *de Cuſa* (who thinks ever Star to be a ſeveral World) is of Opinion, that th Light of the Sun is not able to make them appear bright; but the reaſon of their ſhining is, becauſe w behold them at a great diſtance through their Regio of Fire, which do ſet a ſhining Luſtre upon tho Bodies that of themſelves are dark. *Unde ſi quis eſſ extra regionem ignis, terra iſta in circumferentia ſuæ regi nis per medium ignis lucida ſtella appareret.* "So that "a Man were beyond the Region of Fire, this Ear "would appear through that as a bright Star." B if this were the only Reaſon, then would the Moo

De doct. ig. l. 2. c. 12.

e freed from ſuch Increaſes and Decreaſes, as ſhe is ow liable unto.

Keplar thinks that our Earth receives that Light whereby it ſhines, from the Sun; but this (ſaith he) s not ſuch an intended clear Brightneſs as the Moon s capable of, and therefore he gueſſes that the Earth here is of a more choaky Soil, like the Iſle of *Crete*, nd ſo is better able to reflect a ſtronger Light; where- s our Earth muſt ſupply this Intention with the uantity of its Body. But this I conceive to be a eedleſs Conjecture, ſince our Earth (if all things ere well conſider'd) will be found able enough to re- ect as great a Light. For,

1. Conſider its Opacity; if you mark theſe Sublu- ary things, you ſhall perceive that amongſt them, oſe that are moſt perſpicuous, are not ſo well able reverberate the Sun-Beams, as the thicker Bodies. he Rays paſs ſingly through a Diaphanous Matter, ut in an Opacous Subſtance they are doubled in their eturn, and multiplied by Reflexion. Now if the oon and the other Planets can ſhine ſo clearly by eating back the Sun-Beams, why may not the Earth ſo ſhine as well, which agrees with them in the uſe of this Brightneſs, their Opacity?

2. Conſider what a clear Light we may diſcern re- ected from the Earth in the midſt of Summer; and ithal, conceive how much greater that muſt be hich is under the Line, where the Rays are more rectly and ſtrongly reverberated.

3. 'Tis conſiderable, that though the Moon does in e Night-time ſeem to be of ſo clear a Brightneſs, t when we look upon it in the Day, it appears like me little whitiſh Cloud: Not but that at both times, e is of an equal Light in her ſelf. The reaſon of is Difference is, becauſe in the Night we look upon through a dark and obſcure *Medium*, there being no her enlighten'd Body, whoſe Brightneſs may abate om this: Whereas in the Day-time, the whole Hea-

vens round about it are of an equal Clearneſs, and
make it to appear with a weaker Light. Now b
cauſe we cannot ſee how the enlighten'd Parts of o
Earth do look in the Night, therefore in comparin
it with the Moon, we muſt not conſider her, as ſ
is beheld through the advantage of a dark *Mediu*
but as ſhe ſeems in the Day-time. Now, in any cle
Sun-ſhine Day, our Earth does appear as bright as t
Moon, which at the ſame time does ſeem like ſo
duskiſh Cloud (as any little Obſervation may eaſ
manifeſt.) Therefore we need not doubt but that t
Earth is as well able to give Light, as the Moon. T
this it may be added, that thoſe very Clouds, whi
in the Day-time ſeem to be of an equal Light to t
Moon, do in the Evening become as dark as o
Earth; and as for thoſe of them which are look
upon at any great diſtance, they are often miſtak
for the Mountains.

4. 'Tis conſiderable, that though the Moon ſeem
be of ſo great a Brightneſs in the Night, by reaſon
its nearneſs unto thoſe ſeveral Shadows which it ca
yet is it of it ſelf weaker than that part of Twilig
which uſually we have for half an Hour after Sun-
becauſe we cannot till after that time diſcern a
Shadow to be made by it.

5. Conſider the great diſtance at which we beh
the Planets, for this muſt needs add much to th
Shining; and therefore *Cuſanus* (in the above-cit
Place) thinks that if a Man were in the Sun, th
Planet would not appear ſo bright to him, as now
doth to us, becauſe then his Eye could diſcern b
little; whereas here, we may comprehend the Bea
as they are contracted in a narrow Body. *Keplar* b
holding the Earth from a high Mountain, when
was enlighten'd by the Sun, confeſſes that it appear
unto him of an incredible Brightneſs, whereas th
he could only ſee ſome ſmall parts of it; but h
much brighter would it have appeared, if he mig

in a direct Line behold the whole Globe of Earth and theſe Rays gathered together? So that if we conſider that great Light which the Earth receives from the Sun in the Summer, and then ſuppoſe we were in the Moon, where we might ſee the whole Earth hanging in thoſe vaſt Spaces, where there is nothing to terminate the Sight, but thoſe Beams which are there contracted into a little compaſs; I ſay, if we do well conſider this, we may eaſily conceive that our Earth appears as bright to thoſe other Inhabitants in the Moon, as theirs doth to us.

But here it may be objected, that with us for many Days in the Year, the Heavens are ſo over-clouded, that we cannot ſee the Sun at all; and for the moſt part, in our brighteſt Days, there are many ſcattered Clouds which ſhade the Earth in ſundry Places: So that in this reſpect, it muſt needs be unlike the Moon, and will not be able to yield ſo clear, unintermitted a Light, as it receives from that Planet.

To this I Anſwer.

1. As for thoſe leſſer brighter Clouds, which for the moſt part are ſcattered up and down in the cleareſt Days, theſe can be no Reaſon why our Earth ſhould be of a darker Appearance, becauſe theſe Clouds being near unto the Earth, and ſo not diſtinguiſhable at ſo great a diſtance from it; and likewiſe being illuminated on their back Parts by the Sun that ſhines upon them, muſt ſeem as bright to thoſe in the Moon, as if the Beams were immediately reflected from our Earth.

2. When theſe Clouds that are interpoſed, are of any large Extenſion, or great Opacity, as it is in extraordinary laſting and great Rains, then there muſt be ſome diſcernible Alteration in the Light of our Earth: But yet this does not make it to differ from the Moon, ſince it is ſo alſo with that Planet, as is ſhewed in the latter part of the next Chapter.

PROP. XII.

That 'tis probable there may be such Meteors belonging to that World in the Moon, as there are with us.

Plutarch discussing on this Point, affirms that it is not necessary there should be the same Means of Growth and Fructifying in both these Worlds, since Nature might in her Policy find out more ways than one how to bring about the same Effect. But however, he thinks it is probable that the Moon her self sendeth forth warm Winds; and by the swiftness of her Motion, there should breathe out a sweet and comfortable Air, pleasant Dews, and gentle Moisture which might serve for Refreshing and Nourishment of the Inhabitants and Plants in that other World.

But since they have all things alike with us, as Sea and Land, and vaporous Air encompassing both; I should rather therefore think, that Nature there should use the same way of producing Meteors as she doth with us; and not by a Motion, (as *Plutarch* supposes) because she doth not love to vary from her usual Operations without some extraordinary Impediment but still keeps her beaten Path, unless she be driven thence.

One Argument whereby I shall manifest this Truth may be taken from those new Stars which have appeared in divers Ages of the World, and by their Parallax have been discerned to have been above the Moon; such as was that in *Cassiopeia*, that in *Sagittarius*, with many others betwixt the Planets. *Hipparchus* in his time took especial notice of such as these, and therefore fancied out such Constellations in which to place the Stars, shewing how many there were in every Asterism; that so afterwards, Posterity might know whether

Plin. Nat. Hist. l 2. c. 26.

whether there were any new Star produced, or any old one missing. Now the Nature of these Comets may probably manifest, that in this other World there are other Meteors also; for these in all likelihood, are nothing else but such Evaporations caused by the Sun from the Bodies of the Planets. I shall prove this by shewing the Improbabilities and Inconveniences of any other Opinion.

For the better pursuit of this, 'tis in the first place requisite, that I deal with our chief Adversary, *Cæsar la Galla*, who doth most directly oppose that Truth which is here to be proved. He endeavouring to confirm the Incorruptibility of the Heavens, and being there to satisfie the Argument which is taken from these Comets; He answers it thus: *Aut argumentum desumptum ex paralaxi, non est efficax, aut si est efficax, eorum instrumentorum usum decipere, vel ratione astri, vel medii, vel distantiæ, aut ergo erat in suprema parte aeris, aut si in cœlo, tum forsan factum erat ex reflectione radiorum Saturni & Jovis, qui tunc in conjunctione fuerant.* "Either the Argument from the Paralax is not efficacious, or if it be, yet the use of the Instruments might deceive, either in regard of the Star, or the *Medium*, or the Distance, and so this Comet might be in the upper Regions of the Air; or if it were in the Heavens, there it might be produced by the Reflexion of the Rays from *Saturn* and *Jupiter*, who were then in Conjunction." You see what Shifts he is driven to, how he runs up and down to many starting Holes that he may find some Shelter; and instead of the strength of Reason, he answers with a Multitude of Words, thinking (as the Proverb is) that he may use Hail when he hath no Thunder. *Nihil turpius* (saith * *Seneca*) *dubio & incerto, pedem modo referente, modo producente.* "What can there be more unseemly in one that should be a fair Disputant, than to be now here, now there, and so uncertain, that one cannot tell where to find him? He thinks

* *Epist.* 95.

that there are not Comets in the Heavens, becauſe there may be many other Reaſons of ſuch Appearances ; but what, he knows not : Perhaps (he ſays) that Argument from the Paralax is not ſufficient ; or if it be, then there may be ſome Deceit in the Obſervation. To this I may ſafely ſay, That he may juſtly be accounted a weak Mathematician, who miſtruſts the ſtrength of this Argument ; nor can he know much in Aſtronomy, who underſtands not the Paralax, which is a Foundation of that Science : And I am ſure that he is a timerous Man, who dares not believe the frequent Experience of his Senſes, or truſt to a Demonſtration.

Vide Galilæum Syſt. mundi. Colloq. 3.

True indeed, I grant 'tis poſſible that the Eye, the *Medium*, and the Diſtance, may all deceive the Beholder ; but I would have him ſhew which of all theſe was likely to cauſe an Error in this Obſervation : Meerly to ſay they might be deceived, is no ſufficient Anſwer ; for by this I might confute the Poſitions of all Aſtronomers, and affirm the Stars are hard by us, becauſe 'tis poſſible they might be deceived in their obſerving Diſtance. But I forbear any further Reply : My Opinion is of that Treatiſe, That either it was ſet forth purpoſely to tempt a Confutation, that he might ſee the Opinion of *Galilæus* confirmed by others ; or elſe it was Invented with as much haſte and negligence as it was Printed, there being in it almoſt as many Faults as Lines.

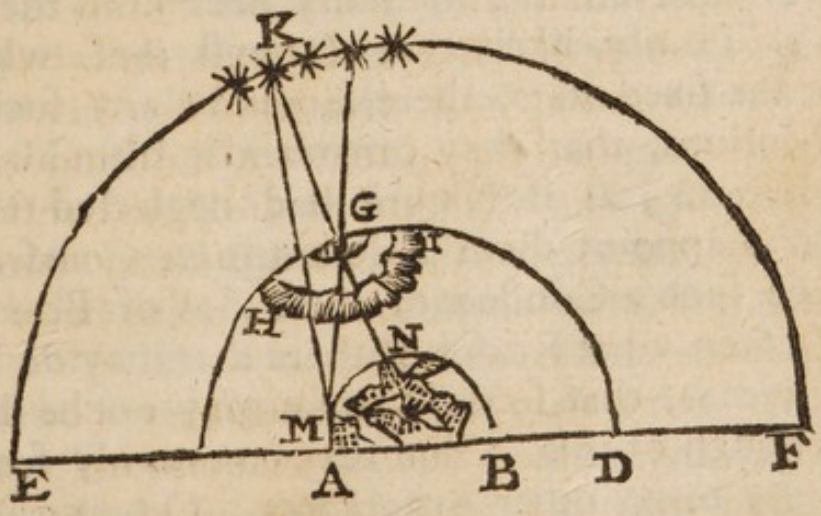
Others think that theſe are not any new Comets, but ſome ancient Stars that were there before, which now ſhine with that unuſual Brightneſs, by reaſon of the Interpoſition of ſuch Vapours, which do multiply their Light ; and ſo the Alterarion will be here only, and not in the Heavens. Thus *Ariſtotle* thought the Appearance of the Milky Way was produced: For he held that there were many little Stars, which by their influence did conſtantly attract ſuch a Vapour towards that place of Heaven, ſo that it always appeared

eared white. Now by the ſame Reaſon may a righter Vapour be the cauſe of theſe Appearances.

But how probable ſoever this Opinion may ſeem, et if well conſidered, you ſhall find it to be altogether bſurd and impoſſible: For,

1. Theſe Stars were never ſeen there before; and is not likely that a Vapour being hard by us, can ſo nultiply that Light, which could not before be at all liſcerned.

2. This ſuppoſed Vapour cannot be either contracted nto a narrow compaſs, or dilated into a broad. 1. It could not be within a little ſpace, for then that Star would not appear with the ſame multiplied Light to hoſe in other Climates. 2. It cannot be a dilated Vapour, for then other Stars which were diſcerned through the ſame Vapour, would ſeem as big as that. This Argument is the ſame in effect with that of the Paralax, as you may ſee in this Figure.



Suppoſe *A B* to be a Hemiſphere of one Earth, *C D* to be the upper part of the higheſt Region, in which there might be either a contracted Vapour, as *G*, or elſe a dilated one, as *H I*. Suppoſe *E F* likewiſe to repreſent half the Heavens, wherein was this appear-

ing Comet at K. Now, I ſay, that a contracted Va pour, as G, could not cauſe this Appearance, becauſ an Inhabitant at M could not diſcern the ſame Sta with this brightneſs, but perhaps another at L, betwix which the Vapour is directly interpoſed. Nor could be cauſed by a dilated Vapour, as H I, becauſe the all the Stars that were diſcerned through it, would b perceived with the ſame brightneſs.

'Tis neceſſary therefore that the Cauſe of this Ap pearance ſhould be in the Heavens. And this granted by the moſt and beſt Aſtronomers. But, ſa ſome, this doth not argue any Natural Alteration i thoſe purer Bodies, ſince 'tis probable that the Con coürſe of many little Vagabond Stars, by the union o their Beams may cauſe ſo great a Light. Of this O pinion were *Anaxagoras* and *Zeno* amongſt the Anci ent, and *Baptiſta Caſatus*, *Blancanus*, with other amongſt our Modern Aſtronomers. For, ſay they when there happens to be a Concourſe of ſome few Stars, then do many other fly unto them from all th parts of Heaven like ſo many Bees unto their King But 1. 'Tis not likely that amongſt thoſe which w count the fixed Stars, there ſhould be any ſuch uncer tain Motions, that they can wander from all parts o the Heavens, as if Nature had neglected them, o forgot to appoint them a determinate Courſe. 2. I there be ſuch a Conflux of theſe, as of Bees to thei King, then what Reaſon is there that they do not ſtil tarry with it, that ſo the Comet may not be diſſolv'd But enough of this. You may commonly ſee it con futed by many other Arguments. Others there are who affirm theſe to be ſome new created Stars, pro duced by an extraordinary Supernatural Power. I anſwer, True indeed, 'tis poſſible they might be ſo but however 'tis not likely they were ſo, ſince ſuch Appearances may be ſolved ſome other way; where fore to fly unto a Miracle for ſuch things, were a great injury to Nature, and to derogate from her Skill; an

Clavius in ſphæram. cap. 1.

Indignity

Indignity much misbecoming a Man who profeſſes himſelf to be a Philoſopher. *Miraculum* (ſaith one) *eſt ignorantiæ Aſylum*; a Miracle often ſerves for the Receptacle of a lazy Ignorance; which any Induſtrious Spirit would be aſham'd of; it being but an idle way to ſhift off the Labour of any further ſearch. But here's the miſery of it, we firſt tye our ſelves unto *Ariſtotle*'s Principles, and then conclude that nothing could contradict them but a Miracle; whereas 'twould be much better for the Commonwealth of Learning, if we would ground our Principles rather upon the frequent Experiences of our own, than the bare Authrity of others.

Some there are who think that theſe Comets are nothing elſe but Exhalations from our Earth, carry'd up into the higher parts of the Heaven. So *Peno*, *Rothmannus* and *Galilæus*. But this is not poſſible, ſince by computation 'tis found, that one of them is above 300 times bigger than the whole Globe of Land and Water. Others therefore have thought that they did proceed from the Body of the Sun, and that that Planet only is *Cometarum officina, unde tanquam emiſſarii & exploratores emitterentur, brevi ad ſolem redituri*: The Shop or Forge of Comets, from whence they were ſent, like ſo many Spies, that they might in ſome ſhort ſpace return again. But this cannot be, ſince if ſo much Matter had proceeded from him alone, it would have made a ſenſible diminution in his Body. The Noble *Tycho* therefore thinks that they conſiſt of ſome ſuch fluider parts of the Heaven, as the Milky Way is framed of, which being condens'd together, yet not attaining to the conſiſtency of a Star, is in ſome ſpace of time rarify'd again into its wonted Nature. But this is not likely, becauſe the appearance of the Milky Way does not ariſe from ſome fluider parts of the Heaven (as he ſuppoſes) but from the Light of many leſſer Stars which are thereabouts. And therefore it is uſually thus deſcribed: *Via lactea nihil*

Tycho Progym. l. c. 9.

Fromond. Meteor. l. 2. c. 5. art. 2.

Item Veſta tract. 5. c. 2. *nihil aliud eſt quam innumerabiles ſtellarum fixarum grege qui confuſo & pallenti lumine tractum illum inalbant.* The Milky Way is nothing elſe but the pale and confuſed Light of many leſſer Stars, whereby ſome parts of the Heaven are made to appear white.

And beſide, what likely cauſe can we conceive of this condenſation, unleſs there be ſuch Qualities there as there are in our Air, and then why may not the Planets have the like Qualities as our Earth? And if ſo, then 'tis more probable that they are made by the ordinary way of Nature, as they are with us, and conſiſt of ſuch Exhalations from the Bodies of the Planets, as being very much rarified, may be drawn up through the Orb of Groſs Vaporous Air that encompaſſes them. Nor is this a ſingular Opinion; but it ſeemed moſt likely to *Camillus Glorioſus*, *Th. Campanella*, *Fromondus*, with ſome others. But if you ask whither ſhall all theſe Exhalations return? I anſwer every one into his own Planet. If it be again objected, that then there will be ſo many Centers of Gravity, and each ſeveral Planet will be a diſtinct World I reply, we have not like probability concerning the reſt; but yet perhaps all of them are ſo, except the Sun, though *Cuſanus* and ſome others, think there is one alſo; and later Times have diſcovered ſome leſſer Clouds moving round about him. But as for *Saturn*, he hath two Moons on each ſide. *Jupiter* hath four that encircle him with their Motion; which are likewiſe eclipſed by the interpoſition of his Body, as the Moon is by our Earth. *Venus* is obſerved to increaſe and decreaſe as the Moon. And this perhaps hath been noted by former Ages, as may be gueſs'd by that Relation of St. *Auſtin* out of *Varro*. *Mars*, and all the reſt, derive their Light from the Sun. Concerning *Mercury*, there hath been little or no obſervation, becauſe, for the moſt part, he lies hid under the Sun-beams, and ſeldom appears by himſelf. But when he does, yet the Compaſs of his Body is ſo little,

De Comet. l. 5. c. 4. *Apol. pro Galil.* *Meteor. l. 3. c. 2. Art. 6.* *Lactant. Inſt. l. 3. c. 23.* *De Civit. De l. 21. cap. 8.*

e, and his Light of ſo clear a brightneſs, by reaſon f his nearneſs to the Sun, that the Perſpective can- ot make the ſame diſcoveries upon him, as from the eſt.

So that if you conſider their Quantity, their Opacity, r theſe others Diſcoveries, you ſhall find it probable nough, that each of them may be a ſeveral World. Eſpecially ſince every one of them is allotted to a ſe- eral Orb, and not altogether in one, as the fixed tars ſeem to be. But this would be too much for to ent at the firſt: The chief thing at which I now aim n this Diſcourſe, is to prove tnat there may be one n the Moon.

It hath been before confirmed, that there was a phere of Thick Vaporous Air encompaſſing the Moon, as the firſt and ſecond Regions do this Earth. have now ſhew'd, that thence ſuch Exhalations may roceed as do produce the Comets: Now from hence t may probably follow, that there may be Wind alſo nd Rain, with ſuch other Meteors as are common mongſt us. This conſequence is ſo dependant, that *Fromondus* dares not deny it, though he would (as he onfeſſes himſelf;) for if the Sun be able to exhale rom them ſuch Fumes as may cauſe Comets, why ot then ſuch as may cauſe Winds, and why not ſuch lſo as may cauſe Rain, ſince I have above ſhewed, hat there is Sea and Land, as with us? Now Rain eems to be more eſpecially requiſite for them, ſince t may allay the Heat and Scorchings of the Sun when e is over their Heads. And Nature hath thus provi- ded for thoſe in *Peru*, with the other Inhabitants un- der the Line.

De Meteor. l. 3. c. 2. Art. 6.

But if there be ſuch great and frequent Alterations n the Heavens, why cannot we diſcern them?

I anſwer:

1. There may be ſuch, and we not able to perceive them, becauſe of the weakneſs of our Eye, and the diſtance of thoſe Places from us; they are the Words of

of *Fienus* (as they are quoted by *Fromondus* in t
above-cited Place) *Possunt maximæ permutationes in c
fieri, etiamsi a nobis non conspiciantur ; hoc visus nostri
bilitas & immensa cœli distantia faciunt.* And unto hi
assents *Fromondus* himself, when a little after he say
*Si in sphæris Planetarum degeremus, plurima forsan cœles
um nebularum vellera toto æthere passim desperse viderem
quorum species jam evanescit nimiâ spatii intercapedine.*"
" we did live in the Spheres of the Planets, we mig
" there perhaps discern many great Clouds dispers
" through the whole Heavens, which are not no
" visible by reason of this great distance.

Dissert. 2. cum nunc. Galil. item Somn. Astron. nota ultima.

2. *Mæstlin* and *Keplar* affirm, That they have se
some of these Alterations. The Words of *Mæstlin* a
these (as I find them cited.) *In eclipsi Lunari vesp
Dominicæ Palmarum Anni* 1605. *In corpore Lunæ ver
Boream, nigricans quædam macula conspecta fuit, obscur
cætero toto corpore, quod candentis ferri figuram repræsent
bat ; dixisses nubila in multam regionem extensa pluviis
tempestuosis imbribus gravida, cujusmodi ab excelsorum m
tium jugis in humiliora convallium loca videre non rarò co
tingit.* " In that Lunary Eclipse which happened
" the Even of *Palm-Sunday*, in the Year 1605, the
" was a certain blackish Spot discerned in the Northe
" ly part of the Moon, being darker than any oth
" place of her Body, and representing the Colour
" red hot Iron ; you might conjecture that it w
" some dilated Cloud, being pregnant with Showers
" for thus do such lower Clouds appear from the to
" of high Mountains.

And a little before this Passage, the same Auth
speaking of that Vaporous Air about the Moon, te
us; *Quod circumfluus ille splendor diversis temporibus app
ret limpidior plus minusve.* That it does at divers tim
appear of a different clearness, sometimes more, a
sometimes less ; which he guesses to arise from t
Clouds and Vapours that are in it.

Un

Unto this I may add another Teſtimony of *Bapt. ſatus*, as he is quoted by *Nierembergius*, grounded on an Obſervation taken 23 Years after this of *æſlin*, and writ to this *Euſeb. Nieremberg.* in a Let- by that diligent and judicious Aſtronomer. The ords of it run thus; *Et quidem in Eclipſi nupera ſolari æ fuit ipſo die natali Chriſti, obſervavi clarè in luna ſoli poſita, quidpiam quod valde probat id ipſum quod Co- tæ quoq; & maculæ ſolares urgent, nempe cœlum non eſſe tenuitate & variationibus aeris exemptum; nam circa nam adverti eſſe ſphæram ſeu orbem quendam vaporoſum, n ſecus atque circum terram, adeoq; ſicut ex terra in ali- am uſque ſphæram vapores & exhalationes expirant, ita oque ex luna.* "In that late Solary Eclipſe which happen'd on *Chriſtmas-day*, when the Moon was juſt under the Sun, I plainly diſcerned that in her which may clearly confirm what the Comet's and Sun's Spots do ſeem to prove, *viz.* That the Hea- vens are not ſo ſolid, nor freed from thoſe Changes which our Air is liable unto; for about the Moon I perceived ſuch an Orb, or Vaporous Air as that is which doth encompaſs our Earth; and as Vapours and Exhalations are raiſed from our Earth into this Air, ſo are they alſo from the Moon.

Hiſtor. nat. l. 2. c. 11.

You ſee what probable Grounds, and plain Te- monies I have brought for the confirmation of is Propoſition: Many other Things in this be- lf might be ſpoken, which for brevity ſake I now mit, and paſs unto the next.

PROP.

PROP. XIII.

That 'tis probable there may be Inhabitants in th other World; but of what kind they are, is unce tain.

I Have already handled the Seaſons, and Meteors b longing to this New World: 'Tis requiſite that i the next Place I ſhould come unto the third Thir which I promiſed, and ſay ſomewhat of the Inhab tants: Concerning whom there might be many difficu Queſtions raiſed; as, whether that Place be more incon venient for Habitation than our World (as *Keplar* thinks whether they are the Seed of *Adam*; whether they a there in a Bleſſed Eſtate, or elſe what means the may be for their Salvation? With many other ſuc uncertain Enquiries, which I ſhall willingly omit Leaving it to their Examination who have more Le ſure and Learning for the Search of ſuch particu lars.

Being for mine one Part content only to ſet dow ſuch Notes belonging unto theſe, which I have obſerve in other Writers. *Cum tota illa regio nobis ignota ſit, r manent inhabitatores illi ignoti penitus* (ſaith *Cuſanus*; ſince we know not the Regions of that Place, w muſt be altogether ignorant of the Inhabitants. Ther hath not yet been any ſuch Diſcovery concerning theſ upon which we may build a Certainty, or good Pro bability: Well may we gueſs at them, and that to very doubtfully, but we can know nothing; for, *we do hardly gueſs aright at things which be upon Earth, with labour we do find the things that are at hand, bo then can we ſearch out thoſe things that are in Heaven?* Wha a little is that which we know, in reſpect of thoſe ma ny Matters contained within this great Univerſe? Thi whole Globe of Earth and Water, though it ſeem t

De doct. ignorantia. l. 2. c. 12.

Wiſd. 9. 16.

is to be of a large extent, yet it bears not so great a Proportion unto the whole Frame of Nature, as a small Sand doth unto it; and what can such little Creatures as we discern, who are tied to this point of Earth? or what can they in the Moon know of us? *If we understand any thing* (saith *Esdras*) *'tis nothing but that which is upon the earth; and he that dwelleth above in the heavens, may only understand the things that are above in the height of the heavens.* 2 Esd. 4. 21.

So that 'twere a very needless thing for us to search after any particulars; however, we may guess in the general that there are some Inhabitants in that Planet: For why else did Providence furnish that Place with all such Conveniences of Habitation as have been above declared?

But you will say, perhaps, is there not too great and intolerable a heat, since the Sun is in their *Zenith* every Month, and doth tarry there so long before he leaves it?

I answer, 1. This may, perhaps, be remedied (as it is under the Line) by the Frequency of mid-day Showers, which may cloud their Sun, and cool their Earth.

2. The equality of their Nights doth much temper the scorching of the Day; and the extreme Cold that comes from the one, requires some space before it can be dispelled by the other; so that the Heat spending a great while before it can have the Victory, hath not afterwards much time to rage in. Wherefore notwithstanding this doubt, yet that Place may remain habitable. And this was the Opinion of the *Cardinal de Cusa*, when speaking of this Planet, he says, *Hic locus Mundi est habitatio hominum & animalium atque vegetabilium.* "This part of the World is inhabited by Men, "and Beasts, and Plants." To him assented *Campanella*; but he cannot determine whether they were Men or rather some other kind of Creatures. If they were Men, then he thinks they could not be infected *De doct. ign. l. 2. cap. 12.*

with

with *Adam*'s Sin; yet perhaps, they had ſome of the own, which might make them liable to the ſame miſ ry with us; out of which, it may be, they were d livered by the ſame means as we, the Death Chriſt; and thus he thinks that Place of the *Epheſia* Epheſ. 1. 10. may be interpreted, where the Apoſtle ſays, *God g thered all things together in Chriſt, both which are in eart and which are in the heavens:* So alſo that of the ſam Apoſtle to the *Coloſſians*, where he ſays, that *it pleaſ* Col. 1. 20. *the Father to reconcile all things unto himſelf by Chriſt, wh ther they be things in earth, or things in heaven.*

But I dare not jeſt with Divine Truths, or appl theſe Places according as Fancy directs. As I thin this Opinion doth not any where contradict Scripture ſo I think likewiſe, that it cannot be proved from i Wherefore *Campanella*'s ſecond Conjecture, may b more probable, that the Inhabitants of that World ar not Men as we are; but ſome other kind of Creature which bear ſome Proportion and Likeneſs to our Na tures. Or it may be, they are of a quite differen Nature from any thing here below, ſuch as no Imag nation can deſcribe; our Underſtandings being capa ble only of ſuch things as have entered by our Sen ſes, or elſe ſuch mixed Natures as may be compoſed fro them. Now, there may be many other Species of Cre tures beſide thoſe that are already known in the Worl there is a great Chaſm betwixt the Nature of Me and Angels: It may be the Inhabitants of the Planet are of a middle Nature between both theſe. 'Tis no improbable that God might create ſome of all kind that ſo he might more compleatly glorify himſelf i the Works of his Power and Wiſdom.

Cuſanus too, thinks they differ from us in man Reſpects; I will ſet down his Words as they may b found in the above cited Place, *Suſpicamur in regione ſ lis magis eſſe ſolares, claros & illuminatos intellectuales ha bitatores, ſpiritualiores etiam quàm in luna, ubi magis luna tici, & in terra magis materiales & craſſi, ut illi intellect*

al

lis naturæ ſolares ſint multum in actu & parum in potentia, errenæ vero magis in potentia, & parum in actu, lunares in nedio fluctuantes. Hoc quidem opinamur ex influentia ignili olis, aquatica ſimul & aerea lunæ, & gravedine materiali rræ, & conſimiliter de aliis ſtellarum regionibus, ſuſpican-es nullam habitationibus carere, quaſi tot ſint partes particula-es mundiales unius univerſi, quot ſunt ſtellæ quarum non eſt umerus, niſi apud eum qui omnia in numero creavit.

" We may conjecture (ſaith he) the Inhabitatants of the Sun are like to the Nature of that Planet, more clear and bright, more intellectual than thoſe in the Moon where they are nearer to the Nature of that duller Planet, and thoſe of the Earth being more groſs and material than either ; ſo that theſe intellectual Natures in the Sun, are more Form than Matter, thoſe in the Earth more Matter than Form, and thoſe in the Moon betwixt both. This we may gueſs from the fiery Influence of the Sun, the watery and aereous Influence of the Moon, as alſo the material Heavineſs of the Earth. In ſome ſuch manner likewiſe is it with the Regions of the other Stars ; for we conjecture that none of them are without Inhabitants,but that there are ſo many particular Worlds and Parts of this one Univerſe, as there are Stars, which are innumerable, unleſs it be to him who created all things in Number.

For he held that the Stars were not all in one equal rb as we commonly ſuppoſe; but that ſome were r higher than others, which made them appear leſs ; d that many others were ſo far above any of theſe, at they were altogether inviſible unto us. An Opion which (as I conceive) hath not any great Probility for it, nor Certainty againſt it.

The Prieſt of *Saturn* relating to *Plutarch* (as he feigns) the Nature of theſe *Selenites*, told him they were divers Diſpoſitions, ſome deſiring to live in the wer Parts of the Moon, where they might look wnwards upon us, while others were more ſurely

mounted aloft, all of them ſhining like the Rays of th Sun, and as being Victorious, are crowned with Ga lands made with the Wings of *Euſtathia* or *Conſta cy.*

It hath been the Opinion amongſt ſome of the An cients, that their Heavens and *Elyſian* Fields were i the Moon, where the Air is moſt quiet and pure. Th *Socrates*, thus *Plato*, with his Followers, did eſteer this to be the Place where thoſe purer Souls inhabi who are freed from the Sepulchre, and Contagion the Body. And by the Fable of *Ceres*, continuall wandring in Search of her Daughter *Proſerpina*, meant nothing elſe but the longing Deſire of Me who live upon *Ceres*, Earth, to attain a Place in *Proſe pina*, the Moon or Heaven.

Nat. Com. l. 3. c. 19.

Plutarch alſo ſeems to aſſent unto this; but he thin moreover, that there are two Places of Happine anſwerable to two parts which he fancies to remain a Man when he is dead, the Soul and the Underſtan ing; the Soul he thinks is made of the Moon; and our Bodies do ſo proceed from the Duſt of this Earth that they ſhall return to it hereafter; ſo our Souls wer generated out of that Planet, and ſhall be reſolved in to it again; whereas the Underſtanding ſhall aſcen unto the Sun, out of which it was made; where ſhall poſſeſs an Eternity of Well-being, and far greate Happineſs than that which is enjoyed in the Moo So that when a Man dies, if his Soul be much pollute then muſt it wander up and down in the middle Reg on of the Air where Hell is, and there ſuffer unſpeak able Torments for thoſe Sins whereof it is guilt Whereas the Souls of better Men, when they have i ſome Space of Time been purged from that Impurit which they did derive from the Body, then do the return into the Moon, where they are poſſeſt wi ſuch Joy, as thoſe Men feel who profeſs Holy Myſt ries; from which Place (ſaith he) ſome are ſen down to have the Superintendance of Oracles, bein

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iligent either in the Preſervation of the Good, either rom, or in, all Perils, and the Prevention or Puniſh- nent of all wicked Actions; but if in theſe Employ- nents they miſ-behave themſelves, then are they again o be impriſoned in a Body, otherwiſe they remain n the Moon, till their Souls be reſolved into it, and he Underſtanding being cleared from all Impediments, ſcends to the Sun which is its proper place. But this equires a diverſe Space of Time, according to the livers Affections of the Soul. As for thoſe who have een retired and honeſt, addicting themſelves to a ſtu- ious and quiet Life, theſe are quickly preferred to a igher Happineſs. But as for ſuch who have buſied hemſelves in many Broils, or have been vehement in ne Proſecution of any Luſt, as the ambitious, the a- norous, the wrathful Man, theſe ſtill retain the Glimpſes nd Dreams of ſuch things as they have performed in neir Bodies, which make them either altogether un- t to remain there, where they are, or elſe keeps them ng ere they can put off their Souls. Thus you ſee *lutarch*'s Opinion concerning the Inhabitants and Neighbours of the Moon, which (according to the Manner of the Academicks) he delivers in a third erſon; you ſee he makes that Planet an inferior kind f Heaven; and though he differs in many Circum- ances, yet doth he deſcribe it to be ſome ſuch Place, s we ſuppoſe Paradiſe to be. You ſee likewiſe his O- inion concerning the Place of the Damned Spirits, nat it is in the middle Region of the Air; and in either of theſe is he ſingular, but ſome more late and Orthodox Writers have agreed with him. As or the Place of Hell, many think it may e in the Air, as well as any where lſe.

True indeed, St. *Auſtin* affirms that this Place can- ot be diſcovered; but others there are who can ſhew ne Situation of it out of Scripture; ſome holding it o be in another World without this, becauſe our Sa- viour

De Civit. Dei l. 22. *c.* 16.

Mat. 25. 30. *Eph.* 4. 9. viour calls it σκότος ἐξώτερον, outward Darkneſs. But the moſt will have it placed towards the Center of our Earth, becauſe 'tis ſaid, Chriſt deſcended into the lower Parts of the Earth: And ſome of theſe are ſo confident that this is its Situation, that they can deſcribe you its Bigneſs alſo, and of what Capacity it is. *Francis Ribera* in his Comment on the *Revelations* ſpeaking of thoſe Words, where 'tis ſaid, *That the blood went out of the Wine-preſs, even unto the Horſes Bridles by the ſpace of one thouſand and ſix hundred Furlongs*, interprets them to be meant of Hell, and that that Number expreſſes the Diameter of its Concavity, which is 200 *Italian* Miles. But *Leſſius* thinks that this Opinion gives them too much room in Hell, and therefore he gueſſes that 'tis not ſo wide; for, ſaith he, the Diameter of one League being cubically multiplied, will make a Sphere capable of 800000 Millions of Damned Bodies, allowing to each ſix Foot in the ſquare whereas, ſays he, tis certain, that there ſhall not be One hundred thouſand Millions in all that ſhall be Damned. You ſee the bold *Jeſuit* was careful that every one ſhould have but room enough in Hell; and by the ſtrangeneſs of the Conjecture, you may gueſs that he had rather be abſurd, than ſeem either uncharitable or ignorant. I remember there is a Relation in *Pliny*, how that *Dionyſiodorus* a Mathematician being dead, did ſend a Letter from this Place to ſome of his Friends upon Earth, to certifie them what diſtance there was betwixt the Center and Superficies: He might have done well to have prevented this Controverſie, and informed them the utmoſt Capacity of that Place. However, certain it is, that that Number cannot be known; and probable it is, that the Place is not yet determined, but that Hell is there where there is any Tormented Soul, which may be in the Regions of the Air, as well as in the Center; and therefore perhaps it is, that the Devil is ſtiled the Prince of the Air. But of this only occaſionally, and

Rev. 14. 20.

De Morib. div. l. 13. *c.* 24.

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by reaſon of *Plutarch*'s Opinion concerning thoſe that are round about the Moon. As for the Moon it ſelf, he eſteems it to be a lower kind of Heaven; and therefore in another place he calls it a Terreſtrial Star, and an Olympian or Cæleſtial Earth; anſwerable, as I conceive, to the Paradiſe of the Schoolmen. And, that Paradiſe was either in, or near the Moon, is the Opinion of ſome later Writers, who derived it (in all likelihood) from the Aſſertion of *Plato*, and perhaps, this of *Plutarch*. *Toſtatus* lays this Opinion upon *Iſidor. Hiſpalenſis*, and the venerable *Bede*, and *Pererius*, fathers it upon *Strabus* and *Rabanus* his Maſter. Some would have it to be ſituated in ſuch a place as could not be diſcovered; which cauſed the Penman of *Eſdras* to make it a harder Matter *to know the out-goings of Paradiſe, than to weigh the weight of the Fire, or meaſure the blaſts of Wind, or call again a Day that is paſt.* But notwithſtanding this, there be ſome others, who think that it is on the top of ſome high Mountain under the Line; and theſe interpreted the Torrid Zone to be the Flaming Sword whereby Paradiſe was guarded. 'Tis the Conſent of divers others, that Paradiſe is ſituated in ſome high and eminent Place. So *Toſtatus*: *Eſt etiam Paradiſus ſitu altiſſima, ſupra omnem terræ altitudinem.* "Paradiſe is ſituated in ſome high place above the Earth." And therefore in his Comment upon the 49th. of *Geneſis*, he underſtands the Bleſſing of *Jacob* concerning the Everlaſting Hills, to be meant of Paradiſe, and the Bleſſing it ſelf to be nothing elſe but a Promiſe of Chriſt's Coming, by whoſe Paſſion the Gates of Paradiſe ſhould be opened. Unto him aſſented *Rupertus*, *Scotus*, and moſt of the other Schoolmen, as I find them cited by *Pererius*, and out of him in Sir *Walter Rawleigh*. Their Reaſon was this: Becauſe in probability, this Place was not overflowed by the Flood, ſince there were no Sinners there, which might draw that Curſe upon it. Nay, *Toſtatus* thinks that the Body of *Enoch* was kept there; and ſome of

Cur ſilent oracula.

Sir *W. Raw. l.* 1. *c.* 3. *ſect.* 7.

In Geneſ.

2 *Eſdr.* 4. 7.

In Geneſ.

Comment. in 2. *Gen. v.* 8.

L. 1. *c.* 3. *ſect.* 6, 7.

the Fathers, as *Tertullian* and *Auſtin*, have affirme
That the Bleſſed Souls were reſerved in that Place
the Day of Judgment; and therefore 'tis likely th
it was not overflowed by the Flood. It were eaſie
produce the unanimous Conſent of the Fathers,
prove that Paradiſe is yet really exiſtent. Any di
gent Peruſer of them, may eaſily obſerve how th
2 Cor. 12. 4. do generally interpret the Paradiſe whereto St. P
Luke 23. 43. was wrapt, and that wherein our Saviour promiſ
the Thief ſhould be with him, to be locally the ſa
from whence our firſt Parents were baniſhed. No
there cannot be any Place on Earth deſigned whe
this ſhould be; and therefore it is not altogether i
probable that it was in this other World.

And beſides, ſince all Men ſhould have went Nak
if *Adam* had not fell, 'tis requiſite therefore that
ſhould be ſituated in ſome ſuch Place where it mig
be privileged from the Extremities of Heat and Co
But now this could not be (they thought) ſo conve
ently in any lower, as it might in ſome higher A
For theſe and ſuch like Conſiderations, have ſo ma
affirmed that Paradiſe was in a high elevated Plac
Which ſome have conceived could be no where but
the Moon: For it could not be in the top of a
Mountain; nor can we think of any other Body
parated from this Earth, which can be a more conv
nient Place for Habitation than this Planet; therefo
they concluded that it was there.

It could not be on the top of any Mountain:

Gen. 7. 19. 1. Becauſe we have expreſs Scripture, that t
higheſt of them was overflowed.

2. Becauſe it muſt be of a greater Extenſion, a
not ſome ſmall Patch of Ground, ſince 'tis likely
Men ſhould have lived there, if *Adam* had not fe
But for a ſatisfaction of the Arguments, together wi
a farther Diſcourſe of Paradiſe, I ſhall refer you
thoſe who have written purpoſely upon this Subje
Being content for my own part to have ſpoken

muc

much of it, as may conduce to ſhew the Opinion of others concerning the Inhabitants of the Moon; I dare not my ſelf affirm any thing of theſe *Selenities*, becauſe I know not any Ground whereon to build any probable Opinion. But I think that future Ages will diſcover more; and our Poſterity, perhaps, may invent ſome Means for our better Acquaintance with theſe Inhabitants.

PROP. XIV.

That 'tis poſſible for ſome of our Poſterity, to find out a Conveyance to this other World; and if there be Inhabitants there, to have Commerce with them.

ALL that hath been ſaid concerning the People of the new World, is but Conjectural, and full of Uncertainties; nor can we ever look for any evident or more probable Diſcoveries in this kind, unleſs there be ſome hopes of inventing Means for our Conveyance thither. The poſſibility of which, ſhall be the Subject of our Enquiry in this laſt Propoſition.

And, if we do but conſider by what Steps and Leiſure, all Arts do uſually riſe to their growth, we ſhall have no cauſe to doubt why this alſo may not hereafter be found out amongſt other Secrets. It hath conſtantly yet been the Method of Providence, not preſently to ſhew us all, but to lead us on by degrees, from the knowledge of one thing to another.

'Twas a great while e'er the Planets were diſtinguiſhed from the fixed Stars; and ſome time after that, e'er the Morning and Evening Star were found to be the ſame; and in greater ſpace (I doubt not) but this alſo, and other as excellent Myſteries will be diſcovered. Time, who hath always been the Father of

new Truths, and hath revealed unto us many thin which our Anceſtors were ignorant of, will alſo man feſt to our Poſterity that which we now deſire, b cannot know. *Veniet tempus* (ſaith *Seneca*) *quo iſta qu nunc latent, in lucem dies extrahet, & longioris ævi di gentia.* Time will come, when the Endeavours of A ter-Ages ſhall bring ſuch things to Light, as now l hid in Obſcurity. Arts are not yet come to their Sc ſlice; but the Induſtry of future Times, aſſiſted wi the Labours of their Forefathers, may reach that heig which we could not attain to. *Veniet tempus quo poſte noſtri nos tam aperta neſciſſe mirentur.* As we now wo der at the Blindneſs of our Anceſtors, who were n able to diſcern ſuch things as ſeem plain and obviou unto us; ſo will our Poſterity admire our Ignoranc in as perſpicuous Matters.

Nat. Qu. l. 7. c. 25.

In the firſt Ages of the World, the Inlanders thoug themſelves either to be the only Dwellers upon Earth or elſe if there were any other, they could not poſſ bly conceive how they might have any Commerc with them, being ſevered by the deep and broad Sea But After-times found out the Invention of Ships in which notwithſtanding, none but ſome bold darin Men durſt venture, according to that of the Tra gœdian.

Sen. Med. act 1.

Audax nimium qui freta primus
Rate tam fragili perfida rupit.

Vide Hora. Od. 3.

Too bold was he, who in a Ship ſo frail,
Firſt ventur'd on the treacherous Waves to Sail.

Juvenal. ſat. 12.

Claud. præf. ad 1. lib. de rap. Proſer.

And yet now, how eaſie a thing is this even to timorous and cowardly Nature? And queſtionleſs, th Invention of ſome other Means for our Conveyanc to the Moon, cannot ſeem more incredible to us, tha this did at firſt to them; and therefore we have n juſt reaſon to be diſcouraged in our hopes of the lik Succeſs.

Yea

Yea, but (you will ſay) there can be no Sailing hither, unleſs that were true which the Poet does but feign, That ſhe made her Bed in the Sea. We have not now any *Drake*, or *Columbus*, to undertake his Voyage, or any *Dædalus* to invent a Conveyance through the Air.

I anſwer, Though we have not, yet why may not ſucceeding Times raiſe up ſome Spirits as eminent for new Attempts, and ſtrange Inventions, as any that were before them? 'Tis the Opinion of *Keplar*, That as ſoon as the Art of Flying is found out, ſome of their Nation will make one of the firſt Colonies that ſhall tranſplant into that other World. I ſuppoſe his appropriating this Preheminence to his own Countreymen, may ariſe from an over-partial affection to them. But yet thus far I agree with him, That whenever that Art is invented, or any other, whereby a Man may be convey'd ſome twenty Miles high, or thereabouts, then 'tis not altogether improbable that ſome or other may be ſucceſsful in this Attempt. *Dissertat. cum Nun. Syder.*

For the better clearing of which I ſhall firſt lay down, and then anſwer thoſe Doubts that may make it ſeem utterly impoſſible.

Theſe are chiefly Three.

The Firſt, taken from the natural heavineſs of a Man's Body, whereby it is made unfit for the Motion of Aſcent, together with the vaſt diſtance of that Place from us.

2. From the extreme Coldneſs of the Æthereal Air.

3. The extreme Thinneſs of it.

Both which muſt needs make it impaſſible, though it were but as many ſingle Miles thither as it is thouſands.

For the firſt. Though it were ſuppoſed that a Man could fly, yet we may well think he would be very ſlow in it, ſince he hath ſo heavy a Body, and ſuch

ſuch a one too, as Nature did not principally inte
for that kind of Motion. 'Tis uſually obſerved, th
amongſt the variety of Birds, thoſe which do m
converſe upon the Earth, and are ſwifteſt in their ru
ning, as a Pheaſant, Partridge, *&c.* together with
Domeſtical Fowl, are leſs able for flight than oth
which are for the moſt part upon the Wing, as a Sw
low, Swift, *&c.* And therefore we may well thin
that Man being not naturally endowed with any ſu
Condition as may enable him for this Motion; and b
ing neceſſarily tied to a more eſpecial Reſidence on t
Earth, muſt needs be ſlower than any Fowl, or l
able to hold out. Thus it is alſo in Swimming; whi
Art though it be grown to a good eminence, yet h
that is beſt skilled in it, is not able either for contin
ance, or ſwiftneſs to equal a Fiſh; becauſe he is n
naturally appointed to it. So that though a Man cou
fly, yet he would be ſo ſlow in it, and ſo quickly we
ry, that he could never think to reach ſo great a Jou
ney as it is to the Moon.

But ſuppoſe withal that he could fly as faſt and lon
as the ſwifteſt Bird, yet it cannot poſſibly be conce
ved how he ſhould ever be able to paſs through ſo va
a diſtance as there is betwixt the Moon and our Eart
For this Planet, according to the common Ground
is uſually granted to be at the leaſt 52 Semidiameter
of the Earth from us; reckoning for each Semidiame
ter 3456 *Engliſh* Miles, of which the whole Space wi
be about 179712.

So that though a Man could conſtantly keep on i
his Journey thither by a ſtrait Line, though he could fl
a Thouſand Miles in a Day, yet he would not arriv
thither under 180 Days, or half a Year.

And how were it poſſible for any to tarry ſo lon
without Diet or Sleep?

1. For Diet. I ſuppoſe there could be no truſtin
Prop. 3. to that Fancy of *Philo* the *Jew* (mentioned before,
wh

who thinks that the Muſick of the Spheres ſhould ſup-
ly the ſtrength of Food.

Nor can we well conceive how a Man ſhould
e able to carry ſo much Luggage with him, as
ight ſerve for his *Viaticum* in ſo tedious a Jour-
ey.

2. But if he could, yet he muſt have ſome time to
eſt and ſleep in. And I believe he ſhall ſcarce find
ny Lodgings by the way. No Inns to entertain Paſ-
engers, nor any Caſtles in the Air (unleſs they be en-
hanted ones) to receive Poor Pilgrims, or Errant
Knights. And ſo conſequently he cannot have any
oſſible hopes of reaching thither.

Notwithſtanding all which Doubts, I ſhall lay down
his Poſition.

That ſuppoſing a Man could fly, or by any other
neans raiſe himſelf twenty Miles upwards, or
hereabouts, it were poſſible for him to come unto
he Moon.

As for thoſe Arguments of the firſt kind, that ſeem
o overthrow the truth of this, they proceed upon a
wrong ground; whilſt they ſuppoſe that a condenſed
Body, in any place of the Air, would always retain in
t a ſtrong Inclination of tending downwards towards
he Center of this Earth. Whereas 'tis more proba-
le, that if it were but ſomewhat above this Orb of
Vaporous Air, it might there reſt immovable, and
would not have in it any propenſion to this Motion of
Deſcent.

For the better illuſtration of this, you muſt know, *De cælo, lib. 4. c. 1.*
hat the heavineſs of a Body, or (as *Ariſtotle* defines
t) the proneneſs of it to tend down unto ſome Cen-
er, is not any abſolute Quality intrinſical unto it, as
f where-ever the Body did retain its Eſſence, it muſt
lſo retain this Quality: Or as if Nature had implant-
ed in every condenſed Body *Appetitionem centri, & fu-
am extremitatis.* Such a Love to the Center, and Ha-
red to the Extremities. Becauſe one of theſe being
leſs

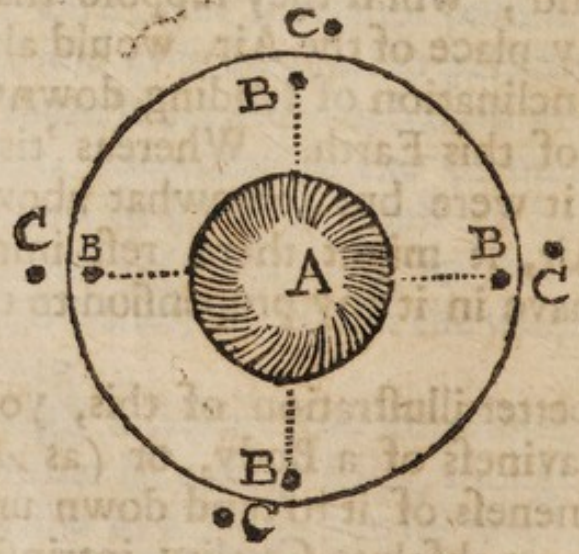
leſs than a Quantity, and the other no more, cann have any Power of attraction or depulſion in the According to that common Principle, *Quantitatis nu eſt efficacia.*

A magnetical Natural Attraction. So *Keplar, Somn. Aſtron. N. 66. Coper. l. 1. cap. 26. Foſcarin in epiſt. ad Sebaſt. Fanſenum.*

But now the true nature of Gravity is this. 'T ſuch a reſpective mutual deſire of union, whereby co denſed Bodies, when they come within the Sphere their own Vigour, do naturally apply themſelves one another by attraction or coition. But being both wit out the reach of either's Virtue, they then ceaſe move, and though they have general aptitude, y they have not any preſent inclination or proneneſs one another. And ſo conſequently cannot be ſtyl heavy.

The meaning of this will be more clearly illuſtrat by a Similitude. As any light Body (ſuppoſe t Sun) does ſend forth its Beams in an Orbicular For ſo likewiſe any Magnetical Body, for inſtance a Rou Loadſtone does caſt abroad his Magnetical Vigour in Sphere. Thus.

Gilbert. de Magnet. l. 2. cap. 7.



Where ſuppoſe the inward Circle at *A* to repreſe the Loadſtone, and the outward one betwixt *B*, *C*, th Orb that does determinate its Virtue.

Nov

Now any other Body that is like affected coming thin this Sphere, as *B*, will preſently deſcend to-rds the Center of it, and in that reſpect may be led heavy. But place it without this Sphere as *C*, d then the deſire of union ceaſeth, and ſo conſe-ently the Motion alſo.

To apply then what hath been ſaid. This great obe of Earth and Water hath been proved by ma- Obſervations, to participate of Magnetical Proper-s. And as the Loadſtone does caſt forth its own gour round about its Body, in a Magnetical Com-ſs, ſo likewiſe does our Earth. The difference is, at it is another kind of Affection which cauſes the nion betwixt the Iron and Loadſtone, from that nich makes Bodies move unto the Earth. The for-er is ſome kind of nearneſs and ſimilitude in their Na-res, for which Philoſophy, as yet, has not found a rticular Name. The latter does ariſe from that pe-liar Quality whereby the Earth is properly diſtin-iſh'd from the other Elements, which is its Conden-y. Of which the more any thing does participate, ſo much the ſtronger will be the deſire of union to So Gold and other Metals which are moſt cloſe their Compoſition, are likewiſe moſt ſwift in their otion of Deſcent.

And though this may ſeem to be contradicted by e inſtance of Metals which are of the ſame weight, nen they are melted, and when they are hard: As o of Water, which does not differ in reſpect of avity, when it is frozen, and when it is fluid: Yet e muſt know that Metals are not rarify'd by melting, t mollify'd. And ſo too for Frozen Waters, they e not properly condenſed, but congealed into a har-r Subſtance, the Parts being not contracted cloſer gether, but ſtill poſſeſſing the ſame Extenſion. But t (I ſay) 'tis very probable that there is ſuch a here about the Earth, which does terminate its Pow- of attracting other things unto it. So that ſuppoſe a Body

a Body to be placed within the Limits of this Sphe and then it muſt needs tend downwards towards Center of it. But on the contrary, if it be beyo this Compaſs, then there can be no ſuch mutual traction; and ſo conſequently it muſt reſt immova from any ſuch Motion.

For the farther confirmation of this, I ſhall prop two Pertinent Obſervations.

Lib. de Sympath. & Antip. c. 7.

The firſt taken in the preſence of many Phyſicia and related by an Eminent Man in that Profeſſi *Hieron. Fracaſtorius.* There being divers Needles p vided of ſeveral kinds, like thoſe in a Mariner's Cha they found that there was an attractive Power not o ly in the Magnet, but that Iron alſo, and Steel, a Silver did each of them draw its own Metal. When he concludes, *Omne trahit quod ſibi ſimile eſt.* And theſe peculiar Likeneſſes have ſuch a mutual efficacy ſo 'tis probable that this more general Qualification Condenſity may be the cauſe why things ſo affect deſire union to the Earth. And though 'tis likely th this would appear betwixt two leſſer Condenſed B dies, (as ſuppoſe two Pieces of Earth) if they we both placed at liberty in the Æthereal Air, yet bei near the Earth, the ſtronger Species of this great Glo does, as it were, drown the leſs.

Vid. Bapt. Maſul. exer. Acad. de attract. exer. 4.

'Tis a common Experiment, that ſuch a Lump Ore or Stone, as being on the Ground, cannot be m ved by leſs than Six Men, being in the bottom of deep Mine, may be ſtirred by two. The Reaſon becauſe then 'tis compaſſed with attractive Beam there being many above it as well as below Whence we may probably infer (ſaith the Learne *Verulam*), "That the Nature of Gravity does work b "weakly alſo far from the Earth; becauſe the App "tite of Union in Denſe Bodies muſt be more dull i "reſpect of diſtance." As we may alſo conclud from the Motion of Birds, which riſe from the Groun but heavily, though with much Labour; whereas be ing

Nat. Hiſt. Cent. 1. exper. 33.

g on high, they can keep themſelves up, and ſoar out by the meer extenſion of their Wings. Now e Reaſon of this difference, is not (as ſome falſly nceive) the depth of Air under them. For a Bird not heavier when there is but a Foot of Air under n, than when there is a Furlong. As appears by a ip in the Water, (an Inſtance of the ſame nature) nich does not ſink deeper, and ſo conſequently is t heavier, when it has but five Fathom depth, an when it has fifty. But the true Reaſon is, the eakneſs of the Deſire of Union in Denſe Bodies at a ſtance.

So that from hence, there might be juſt occaſion to x *Ariſtotle* and his Followers, for teaching that Heaneſs is an abſolute Quality of it ſelf, and really diſtinct from Condenſity: Whereas it is only a Modification of it, or rather another Name given to a conſed Body in reference to its Motion.

For if it were abſolute, then it ſhould always be inrent in its Subject, and not have its Eſſence depend on the Bodies being here or there. But it is not ſo. or,

1. Nothing is heavy in its proper Place, according his own Principle, *Nihil grave eſt in ſuo loco.* And en,

2. Nothing is heavy, which is ſo far diſtant from at proper Orb to which it does belong, that it is not ithin the reach of its Virtue. As was before conmed.

But unto this it may be objected; though a Body ing ſo placed, be not heavy *in actu ſecundo*; yet it *in actu primo*: Becauſe it retains in it an inward ononeneſs to move downwards, being once ſevered from proper Place. And this were Reaſon enough why e Quality of Heavineſs ſhould have an abſolute Beg.

I anſwer, this Diſtinction is only appliable to ſuch tural Powers as can ſuſpend their Acts; and will

not

not hold in Elementary Qualities, whoſe very Eſſen does neceſſarily require an Exerciſe of the ſecond A as you may eaſily diſcern by an Induction of all t reſt. I cannot ſay, that Body has in it the Quality Heat, Coldneſs, Drineſs, Moiſture, Hardneſs, So neſs, *&c.* which for the preſent has not the ſeco Act of theſe Qualities. And if you mean by t Eſſence of them, a Power unto them: Why, the is not any natural Body but has a Power to the all.

From that which hath been ſaid concerning t Nature of Gravity, it will follow, That if a Ma were above the Sphere of this Magnetical Virtu which proceeds from the Earth, he might there ſtan as firmly in the open Air, as he can now upon th Ground: And not only ſo, but he may alſo mov with a far greater Swiftneſs, than any living Creatur here below; becauſe then he is without all Gravity being not attracted any way; and ſo conſequentl will not be liable to ſuch Impediments as may in th leaſt manner reſiſt that kind of Motion which he ſha apply himſelf unto.

If you yet enquire, how we may conceive it poſſi ble, that a condenſed Body ſhould not be heavy in ſuc a Place?

I anſwer, by the ſame Reaſon as a Body is not hea vy in its proper Place. Of this I will ſet down tw Inſtances.

1. When a Man is in the Bottom of a deep River though he have over him a Multitude of heavy Waters yet he is not burden'd with the Weight of them And though another Body, that ſhould be but of an equal Gravity with theſe Waters, when they are taken out, would be heavy enough to preſs him to Death yet notwithſtanding whilſt they are in the Channel they do not in the leaſt manner cruſh him with their Load. The Reaſon is, becauſe they are both in their right Places; and 'tis proper for the Man, being the

more

ore condenſed Body, to be lower than the Waters. r rather thus, Becauſe the Body of the Man does ore nearly agree with the Earth, in this Affection, hich is the Ground of its Attraction, and therefore ththat more ſtrongly attract it, than the Waters that e over it. Now, as in ſuch a Caſe, a Body may ſe the Operation of its Gravity, which is, to move, to preſs downwards: So may it likewiſe, when it ſo far out of its Place, that this attractive Power can-ot reach unto it.

'Tis a pretty Notion to this Purpoſe, mentioned by *Albertus de Saxonia*, and out of him by † *Francis Mencа*; That the Air is in ſome part of it Navigable. nd that upon this Statick Principle, any Braſs or Iron eſſel (ſuppoſe a Kettle) whoſe Subſtance is much avier than that of the Water; yet being filled with e lighter Air, it will ſwim upon it, and not ſink. So ppoſe a Cup, or Wooden Veſſel, upon the outward orders of this Elementary Air, the Cavity of it be-g filled with Fire, or rather Æthereal Air, it muſt ceſſarily upon the ſame Ground remain ſwimming ere, and of it ſelf can no more fall, than an npty Ship can ſink.

* *Phyſ. l. 3. Q. art 2. 6.*
† *Viridar. l. 4. prob. 47.*
Vid. Arch. l. de inſidentibus humido.

2. 'Tis commonly granted, that if there were a ole quite through the Centre of the Earth, though y heavy Body (as ſuppoſe a Milſtone) were let fall to it; yet when it came unto the Place of the Cen-e, it would there reſt immoveable in the Air. Now, in this Caſe, its own Condenſity cannot hinder, but at it may reſt in the open Air, when there is no o-er Place to which it ſhould be attracted; ſo neither uld it be any Impediment unto it, if it were placed thout the Sphere of the Earth's Magnetical Vigor, here there ſhould be no Attraction at all.

From hence then (I ſay) you may conceive, that a Man were beyond this Sphere, he might there nd as firmly in the open Air, as now upon the rth. And if he might ſtand there, why might he

not alſo go there? And if ſo; then there is a Poſſibi lity likewiſe of having other Conveniences for Trav ling.

And here 'tis conſiderable, that ſince our Bod will then be devoid of Gravity, and other Impedime of Motion; we ſhall not at all ſpend our ſelves in ny Labour, and ſo conſequently not much need Reparation of Diet: But may perhaps live altogeth without it, as thoſe Creatures have done, who by r ſon of their Sleeping for many Days together, ha not ſpent any Spirits, and ſo not wanted any Foo Which is commonly related of Serpents, Crocodi Bears, Cuckoes, Swallows, and ſuch like. To t purpoſe, * *Mendoca* reckons up divers ſtrange Relatio As that of *Epimenides*, who is ſtoried to have ſlept Years. And another of a Ruſtick in *Germany*, w being accidentally covered with a Hay-rick ſlept th for all Autumn, and the Winter following, with any Nouriſhment.

* *Viridar. l. 4. prob. 24.*

Or, if this will not ſerve; yet why may not a piſt faſt ſo long, as well as *Ignatius* or *Xaverius*? O there be ſuch a ſtrange Efficacy in the Bread of Euchariſt, as their miraculous Relations do attribute it: Why then, that may ſerve well enough, for th *Viaticum.*

Or, if we muſt needs feed upon ſomething e why may not Smells nouriſh us? * *Plutarch* and † P and divers other Ancients, tell us of a Nation in *In* that lived only upon pleaſing Odors. And 'tis common Opinion of Phyſicians, that theſe do ſtran ly both ſtrengthen and repair the Spirits. Hence it that *Democritus* was able for divers Days together, feed himſelf with the meer Smell of hot Bread.

* *De facie in Luna.*
† *Nat. Hiſt. l. 7. c. 2.*
Diog. Laer. l. 1. c. 9.

Or if it be neceſſary that our Stomachs muſt rece the Food: Why then 'tis not impoſſible that the rity of the Æthereal Air, being not mixed with improper Vapours, may be ſo agreeable to our Bod

o yield us ſufficient Nonriſhment; according to that the Poet:

——— ——— *Veſcitur aurâ* *Virgil.*
Ætherea ——— ——— ———

Twas an old *Platonick* Principle, that there is in ſome t of the World ſuch a Place where Men might be ıtifully nouriſhed by the Air they breathe: Which not more properly be aſſigned to any one particu- than to the Æthereal Air above this.

know 'tis the common Opinion, that no *Element* can ve *Aliment*, becauſe 'tis not proportionate to the Bo- of living Creatures which are compounded. *Ariſt. de Senſ. c. 5.*

. This Æthereal Air is not an Element; and tho' e purer, yet 'tis perhaps of a greater Agreeableneſs Man's Nature and Conſtitution.

. If we conſult Experience and the credible Relati- of others, we ſhall find it probable enough that ıy things receive Nouriſhment from meet Elements. irſt, for the Earth; * *Ariſtotle* and † *Pliny*, thoſe great Naturaliſts, tell us of ſome Creatures, that fed only with this. And it was the Curſe of the ent, *Gen.* 3. 14. *Upon thy belly ſhalt thou go, and ſhalt thou eat all the days of thy life.* The earth. * *Hiſt. Animal. l.* 8. *cap.* 5. † *Hiſt. l.* 10. *cap.* 72.

o likewiſe for the Water. ∴ *Albertus Magnus* ſpeaks Man who lived Seven Weeks together by the meer nking of Water. * *Rondoletius* (to whoſe Diligence e later Times are much beholden for ſundry Ob- ations concerning the Nature of Aquatils;) af- s that his Wife did keep a Fiſh in a Glaſs of Wa- without any other Food for three Years: In ch Space it was conſtantly augmented, till at firſt uld not come out of the Place at which it was put and at length was too big for the Glaſs it ſelf, gh that were of a large Capacity. *Cardan* tells us ſome Worms, that are bred and nouriſhed by Snow, from which being once ſeparated, they The Water. ∴ *De Animal. l.* 7. * *De Piſc. l.* 1. *c.* 12. *Subtil. l.* 9.

The Air.

Thus alſo is it with the Air, which we may well co ceive does chiefly concur to the nouriſhing of all V getables. For if their Food were all ſucked out fr the Earth, there muſt needs be then ſome ſenſi Decay in the Ground by them; eſpecially ſince th do every Year renew their Leaves and Fruits: Wh being ſo many, and ſo often, could not be produ without Abundance of Nouriſhment. To this p poſe is the Experiment of Trees cut down which of themſelves put forth Sprouts. As alſo that of O ons, and the Semper-vive, which will ſtrangely ſh forth, and grow as they hang in the open Air. T likewiſe is it with ſome ſenſible Creatures; the *Ca lion* (ſaith* *Pliny* and † *Solinus*) meerly nouriſhed this: And ſo are the Birds of Paradiſe, treated of many ∴, which reſide conſtantly in the Air, Nat having not beſtowed upon them any Legs, and the fore they are never ſeen upon the Ground but be dead. If you ask how they multiply? 'Tis anſwer they lay their Eggs on the Backs of one another, on which they ſit till their young Ones be fledg * *Rhondoletius* from the Hiſtory of *Hermolaus Barba* tells us of a Prieſt (of whom one of the Popes the Cuſtody) that lived Forty Years upon meer A As alſo of a Maid in *France*, and another in G *many*, that for divers Years together did feed on thing but this: Nay, he affirms that he himſelf ſeen one, who lived till ten Years of Age without ny other Nouriſhment. You may find moſt of the and ſome other Examples to this purpoſe, gathered gether by *Mendoca Viridar. Lib.* 4. *Prob.* 23, 24. No if this Elementary Air, which is mixed with ſuch proper Vapours, may accidentally nouriſh ſome P ſons; perhaps then, that pure Æthereal Air may it ſelf be more natural to our Tempers.

* *Hiſt. l.* 8. *cap.* 33. *Polyhiſtor. cap.* 53.
† *Lop. hiſt. Ind. Occid. cap.* 96. *Maiolus. Colloq.* 3.
∴ 'Tis likely that theſe Birds do chiefly reſide in the Æthereal Air, wher they are nouriſhed and upheld.
* *De Piſcibus, l.* 1. *cap.* 13.

But if none of theſe Conjectures may ſatisfy; there may haply be ſome poſſible Means for the Co veyance of other Food, as ſhall be ſhewed afterwar

Agai

Again, ſeeing we do not then ſpend our ſelves in y Labour, we ſhall not, it may be, need the Refreſh-ent of Sleep. But if we do, we cannot deſire a fter Bed than the Air, where we may repoſe our ves firmly and ſafely as in our Chambers.

But here you may ask, whether there be any means r us to know, how far this Sphere of the Earth's irtue does extend it ſelf?

I anſwer, 'tis probable that it does not reach much rther than that Orb of thick vaporous Air, that en-mpaſſeth the Earth; becauſe 'tis likely the Sun may thale ſome earthly Vapours, near unto the utmoſt ounds of the Sphere allotted to them.

Now there are divers ways uſed by Aſtronomers, to ke the Altitude of this vaporous Air. As,

1. By obſerving the Height of that Air which auſeth the *Crepuſculum*, or Twilight; for the finding f which, the Ancients uſed this Means: As ſoon as ver they could diſcern the Air in the *Eaſt* to be altered ith the leaſt Light, they would by the Situation of he Stars find out how many Degrees the Sun was be-ow the *Horizon*, which was uſually about Eighteen. rom whence they would eaſily conclude, how high hat Air muſt be above us, which the Sun could ſhine pon, when he was 18 Degrees below us. And from his Obſervation, it was concluded to be about 52 Miles high. *Vitel. l.* 10. *Theo.* 7.

But in this Concluſion, the Ancients were much de-eived, becauſe they proceeded upon a wrong ground, vhilſt they ſuppoſed that the Shining of the Sun's di-ect Rays upon the Air, was the only Reaſon of the *Crepuſculum*; whereas 'tis certain that there are many other things which may alſo concur to the cauſing of t. As, *Keplar. Ep. Coper. l.* 1. *part* 3.

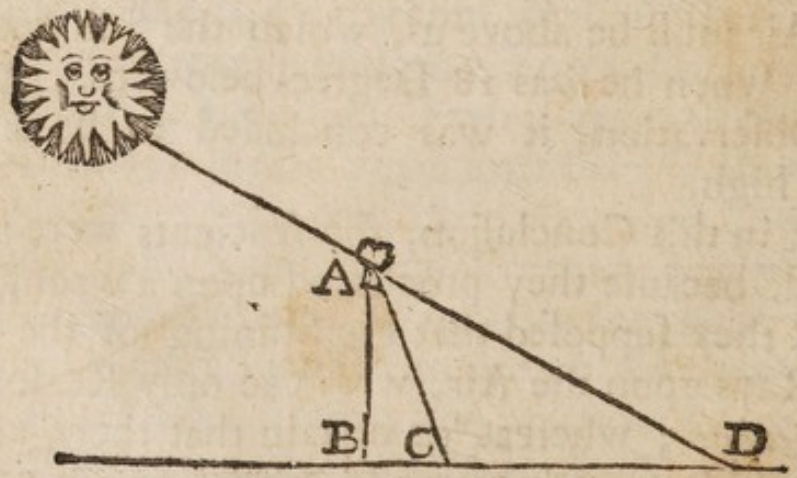
1. Some bright Clouds below the *Horizon*, which being illuminated by the Sun, may be the Means of conveying ſome Light to our Air, before the direct Rays can touch it.

2. The often Refraction of the Rays, which ſuffer a frequent Repercuſſion from the Cavity of this Sphere, may likewiſe yield us ſome Light.

3. And ſo may the Orb of enlightned Air compaſſing the Sun, part of which muſt riſe before his Body.

2. The ſecond way whereby we may more ſurely find the Altitude of this groſſer Air, is by taking the Heighth of the higheſt Cloud: Which may be done 1. Either as they uſe to meaſure the Altitude of things that cannot be approached unto, *viz.* by two Stations when two Perſons ſhall at the ſame time, in ſeveral Places, obſerve the Declination of any Cloud from the vertical Point. Or, 2. which is the more eaſie way, when a Man ſhall chuſe ſuch a Station, where he may at ſome diſtance diſcern the Place on which the Cloud does caſt its Shadow, and withal does obſerve, how much both the Cloud and the Sun decline from the vertical Point. From which he may eaſily conclude the true Altitude of it, as you may more plainly conceive by this following Diagram.

Stevinius. Geog. l. 3. *prop.* 3.



Where *A B* is a perpindicular from the Cloud, *C* the Station of him that meaſures, *D* the Place where the Shadow of the Cloud doesfall.

The

The Instrument being directed from the Station *C*, the Cloud at *A*, the Perpendicular will shew the Angle *B A C*. Then letting the Sun shine through the Sights of your Instrument, the Perpendicular of it will give the Angle *B A D*. Afterwards having measured the Distance *C D* by Paces, you may according to the common Rules, find the Heighth *B A*. *Pitisc. Trigon.*

But if without making the Observation, you would know of what Altitude the highest of these are found by Observation; * *Cardan* answers, not above two Miles; † *Keplar* not above 16000 Paces or thereabouts. **Subt. l.* 17. † *Epit. Cop. l.* 1. *p.* 3.

3. Another way to find the Height of this vaporous Air, is, by knowing the Difference of Altitude which causeth in refracting the Beams of any Star near the *Horizon*. And from this Observation also, it is usually concluded to be about two or three Miles high.

But now you must not conceive, as if the Orb of Magnetical Vigor were bounded in an exact Superfies, or as if it did equally hold out just to such a determinate Line, and no farther. But, as it hath been said of the first Region, which is there terminated where the Heat of Reflexion does begin to languish; so likewise is it probable, that this Magnetical Vigor does remit of its Degrees proportionally to its Distance from the Earth, which is the Cause of it: And therefore though the thicker Clouds may be elevated no higher, yet this Orb may be continued in weaker Degrees a little beyond them. We will suppose it (which in all likelihood is the most) to be about twenty Miles high. So that you see the former Thesis remains probable; that if a Man could but fly, or by any other Means get twenty Miles upwards, it were possible for him to reach unto the Moon.

But it may be again objected; Though all this were true; though there were such an Orb of Air which did terminate the Earth's Vigor: And though the Heavinesse of our Bodies could not hinder our Passage,

ſage through the vaſt Spaces of the Æthereal Air yet thoſe two other Impediments may ſeem to den the Poſſibility of any ſuch Voyage.

1. The extream *Coldneſs* of that Air. If ſome our higher Mountains for this reaſon be not habit ble, much more then will thoſe Places be ſo, whic are farther from any cauſe of Heat.

2. The extream thinneſs of it, which may make unfit for Expiration. For, if in ſome Mountains (*Ariſtotle* tells us of *Olympus*, and out of him * St. *A ſtin*) the Air be ſo thin, that Men cannot draw the Breath, unleſs it were through ſome moiſtned Spur ges; much more then muſt that Air be thin, whic is more remotely ſituated from the Cauſes of Impuri ty and Mixture. And then beſide, the Refractio that is made by the vaporous Air encompaſſing ou Earth, may ſufficiently prove that there is a great di ference betwixt the Æthereal Air and this, in reſpe of Rarity.

* *In Gen. ad literam. l.* 3. *cap.* 2.

To the firſt of theſe I anſwer, That though the ſe cond Region be naturally endowed with ſo muc Coldneſs, as may make it fit for the production Meteors; yet it will not hence follow, that all that A above it which is not appointed for the like purpoſ ſhould partake of the ſame Condition: But it ma ſeem more probable, that this Æthereal Air is free from having any Quality in the Extreams. And th may be confirmed from thoſe common Argument which are uſually brought to prove the Warmneſs the third Region; as you may ſee in * *Fromundus*, an others who treat of that Subject.

* *Meteor. lib.* 1. *ca.* 2. *art.* 1.

'Tis the Aſſertion of *Pererius*, that the ſecond Re gion is not cold meerly for this Reaſon, becauſe it diſtant from the ordinary Cauſes of Heat, but be cauſe it was actually made ſo at the firſt, for the con denſing of the Clouds, and the production of othe Meteors that were there to be generated; which (as conceive) might be ſufficiently confirmed from tha

Comment. in Gen. 1. 8.

Orde

rder of the Creation obſerved by *Moſes*, who tells that the Waters above the Firmament (by which, the greateſt probability, we are to underſtand the louds in the ſecond Region) were made the ſecond ay, *Gen.* 1. 7, 8. whereas the Sun it ſelf (whoſe eflection is the cauſe of Heat) was not created till ie fourth Day, *ver.* 16, 19.

To the other Objection I anſwer, That though the ir in the ſecond Region (where by reaſon of its Coldeſs there are many thick Vapours) do cauſe a great efraction; yet 'tis probable that the Air which is ext the Earth, is ſometimes, and in ſome places, of far greater thinneſs; nay, as thin as the Æthereal ir it ſelf; ſince ſometimes there is ſuch a ſpecial heat f the Sun, as may rarifie it in an eminent degree: nd in ſome dry places, there are no groſs impure Exalations to mix with it.

But here it may be objected: If the Air in the ſeond Region were more condenſed and heavy than is wherein we breathe, then that muſt neceſſarily end downwards, and poſſeſs the lower place.

To this ſome anſwer, That the hanging of the louds in the open Air, is no leſs than a Miracle. They are the words of *Pliny*: *Quid mirabilius aquis in* *Hiſt. l.* 31 *æthere ſtantibus?* What more wonderful thing is there, *cap.* 1. than that the Waters ſhould ſtand in the Heavens? Others prove this from the Derivation of the word שמים from שאה *ſtupeſcere* and מים *aquæ*; becauſe the Waters do hang there after ſuch a ſtupendious inconceivable Manner: Which ſeems likewiſe to be favoured by Scripture, where 'tis mentioned as a great Argument of God's Omnipotency, that he holds up the Clouds from falling. *He binds up the Waters in his thick* *Job* 26. 8. *Clouds, and the Cloud is not rent under them.*

But that which unto me ſeems full Satisfaction againſt this Doubt, is this Conſideration; That the natural Vigour whereby the Earth does attract denſe Bodies unto it, is leſs efficacious at a diſtance; and there-

therefore a Body of leſs Denſity, which is near unt it, as ſuppoſe this thin Air wherein we breathe, ma naturally be lower in its Situation, than another of greater Condenſity that is farther off; as ſuppoſe th Clouds in the ſecond Region. And though the on be abſolutely, and in it ſelf more fit for this Motio of Deſcent; yet by reaſon of its diſtance, the Earth Magnetical Vertue cannot ſo powerfully work up on it.

As for that Relation of *Ariſtotle*, if it were true yet it does not prove this Air to be altogether impaſ ſible, ſince moiſtned Spunges might help us againſt i thinneſs: But 'tis more likely that he took it upo truſt, as he did ſome other Relations concerning th height of the Mountains, wherein 'tis evident that h was groſly miſtaken: As where he tells us of *Cauca* *Meteor. l. 1. c. 11.* *ſus*, that it caſts its Shadow 560 Miles. And this Re lation being of the ſame Nature, we cannot ſafel truſt unto him for the truth of it.

If it be here enquired, what Means there may b conjectured, for our aſcending beyond the Sphere o the Earth's Magnetical Vigour.

I anſwer. 1. 'Tis not perhaps impoſſible that Man may be able to Fly, by the application of Wing to his own Body: As Angels are pictured, as *Mercur* and *Dædalus* are feigned, and as hath been attempte by divers; particularly by a *Turk* in *Conſtantinople*, a *Busbequius* relates.

2. If there be ſuch a great *Ruck* in *Madagaſcar*, a *Mr. Burton.* Melanch. *pa. 2. ſect. 2. mem. 3.* * *Marcus Polus* the *Venetian* mentions, the Feathers i whoſe Wings are twelve Foot long, which can ſoo up a Horſe and his Rider, or an Elephant, as ou Kites do a Mouſe; why then 'tis but teaching one o theſe to carry a Man, and he may ride up thither, a *Ganymede* does upon an Eagle. * *Lib. 3. c. 40.*

3. Or if neither of theſe Ways will ſerve: Yet do ſeriouſly, and upon good Grounds affirm it poſſi ble to make a Flying-Chariot; in which a Man may

ſit

t, and give ſuch a Motion unto it, as ſhall convey im through the Air. And this perhaps might be ıade large enough to carry divers Men at the ſame me, together with Food for their *Viaticum*, and Commodities for Traffick. It is not the bigneſs of ny thing in this kind, that can hinder its Motion, if ıe motive Faculty be anſwerable thereunto. We ſee great Ship ſwims as well as a ſmall Cork, and an agle flies in the Air as well as a little Gnat.

This Engine may be contrived from the ſame Prinıples by which *Archytas* made a Wooden Dove, and *Regiomontanus* a Wooden Eagle.

I conceive it were no difficult Matter (if a Man had eiſure) to ſhew more particularly the Means of Comoſing it.

The perfecting of ſuch an Invention, would be of ıch excellent Uſe, that it were enough, not only to ıake a Man Famous, but the Age alſo wherein he ves. For beſides the ſtrange Diſcoveries that it might ccaſion in this other World, it would be alſo of inonceivable Advantage for Travelling, above any other Conveyance that is now in uſe.

So that notwithſtanding all theſe ſeeming Impoſſiilities, 'tis likely enough, that there may be a Means ıvented of Journying to the Moon ; and how happy ıall they be, that are firſt ſucceſsful in this Attempt ?

——— *Feliceſq; animæ, quas nubila ſupra,*
Et turpes fumos, plenumq; vaporibus orbem,
Inſeruit cælo ſancti ſcintilla Promethei.

Having thus finiſhed this Diſcourſe, I chanced upn a late Fancy to this purpoſe, under the feigned Name of *Domingo Gonſales*, written by a late Reveend and Learned Biſhop : In which (beſides ſundry Particulars wherein this latter Chapter did unwittingy agree with it) there is delivered a very pleaſant and

and well-contrived Fancy concerning a Voyage t this other World.

He ſuppoſeth that there is a natural and uſual Pa ſage for many Creatures betwixt our Earth and th Planet. Thus he ſays, thoſe great Multitudes of Lo cuſts, wherewith divers Countries have been deſtroy ed, do proceed from thence. And if we peruſe th Authors who treat of them, we ſhall find that man times they fly in numberleſs Troops, or Swarms, an for ſundry Days together before they fall, are ſee over thoſe Places in great high Clouds, ſuch as com ing nearer, are of extenſion enough to obſcure th Day, and hinder the Light of the Sun. From whic together with divers other ſuch Relations, he co cludes that 'tis not altogether improbable they ſhou proceed from the Moon. Thus likewiſe he ſuppoſe the Swallows, Cuckoes, Nightingales, with divers ther Fowl, which are with us only half the Year, fly up thither, when they go from us. Among which kind, there is a Wild-Swan in the *Eaſt-Indi* which at certain Seaſons of the Year do conſtant take their Flight thither. Now this Bird being great ſtrength, able to continue for a long Flight, alſo going uſually in Flocks, like our Wild-Geeſe; ſuppoſeth that many of them together, might raught to carry the weight of a Man; eſpecially if Engine were ſo contrived (as he thinks it might) th each of them ſhould bear an equal ſhare in the Bu den. So that by this means 'tis eaſily conceivab how once every Year a Man might finiſh ſuch a Vo age; going along with theſe Birds at the beginni of Winter, and again returning with them at t Spring.

And here, one that had a ſtrong Fancy, were be ter able to ſet forth the great Benefit and Pleaſure be had by ſuch a Journey. And that whether y conſider the ſtrangeneſs of the Perſons, Languag

Ar

Arts, Policy, Religion of thoſe Inhabitants, together with the new Traffick that might be brought thence. In brief, do but conſider the Pleaſure and Profit of thoſe later Diſcoveries in *America*, and we muſt needs conclude this to be inconceivably beyond it.

But ſuch Imaginations as theſe, I ſhall leave to the Fancy of the Reader.

——— ——— *Sic itur ad aſtra.*
Reptet humi quicunq; velit ——— ———

Cœlo reſtat iter, cœlo tentabimus ire.

THE

The SECOND BOOK.

A

DISCOURSE

Concerning A

NEW PLANET.

Tending to prove, *That* ('tis probable) *our Earth is one of the* Planets.

Digna res est Contemplatione, ut sciamus in quo rerum statu scimus: Pigerimam sortiti, an velocissimam sedem: Circa nos Deus omnia, an nos agat. Sen. Nat. Quæst. Lib. 7. Cap. 2.

The Fifth Impression.

By the Right Reverend Father in God, *JOHN WILKINS*, late Lord Bishop of *CHESTER*.

LONDON:

Printed for *John Nicholson* at the *King's-Arms* in *Little Britain*; *Benj. Tooke* at the *Middle Temple Gate* in *Fleetstreet*; *And. Bell* at the *Cross Keys and Bible* in *Cornhill*; and *Ralph Smith* under the *Piazza* of the *Royal-Exchange*. MDCCVII.

To the READER.

NOT to trouble you with an *Invective* againſt thoſe multitudes of Pamphlets which are every day preſs'd into the World; or an *Apology*, why this was publiſh'd amongſt the reſt (the uſual Matter for ſuch kind of Epiſtles:) Let me in brief premoniſh you ſomething concerning the

Chief Scope } of this following Diſcourſe.
And
Manner

1. 'Tis not the *Purpoſe* of it to ſet down an Exact Treatiſe of this kind of *Aſtronomy*, but rather to remove thoſe Common Prejudices which uſually deter Men from taking any Argument, tending this way, into their Conſiderations. For we may obſerve, that in thoſe Points which are cry'd down by the more General Opinion, Men do for the moſt part reſt themſelves in the Superficial Knowledge of Things, as they ſeem at their firſt Appearances, thinking they can ſay enough to any Paradox, againſt which they can urge the moſt Obvious and Eaſy Objections; and therefore ſeldom or never ſearch into the depth of theſe Points, or enter into any Serious Impartial Examination of thoſe Grounds on which they are bottomed. Which as it muſt needs be a great hindrance to the Proficiency of all kind of Learning, ſo more eſpecially is it in this Particular. We might diſcern a greater Comelineſs and Order in this great Fabrick of the World, and more eaſily underſtand the Appearances in *Aſtronomy*, if we could with Indifferency attend to what might be ſaid for that Opinion of *Copernicus*, which is here defended.

2. *For the Manner.* It is not maintained with ſuc Heat and Religion, as if every one that reads it wer preſently bound to yield up his Aſſent: But as it is i other Wars where *Victory* cannot be had, Men muſt b content with Peace: So likewiſe is it in this, an ſhould be in all other Philoſophical Contentions. there be nothing able to convince and ſatisfy the In different Reader, he may ſtill enjoy his own Opin on. All Men have not the ſame way of apprehend ing things; but according to the Variety of the Temper, Cuſtom, and Abilities, their Underſtand ings are ſeverally faſhioned to different Aſſents: Whic had it been but well conſider'd by ſome of our Ho * Adverſaries, they would not have ſhewed more *Vi lence* in oppoſing the *Perſons* againſt whom they writ than *Strength* in confuting the *Cauſe*.

* *Fromond. Al. Roſſ.*

'Tis an Excellent Rule to be obſerved in all Diſpute That Men ſhould give *Soft Words* and *Hard Argument* that they would not ſo much ſtrive to *vex*, as to *con vince* an Enemy. If this were but diligently practiſe in all Caſes, and on all ſides, we might in a good mea ſure be freed from thoſe Vexations in the ſearch o Truth, which the Wiſe *Solomon*, by his own Experi ence did ſo much complain of, *Eccleſiaſtes* 1. 18. *much Wiſdom there is much Grief; and he that increaſeth Knowledge, increaſeth Sorrow.*

To conclude: Though there ſhould be nothing i this Diſcourſe conducible to your Information and Be nefit; yet it may ſerve in the *Peruſal*, as it did in th *Compoſure*, for the Recreation of ſuch Leiſure Hours a may conveniently be ſpared from more weighty Em ploy ments.

Farewell.

TH

THE PROPOSITIONS That are insisted on in this DISCOURSE.

PROP. I.

THAT the seeming Novelty and Singularity of this Opinion can be no sufficient Reason to prove it erroneous.

PROP. II.

That the Places of Scripture which seem to intimate the Diurnal Motion of the Sun or Heavens, are fairly capable of another Interpretation.

PROP. III.

That the Holy Ghost in many Places of Scripture does plainly conform his Expressions to the Error of our Conceits, and does not speak of sundry Things as they are in themselves, but as they appear unto us.

PROP. IV.

That divers Learned Men have fallen into great Absurdities, whilst they have looked for the Grounds of Philosophy from the Words of Scripture.

PROP. V.

That the Words of Scripture in their Proper and St Construction, do not any where affirm the Immobilit the Earth.

PROP. VI.

That there is not any Argument from the Words of S pture, Principles of Nature, or Observations in A nomy, *which can sufficiently evidence the Earth t in the Center of the Universe.*

PROP. VII.

'Tis probable that the Sun is in the Centre of the World.

PROP. VIII.

That there is not any sufficient Reason to prove the E incapable of those Motions which Copernicus *asc unto it.*

PROP. IX.

That it is more probable the Earth does move, than Heavens.

PROP. X.

That this Hypothesis *is exactly agreeable to Com Appearances.*

TH

That the Earth may be a Planet.

PROP. I.

hat the Seeming Novelty and Singularity of this Opinion, can be no Sufficient Reaſon to prove it erroneous.

IN the ſearch of Theological Truths, it is the ſafeſt Method, firſt of all to look unto Divine Authority; becauſe that carries with it as clear an Evidence to our Faith, as any thing elſe can be to ur Reaſon. But on the contrary, in the examination f Philoſophical Points, it were a prepoſterous Courſe o begin at the Teſtimony and Opinion of others, and ien afterwards to deſcend unto the Reaſons that may e drawn from the Nature and Eſſence of the things iemſelves: Becauſe theſe Inartificial Arguments (as ie Logicians call them) do not carry with them any lear and convincing Evidence; and therefore ſhould ome after thoſe that are of more neceſſary depenance, as ſerving rather to confirm, than reſolve the udgment.

But yet, ſo it is, that in thoſe Points which are beides the Common Opinion, Men are carried away at he firſt by the general Cry, and ſeldom or never ome ſo far, as to examine the Reaſons that may be rged for them. And therefore, ſince it is the Purooſe of this Diſcourſe, to remove thoſe Prejudices vhich may hinder our Judgment in the like Caſe, 'tis equiſite that in the firſt place there be ſome ſatisfacti-

on given to thoſe Arguments that may be taken from the Authority of others.

Which Arguments are inſiſted on by our Adverſaries with much Heat and Violence.

What (ſay they) ſhall an upſtart Novelty thruſt out ſuch a Truth as hath paſſed by Succeſſive Tradition through all Ages of the World; and hath been generally entertain'd, not only in the Opinion of the Vulgar, but alſo of the greateſt Philoſophers, and moſt Learned Men? * Shall we think that amongſt the multitude of thoſe who in ſeveral Times have been eminent for New Inventions, and Strange Diſcoveries, there was none able to find out ſuch a Secret as this, beſides ſome Fabulous *Pythagoreans*, and of late *Copernicus*? Is it probable that the World ſhould laſt for above Five Thouſand Years together, and yet the Inhabitants of it be ſo dull and ſtupid, as to be unacquainted with its Motion? Nay, ſhall we think that thoſe Excellent Men whom the Holy Ghoſt made uſe of in the Penning of Scripture, who were extraordinarily inſpired with Supernatural Truths, ſhould notwithſtanding be ſo groſly ignorant of ſo common a Matter as this? Can we believe, if there were any ſuch thing, that *Joſhua*, and *Job*, and *David*, and *Solomon*, *&c.* ſhould know nothing of it? Certainly it muſt needs argue a ſtrong Affectation of Singularity for a Man to take up any groundleſs Fancy againſt ſuch Ancient and General Authority.

* *Alex. Roſſ de Terræ motu, contra Lansb. l.* 1. *ſect.* 1. *cap.* 10.

I anſwer: As we ſhould not be ſo fondly conceited of our ſelves, and the extraordinary Abilities of theſe preſent Ages, as to think every thing that is ancient to be obſolete: Or, as if it muſt needs be with Opinions as it is with Cloaths, where the Neweſt is for the moſt part beſt. So neither ſhould we be ſo ſuperſtitiouſly devoted to Antiquity, as to take up every thing for Canonical, which drops from the Pen of a Father, or was approved by the Conſent of the Ancient

nts. 'Tis an Excellent Saying, * Δεῖ ἐλευθέριον ἔχειν τὴν γνώμην τὸν μέλλοντα φιλοσοφεῖν. It behoves every one in the earch of Truth, always to preserve a Philosophical iberty; not to be so enslav'd to the Opinion of any Man, as to think whatever he says to be infallible. Ve must labour to find out what things are in themelves, by our own Experience, and a thorough Examiation of their Natures, not what another says of hem. And if in such an Impartial Enquiry, we hance to light upon a New Way, and that which is esides the Common Road, this is neither our Fault, or our Unhappiness.

* *Alcinous.*

Not our Fault, because it did not arise from Singuarity or Affectation. Not our Unhappiness, because is rather a Privilege to be the first in finding out such Truths as are not discernible to every Common Eye. f Novelty should always be rejected, neither would Arts have arrived to that Perfection wherein now we njoy them, nor could we ever hope for any future Reformation: Though all Truth be in it self eternal, et in respect of Mens Opinions, there is scarce any o ancient but had a beginning, and was once counted a Novelty; and if for this Reason it had been condemned as an Error, what a general Darkness and Igorance would then have been in the World, in comparison of that Light which now abounds; according o that of the Poet:

* *Quod si tam Antiquis Novitas invisa fuisset,*
Quam nobis, quid nunc esse vetus aut quid haberet,
Quod legeret tereretque viritim publicus usus?

* *Horat. lib. 2. ep. 1.*

If our Forefathers had but hated thus,
All that were new; what had been old to us?
Or, how might any thing confirmed be,
For publick use by its Antiquity?

But for more full ſatisfaction of all thoſe Scruples that may ariſe from the ſeeming Novelty or Singularity of this Opinion, I ſhall propoſe theſe following Conſiderations.

Conſid. 1. Suppoſe it were a Novelty, yet 'tis in Philoſophy and that is made up of nothing elſe; but receives addition from every Day's Experiment. True indeed for Divinity we have an Infallible Rule that doe plainly inform us of all neceſſary Truths; and therefore the Primitive Times are of greater Authority, becauſe they were nearer to thoſe HolyMen who were the Penmen of Scripture. But now for Philoſophy there is no ſuch Reaſon: Whatever the Schoolmen may talk, yet *Ariſtotle*'s Works are not neceſſarily true and he himſelf hath by ſufficient Arguments proved himſelf to be liable unto Error. Now in this Caſe, if we ſhould ſpeak properly, Antiquity does conſiſt in the Old Age of the World, not in the Youth of it. In ſuch Learning as may be increaſed by freſh Experiments and new Diſcoveries; 'tis we are the Fathers and of more Authority than former Ages; becauſe we have the advantage of more Time than they had and Truth (we ſay) is the Daughter of Time. However, there is nothing in this Opinion ſo magiſterially propoſed, but the Reader may uſe his own liberty; and if all the Reaſons conſidered together do not ſeem convincing unto him, he may freely reject it.

In thoſe Natural Points which carry with them any Doubt or Obſcurity, it is the ſafeſt way to ſuſpend our Aſſents; and though we may diſpute *pro* or *con*, yet not to ſettle our Opinion on either Side.

Conſid. 2. In weighing the Authority of others, 'tis not their Multitude that ſhould prevail, or their Skill in ſome things that ſhould make them of credit in every thing; but we ſhould examine what particular inſight and experience they had in thoſe Things for which they are cited. Now 'tis plain, that Common People judge by

y their Senſes, and therefore their Voices are altoether unfit to decide any Philoſophical Doubt, which annot well be examined or explained without Diſourſe and Reaſon. And as for the Ancient Fathers, hough they were Men very eminent for their Holy ives, and extraordinary Skill in Divinity, yet they ere moſt of them very ignorant in that part of Learnng which concerns this Opinion; as appears by may of their groſs Miſtakes in this kind; as that conerning the *Antipodes*, *&c.* And therefore it is not their Opinion neither, in this Buſineſs, that to an indiffeent Seeker of Truth will be of any ſtrong Authoity.

But againſt this it is * objected, That the Inſtance f the *Antipodes* does not argue any ſpecial Ignorance n theſe Learned Men; or that they had leſs skill in uch Human Arts than others; ſince *Ariſtotle* himſelf, nd *Pliny*, did deny this as well as they.

* *Alex. Roſſ. l.* 1. *ſect. c.* 8.

I anſwer:

1. If they did, yet this does make more to the preent purpoſe: For if ſuch great Scholars, who were ſo minent for their Knowledge in Natural Things, night yet notwithſtanding be groſly miſtaken in ſuch Matters as are now evident and certain, why then we ave no Reaſon to depend upon their Aſſertions or Authorities, as if they were infallible.

2. Though theſe great Naturaliſts, for want of ſome Experience, were miſtaken in that Opinion, whilſt hey thought no Place was habitable but the Tempeate *Zones*: Yet it cannot be from hence inferr'd that hey denied the poſſibility of *Antipodes*; ſince theſe are uch Inhabitants as live oppoſite unto us in the other Temperate *Zone*: And 'twere an abſurd thing to imagine that thoſe who liv'd in different *Zones*, can be *Antipodes* to one another; and argues that a Man did not underſtand, or elſe had forgotten that Common Diſtinction in *Geography*, wherein the Relation of the World's Inhabitants unto one another are reckoned

up

up under these three Heads; *Antaci*, *Periæci*, and *Antipodes*. But to let this pass: 'Tis certain, that some of the Fathers did deny the Being of any such, upon other more absurd Grounds. Now if such as *Chrysostom*, *Lactantius*, &c. who were noted for great Scholars and such too as flourished in these later times, when all human Learning was more generally profess'd, should notwithstanding be so much mistaken in so obvious a Matter: Why then may we not think that those Primitive Saints, who were the Penmen of Scripture and eminent above others in their Time for Holiness and Knowledge; might yet be utterly ignorant of many Philosophical Truths, which are commonly known in these Days? 'Tis probable, that the Holy Ghost did inform them only with the Knowledge of those things whereof they were to be the Penmen, and that they were not better skilled in Points of Philosophy than others. There were indeed some of them who were supernaturally endowed with human Learning; yet this was because they might thereby be fitted for some particular Ends, which all the rest were not appointed unto. Thus *Solomon* was strangely gifted with all kind of Knowledge, in a great measure; because he was to
Eccl. 1.18. teach us by his own Experience the extream Vanity of it, that we might not so settle our Desires upon it, as if it were able to yield us Contentment. So too the Apostles were extraordinarily inspired with the Knowledge of Languages, because they were to Preach unto all Nations. But it will not hence follow, that therefore the other Holy Penmen were greater Scholars than others. 'Tis likely that *Job* had as much human Learning as most of them, because his Book is more especially remarkable for lofty Expressions, and Discourses of Nature; and yet 'tis not likely that he was acquainted with all those Mysteries which later Ages have discovered; because when God would convince him of his own Folly and Ignorance, he proposes to him such Questions, as being altogether unanswerable;

werable; which notwithſtanding, any ordinary Phiſopher in theſe Days might have reſolved. As you nay ſee at large in the thirty eighth Chapter of that Book.

The Occaſion was this: *Job* having * before deſired hat he might diſpute with the Almighty concerning he Uprightneſs of his own Ways, and the Unreaſonableneſs of thoſe Afflictions which he underwent, does t length obtain his Deſire in this kind; and God ouchſafes in this thirty eighth Chapter, to argue the Caſe with him. Where he does ſhew *Job* how unfit e was to judge of the Ways of Providence, in diſpoſing f Bleſſings and Afflictions; when as he was ſo ignoant in ordinary Matters, being not able to diſcern the Reaſon of natural and common Events. As * why he Sea ſhould be ſo bounded from overflowing the Land? What is the † Breadth of the Earth? What is he * Reaſon of the Snow or Hail? What was the † Cauſe of the Rain or Dew, of Ice and Froſt, and the ike. By which Queſtions, it ſeems, *Job* was ſo utterly puzzled, that he is fain afterwards to humble himſelf in his Acknowledgment: * *I have utterred that I underſtood not, things too wonderful for me, which I knew not. Wherefore I abhor my ſelf, and repent in duſt and aſhes.*

*Cap. 13. 3.

* *V.* 8, 10, 11.

† *Ver.* 18.
* *Ver.* 22.
† *Ver.* 28, 29.

* *Cap.* 42. *ver.* 3, 6.

So that 'tis likely theſe holy Men had not theſe human Arts by any ſpecial Inſpiration, but by Inſtruction and Study, and other ordinary Means; and therefore *Moſes* his Skill in this kind is called the Learning of the *Egyptians*. Now, becauſe in thoſe times all Sciences were taught only in a rude and imperfect Manner; therefore 'tis likely that they alſo had but a dark and confuſed Apprehenſion of Things, and were liable to the common Errors. And for this Reaſon is it, why * *Toſtatus* (ſpeaking of *Joſhua*'s bidding the Moon ſtand ſtill as well as the Sun) ſays, *Quod forte erat imperitus circa Aſtrorum doctrinam, ſentiens ut vulgares ſentiunt*: That perhaps he was unſkilful in Aſtronomy, having the ſame groſs Conceit of the Heavens, as the Vul-

Acts 7. 22.

* *Joſh. c.* 10. *Quæſt.* 19.

Vulgar had. From all which it may be inferred, that the Ignorance of ſuch good Men and great Scholars concerning theſe Philoſophical Points, can be no ſufficient Reaſon, why after Examination we ſhould deny them, or doubt of their Truth.

Conſid. 3. 'Tis conſiderable, that in the Rudiments and firſt Beginnings of Aſtronomy, and ſo in ſeveral Ages after, this Opinion hath found many Patrons, and thoſe too Men of eminent Note and Learning. Such was more eſpecially *Pythagoras*, who was generally and highly eſteemed for his Divine Wit, and rare Inventions; under whoſe myſterious Sayings, there be many excellent Truths to be diſcovered.

* *Alex. Roſ. l.* 2. *Sect.* 2. *c.* 10. But againſt his Teſtimony, it is again* objected; If *Pythagoras* were of this Opinion, yet his Authority ſhould not be of any Credit, becauſe he was the Author of many other monſtrous Abſurdities.

To this I anſwer; If a Man's Error in ſome particulars ſhould take away his Credit for every thing elſe, this would aboliſh the Force of all human Authority; for *humanum eſt errare*. Secondly, 'tis probable that many of *Pythagoras*'s Sayings which ſeem ſo abſurd, are not to be underſtood according to their Letter, but in a myſtical Senſe.

2. But he objects again, That *Pythagoras* was not of this Opinion; and that for two Reaſons; Firſt, becauſe no ancient Author that he had read aſcribes it unto him. Secondly, it is contradictory to his other Opinions, concerning the Harmony that was made by the Motion of the Heavens; which could not conſiſt with this other of the Earth's Motion.

To the firſt I anſwer; The Objector could not chuſe but know that this Aſſertion is by many ancient Authors aſcribed to that Sect whereof *Pythagoras* was the Chief. He might have ſeen it expreſly in * *Ariſtotle* himſelf. * *De Cælo. l.* 2. *c.* 13. Οἱ δὲ Πυθαγόρειοι λέγουσιν ὅτι μὲν τὸ μέσον πῦρ ἔδ, τὴν τε γῆν ἓν τῶν ἄστρων ὅταν κύκλῳ φερομένην περὶ μέσον, νύκτα τε καὶ ἡμέραν ποιεῖν.

In

In which the Philoſopher does compendiouſly reckon up the three chief Particulars implyed in the Opinion of the *Pythagoreans.* Firſt, the Sun's being in the Centre of the World. Secondly, the Earth's Annual Motion about it, as being one of the Planets. Thirdly, its diurnal Revolution, whereby it cauſed Day and Night.

To his Second Reaſon I anſwer; Firſt, that *Pythagoras* thought the Earth to be one of the Planets (as appears by *Ariſtotle*'s Teſtimony concerning him;) and to move amongſt the reſt. So that his Opinion concerning the Motion of the Heavens, is not inconſiſtent with that of the Earth. Secondly, but as for the Celeſtial Harmony, he might perhaps under this Myſtical Expreſſion, according to his uſual Cuſtom, ſhadow forth unto us that mutual Proportion and Harmonical Conſent, which he did conceive in the ſeveral Bigneſs, Diſtance, Motions of the Orbs. So that notwithſtanding theſe Objections, it is evident that *Pythagoras* was of this Opinion, and that his Authority may add ſomewhat for the Confirmation of it. Unto him aſſented * *Ariſtarchus Samius*, who flouriſhed about 280 Years before the Birth of our Saviour; and was by reaſon of this Opinion, arraigned for Prophaneneſs and Sacrilege by the *Areopagites*; becauſe he had blaſphemed the Deity of *Veſta*, affirming the Earth to move. To them agreed *Philolaus*, *Heraclides*, *Pontius*, *Nicetas*, *Syracuſanus*, *Ecphantus*, *Lucippus*, and *Plato* himſelf (as ſome think.) So likewiſe *Numa Pompilius*, as *Plutarch* relates it in his Life; who in reference to this Opinion, built the Temple of *Veſta* round, like the Univerſe; in the middle of it was placed the perpetual Veſtal Fire; by which he did repreſent the Sun in the Centre of the World. All theſe Men were in their ſeveral Times of ſpecial Note, as well for their extraordinary Learning, as for this Opinion.

* *Archimedes de arænæ numero.*

'Tis

4. Conſid. 'Tis conſiderable, that ſince this Science of Aſtronomy hath been raiſed to any Perfection, there have been many of the beſt Skill in it, that have aſſented unto that Aſſertion which is here defended. Amongſt whom was the Cardinal *Cuſanus*, but more eſpecially *Copernicus*, who was a Man very exact and diligent in theſe Studies for above Thirty Years together, from the Year 1500 to 1530, and upwards; and ſince him, moſt of the beſt Aſtronomers have been of this ſide. So that now there is ſcarce any of Note and Skill, who are not *Copernicus* his Followers; and if we ſhould go to moſt Voices, this Opinion would carry it from any other. It would be too tedious to reckon up the Names of thoſe that may be cited for it; I will only mention ſome of the chief: Such were *Joachinus Rheticus*, an elegant Writer; *Chriſtopherus Rothman*; *Meſtlin*, a Man very eminent for his ſingular Skill in this Science; who though at the firſt he were a Follower of *Ptolemy*, yet upon his ſecond and more exact Thoughts, he concluded *Copernicus* to be in the right; and that the uſual *Hypotheſis*, * *præſcriptione potius quam ratione valet*, does prevail more by Preſcription than Reaſon. So likewiſe *Eraſmus Reinoldus*, who was the Man that calculated the Prutenical Tables from *Copernicus* his Obſervations, and did intend to write a Commentary upon his other Works, but that he was taken our of this Life before he could finiſh thoſe Reſolutions. Unto theſe alſo I might add the Names of *Gilbert*, *Keplar*, *Galilæus*, with ſundry others, who have much beautified and confirmed this *Hypotheſis*, with their new Inventions. Nay I may ſafely affirm, that amongſt the Variety of thoſe Opinions that are in Aſtronomy, there are more (of thoſe which have skill in it) that are of this Opinion, not only than any other ſide, but than all the reſt put together. So that now it is a greater Argument of Singularity to oppoſe it.

De doct. ignor. l. 2. cap. 12.

* Præf. ad Narrat. Rhetici.

Ibid.

'Tis

'Tis probable, that many other of the Ancients would have aſſented unto this Opinion, if they had been acquainted with thoſe Experiments which later Times have found out for the Confirmation of it: And therefore * *Rheticus* and † *Keplar* do ſo often wiſh that *Ariſtotle* were now alive again. Queſtionleſs, he was ſo rational and ingenious a Man, (not half ſo obſtinate as many of his Followers) that upon ſuch Probabilities as theſe, he would quickly have renounced his own Principles, and have come over to this ſide: Or in one place, having propoſed ſome Queſtions about the Heavens, which were not eaſie to be reſolved, he ſets down this Rule; That in Difficulties, a Man may take a liberty to ſpeak that which ſeems moſt likely to him; and in ſuch Caſes, an aptneſs to gueſs at ſome Reſolution, for the ſatisfying of our Philoſophical Thirſt, does deſerve rather to be ſtiled by the Name of Modeſty, than Boldneſs. And in another place, he refers the Reader to the different Opinions of Aſtronomers, adviſing him to examine their ſeveral Tenents, as well *Eudoxus* as *Calippus*; and to entertain that (not which is moſt ancient, but) which is moſt exact and agreeable to Reaſon. And as for *Ptolomy*, 'tis his Counſel, that we ſhould endeavour to frame ſuch Suppoſitions of the Heavens, as might be more ſimple, being void of all Superfluities: And he confeſſes, that his *Hypotheſis* had many Implications in it, together with ſundry intricate and unlikely Turnings; and therefore in the ſame place, he ſeems to admoniſh us, that we ſhould not be too confident the Heavens were really in the ſame Form wherein Aſtronomers did ſuppoſe them. So that 'tis likely, was his chief intent to propoſe unto us ſuch a Frame of the Celeſtial Bodies, from which we might, in ſome meaſure, conceive of their different Appearances; and according to which, we might be able to calculate their Motions. But now 'tis *Copernicus* his endeavour, to propound unto us the true natural Cauſes

5 *Conſid.*

* *In Narratione.*
† *Myſt. Coſmogr. c.* 1. *Item præf. ad* 4. *l. Aſtr. Copern.*

De Cœl. l. 2. *c.* 12.

Met. lib. 12. *cap.* 8.

Alm. l. 13. *cap.* 2.

ſes of theſe ſeveral Motions and Appearances: It wa the intent of the one, to ſettle the Imagination; an of the other, to ſatisfie the Judgment. So that w have no reaſon to doubt of his Aſſent unto this Op nion, if he had but clearly underſtood all the Groun of it.

'Tis reported of *Clavius*, that when lying upon h Death-Bed, he heard the firſt News of thoſe Diſco veries which were made by *Galilæus*'s Glaſs, he brak forth into theſe Words: *Videre Aſtronomos, quo pac conſtituendi ſunt orbes Cœleſtes, ut hæc Phænomena ſalva poſſint*; That it did behove Aſtronomers to conſider ſome other *Hypotheſis*, beſide that of *Ptolomy*, whereb they might ſolve all thoſe new Appearances. Intim ting that this old one, which formerly he had defen ed, would not now ſerve the turn.: And doubtleſ if he had been informed how congruous all theſe migh have been unto the Opinion of *Copernicus*, he wou quickly have turned on that ſide. 'Tis conſiderabl that amongſt the Followers of *Copernicus*, there a ſcarce any who were not formerly againſt him; an ſuch, as at firſt had been throughly ſeaſoned with th Principles of *Ariſtotle*; in which, for the moſt par they have no leſs skill than thoſe who are ſo violent i the defence of them. Whereas on the contrary, the are very few to be found amongſt the Followers *Ariſtotle* and *Ptolomy*, that have read any thing in C pernicus, or do fully underſtand the Grounds of his O pinion; and I think, not any, who having been on ſettled with any ſtrong Aſſent on this ſide, that ha afterwards revolted from it. Now if we do but ſer ouſly weigh with our ſelves, that ſo many ingeniou conſidering Men, ſhould reject that Opinion whic they were nurſed up in, and which is generally a proved as the Truth; and that for the embracing ſuch a *Paradox* as is condemned in Schools, and com monly cryed down, as being abſurd and ridiculous I ſay, if a Man do but well conſider all this, he mu

nec

eeds conclude, that there is ſome ſtrong Evidence or it to be found out by Examination; and that in ll probability, this is the righter ſide.

'Tis probable, that moſt of thoſe Authors who have ppoſed this Opinion, ſince it hath been confirmed by ew Diſcoveries, were ſtirred up thereunto by ſome f theſe Three inſufficient Grounds. 7 *Conſid.*

1. An over-fond and partial Conceit of their pro- er Inventions. Every Man is naturally more affect- d to his own Brood, than to that of which another the Author; though perhaps it may be more agreea- le to Reaſon. 'Tis very difficult for any one, in the earch of Truth, to find in himſelf ſuch an Indifferen- y, as that his Judgment is not at all ſwayed by an ver-weaning Affection unto that which is proper un- o himſelf. And this perhaps might be the firſt Reaſon hat moved the noble *Tycho* with ſo much heat to op- oſe *Copernicus*, that ſo he might the better make way or the ſpreading of that *Hypotheſis* which was of his wn Invention. To this I might likewiſe refer that pinion of *Origanus* and Mr. *Carpenter*, who attribute o the Earth only a Diurnal Revolution. It does more ſpecially concern thoſe Men that are *Leaders* of ſeveral ides, to beat down any that ſhould oppoſe them.

2. A ſervile and ſuperſtitious fear of Derogating om the Authority of the Ancients, or oppoſing that leaning of Scripture-Phraſes, wherein the ſuppoſed nfallible Church hath for a long time underſtood hem. 'Tis made part of the new Creed, ſet forth by *ius* the Fourth, 1564. That no Man ſhould aſſent un- o any Interpretation of Scripture, which is not appro- ed of by the Authority of the Fathers. And this is he reaſon why the Jeſuits, who are otherwiſe the reateſt Affectors of thoſe Opinions which ſeem to e new and ſubtil, do yet forbear to ſay any thing in efence of this; but rather take all Occaſions to in- eigh againſt it. * One of them does expreſly con- emn it for a Hereſie. And ſince him, it hath been called

* *Serrarius Commen. in Joſ. cap.* 10. *Quæſt.* 14. So *Lipſius Phyſiol. l.* 2.

* *Ann. Dom.* 1616. *item* 1633.

called in by * two Seſſions of the Cardinals, as being an Opinion both abſurd and dangerous. And therefore likewiſe do they puniſh it, by caſting the Defenders of it into the Pope's trueſt Purgatory, the Inquiſition: But yet neither theſe Councils, nor any (that I know of) ſince them, have proceeded to ſuch a peremptory Cenſure of it, as to conclude it a Hereſie; fearing perhaps, leſt a more exact Examination, and the Diſcovery of future Times, finding it to be an undeniable Truth, it might redound to the prejudice of their Church, and its Infallibility. And therefore he that is moſt bitter againſt it, in the heat and violence of Oppoſition, will not call it a Hereſie: The worſt that he dares ſay of it, is, That it is *opinio temeraria quæ altero ſaltem pede intravit hæreſios limen*: A raſh Opinion, and bordering upon Hereſie. Though unto this likewiſe he was incited by the eagerneſs of Diſputation, and a deſire of Victory; for it ſeems many eminent Men of that Church before him, were a great deal more mild and moderate in their Cenſures of it.

Fromondus Antariſt. cap. 6.

Paul the Third was not ſo much offended at *Copernicus*, when he Dedicated his Work unto him.

The Cardinal of *Cuſa* does expreſly maintain this Opinion.

Schonbergius, the Cardinal of *Capua*, did with much Importunity and great Approbation, beg of *Copernicus* the Commentaries that he writ in this kind: And it ſeems the Fathers of the Council of *Trent*, were no ſuch confident Defenders of *Ptolomy*'s *Hypotheſis* againſt *Copernicus*, as many now are. For, ſpeaking of thoſe intricate Subtilties which the Fancies of Men had framed to maintain the Practice of the Church, they compared them to Aſtronomers, who, ſay they, do feign *Excentricks* and *Epicicles*, and ſuch Engines of Orbs, to ſave the *Phænomena*; though they know there are no ſuch things. But now, becauſe this Opinion of *Copernicus* in later Times hath been ſo ſtrictly forbidden and puniſhed, it will concern thoſe of that

Religion

Religion, to take heed of meddling in the defence of it, but rather to ſubmit the liberty of their Reaſon into the Command of their Superiors, and (which is very abſurd) even in Natural Queſtions, not to aſſent unto any thing but what Authority ſhall allow of.

3. A judging of things by Senſe rather than by Diſcourſe and Reaſon: A tying of the Meaning of Scripture to the Letter of it, and from thence concluding Philoſophical Points, together with an ignorance of all thoſe Grounds and Probabilities in *Aſtronomy*, upon which this Opinion is bottomed. And this, in all likelihood, is the Reaſon why ſome Men, who in other things perhaps are able Scholars, do write ſo vehemently againſt it; and why the Common People in general do cry it down, as being abſurd and ridiculous. Under this Head I might refer the Oppoſition of Mr. *Fuller*, *Al. Roſſ. &c.*

But now, no Prejudice that may ariſe from the bare Authority of ſuch Enemies as theſe, will be liable to sway the Judgment of an indifferent conſidering Man; and I doubt not but that he who will throughly weigh with himſelf theſe Particulars that are here propounded, may find ſome ſatisfaction for theſe Arguments, which are taken from the ſeeming Novelty and Singularity of this Opinion.

PROP. II.

That there is not any Place in Scriptures, from which (being rightly underſtood) we may infer the Diurnal Motion of the Sun or Heavens.

IT were happy for us, if we could exempt Scriptur from Philoſophical Controverſies: If we could b content to let it be perfect for that end unto which i was intended, for a Rule of our Faith and Obedience and not ſtretch it alſo to be a Judge of ſuch Natura Truths as are to be found out by our own Induſtr and Experience. Though the Holy Ghoſt could eaſi ly have given us a full Reſolution of all ſuch Particu lars; *yet he hath left this Travel to the Sons of Men to b exerciſed therewith: Mundum reliquit diſputationibus homi num*: That being buſied for the moſt part in an In quiſition after the Creatures, we might find the le leiſure to wait upon our Luſts, or ſerve our more ſin ful Inclinations.

Eccleſ. 3. 10, 11.

But however, becauſe our Adverſaries generally d ſo much inſult in thoſe Arguments that may be draw from hence; and more eſpecially, becauſe *Pineda* dot for this Reaſon with ſo many bitter and empty Re proaches, revile our Learned Countryman, Dr. *Gilber* in that renewing of this Opinion, he omitted an An ſwer to the Scripture Expreſſions: Therefore 'tis re quiſite, that in the proſecution of this Diſcourſe, w ſhould lay down ſuch ſatisfaction as may clear a Doubts that may be taken thence: Eſpecially ſince th Prejudice that may ariſe from the miſapprehenſion o thoſe Scripture Phraſes, may much diſable the Reade from looking on any other Argument with an equa and indifferent Mind.

Comment. in Eccleſ. c. 1. *v.* 4.

The Places that ſeem to oppoſe this, are of two nds. Firſt, Such as imply a Motion in the Heavens : r, Secondly, ſuch as ſeem to expreſs a Reſt and Im- obility in the Earth.

Thoſe of the firſt kind ſeem to bear in them the eareſt Evidence, and therefore are more inſiſted on our Adverſaries. They may be referred unto theſe hree Heads.

1. All thoſe Scriptures where there is any men- on made of the riſing or ſetting of the Sun or ars.

2. That Story in *Joſhua*, where the Sun ſtanding ll is reckoned for a Miracle.

3. That other Wonder in the Days of *Hezekiah*, hen the Sun went back Ten Degrees in the Dial *Ahaz*. All which Places do ſeem to con- ude, That the Diurnal Motion is cauſed by the eavens.

To this I anſwer in general;

That the Holy Ghoſt in theſe Scripture Expreſſions, pleaſed to accommodate himſelf unto the Conceit the Vulgar, and the uſual Opinion : Whereas, in the more proper Phraſe it had been ſaid, That e Earth did riſe and ſet ; or, that the Earth ſtood ll, *&c.* the People who had been unacquainted with at Secret in Philoſophy, would not have underſtood e Meaning of it ; and therefore it was conveni- nt that they ſhould be ſpoken unto in their own anguage.

Ay, but you will reply, It ſhould ſeem more likely, there had been any ſuch thing, that the Holy Ghoſt ould uſe the trueſt Expreſſions : For then he would the ſame time have informed them of the Thing, nd reformed them in an Error : Since his Authority one had been ſufficient to have rectified the Mi- ake.

I Anſwer:

1. Though it were, yet 'tis beſide the chief Scope of thoſe Places, to inſtruct us in any Philoſophical Points, as hath been proved in the former Book; eſpecially when theſe Things are neither neceſſary in themſelves, nor do neceſſarily induce to a more full underſtanding of that which is the main buſineſs of thoſe Scriptures. But now the People might better conceive the Meaning of the Holy Ghoſt, when he does conform himſelf unto their Capacities and Opinions, than when he talks exactly of Things in ſuch a proper Phraſe as is beyond their reach: And therefore 'tis ſaid in *Iſaiah, I am the Lord which teacheth thee* utilia, *profitable Things*: Where the Gloſs has it, *non ſubtilia*, no ſuch Curioſities of Nature as are not eaſily apprehended.

2. 'Tis not only beſides that which is the chief purpoſe of thoſe Places, but it might happen alſo to be ſomewhat oppoſite unto it. For Men being naturally unapt to believe any thing that ſeems contrary to their Senſes, might upon this begin to queſtion the Authority of that Book which affirmed it, or at leaſt to retch Scripture ſome wrong way, to force it to ſome other Senſe, which might be more agreeable to their own Falſe Imagination. † *Tertullian* tells us of ſome Hereticks, who when they were plainly confuted out of any Scripture, would preſently accuſe thoſe Texts or Books to be fallible, and of no Authority; and rather yield Scripture to be erroneous, than forgo thoſe Tenets for which they thought there was ſo good Reaſon. So likewiſe might it have been in theſe Points which ſeem to bear in them ſo much Contradiction to the Senſes and Common Opinion: And therefore 'tis Excellent Advice ſet down by St. † *Auſtin. Quod nihil credere de re obſcurâ temere debemus, ne forte quod poſtea veritas patefecerit, quamvis libris ſanctis ſive teſtamenti veteris, ſive novi, nullo modo eſſe poſſit adverſum, tamen propter amorem noſtri erroris oderimus*

† *Præſcript. c. 17.*

† *In Geneſ. ad lit. l. 2. in fine.*

Tha

That we ſhould not haſtily ſettle our Opinions concerning any obſcure Matter, leſt afterwards, the Truth being diſcover'd, (which however it may ſeem, cannot be repugnant to any thing in Scripture) we ſhould hate that, out of love to the Error that we have before entertained. A little reading may inform us how thoſe Texts have been abuſed to ſtrange and unmeant Allegories, which have mentioned any natural Truth in ſuch a manner as was not agreeable to Mens Conceits. And beſides, if the Holy Ghoſt had propounded unto us any Secrets in Philoſophy, we ſhould have been apt to be ſo buſied about them, as to neglect other Matters of greater importance. And therefore St. *Auſtin* propoſing the Queſtion, What ſhould be the Reaſon, why the Scripture does not clearly ſet down any thing concerning the Nature, Figure, Magnitude and Motion of the Heavenly Orbs; he anſwers it thus: The Holy Ghoſt being to deliver more neceſſary Truths, would not inſert theſe, leſt Men according to the Pravity of their Diſpoſitions, ſhould neglect the more weighty Matters, and beſtow their Thoughts about the ſpeculative natural Points, which were leſs needful. So that it might ſeem more convenient that the Scripture ſhould not meddle with the revealing of theſe unlikely Secrets, eſpecially when it is to deliver unto us many other Myſteries of greater neceſſity, which ſeem to be directly oppoſite to our Senſe and Reaſon. And therefore, I ſay, the Holy Ghoſt might purpoſely omit the treating of theſe Philoſophical Secrets, till Time and future Diſcovery might with leiſure ſettle them in the Opinion of others: As he is pleaſed in other Things of a higher kind, to apply himſelf unto the Infirmity of our Apprehenſions, by being repreſented, as if he were a Human Nature, with the Parts and Paſſions of a Man. So in theſe Things likewiſe, that he might deſcend to our Capacities, does he vouchſafe to conform his Expreſſions unto the Error and Miſtake of our Judgments.

Ibid. cap. 9.

But before we come to a further Illuſtration, let us a little examine thoſe particular Scriptures which are commonly urged to prove the Motion of the Sun or Heavens. Theſe (as was ſaid) might be diſtributed under theſe Three Heads.

* *Pſal.* 19. 5, 6. 1. Thoſe Places which mention the riſing or ſetting of the Sun; as that in the * *Pſalm, The Sun like a Bridegroom cometh out of his Chamber, and rejoiceth as a Giant to run his Race: His going forth is from the end of Heaven and his circuit unto the end of it, and there is nothing hid from the heat thereof.* And that in *Eccleſiaſtes, The Sun* *Eccleſ.* 1. 5. *ariſeth, and the Sun goeth down,* &c.

In which Scriptures we may obſerve divers Phraſes that are evidently ſpoken in reference to the appearance of Things, and the Falſe Opinion of the Vulgar. And therefore 'tis not altogether unlikely, That this, which they ſeem to affirm concerning the Motion of the Heavens, ſhould alſo be underſtood in the ſame Senſe.

The Sun like a Bridegroom cometh out of his Chamber Alluding perhaps unto the Conceit of Ignorant People: As if it took reſt all the while it was abſent from us, and came out of its Chamber when it aroſe.

And rejoiceth as a Giant to run his Race; becauſe in the Morning it appears bigger than at other Times; and therefore in reference to this Appearance, may then be compared unto a *Giant*.

His going forth is from the end of Heaven, and his Circuit unto the ends of it. Alluding again unto the Opinion of the Vulgar: Who not apprehending the Roundneſs of the Heavens, do conceive it to have two Ends, one where the Sun riſeth, the other where it ſetteth.

And there is nothing hid from the Heat thereof; ſpeaking ſtill in reference to the common Miſtake, as if the Sun were actually hot in it ſelf; and as if the Heat of the Weather were not generated by reflection, but

ut did immediately proceed from the Body of the un.

So likewiſe, for that in *Eccleſiaſtes*, where 'tis ſaid, *he Sun riſeth, and the Sun goeth down*, &c. which hraſes being properly underſtood, do import that he ſometimes in a higher place than at others: Where-s, in a Circumference, there is no Place higher or ower, each part being at the ſame diſtance from the entre, which is the Bottom. But now underſtand he Phraſe in reference to the Sun's appearance, and hen we grant that he does ſeem ſometimes to riſe, nd ſometimes to go down, becauſe in reference to he *Horizon*, (which Common People apprehend to be he Bottom, and in the utmoſt Bounds of it to join vith the Heavens,) the Sun does appear in the Morn-ng to riſe up from it, and in the Evening to go down nto it. Now, I ſay, becauſe the Holy Ghoſt, in the nanner of theſe Expreſſions, does ſo plainly allude nto Vulgar Errors, and the Falſe Appearance of hings; therefore 'tis not without probabillity, that e ſhould be interpreted in the ſame Senſe, when e ſeems to imply a Motion in the Sun or Hea-ens.

2. The Second Place was that Relation in *Joſhua*; vhere 'tis mention'd as a Miracle, That the Sun did tand ſtill. And *Joſhua* ſaid, *Sun ſtand thou ſtill upon Gibeon, and thou Moon in the Valley of Ajalon. So the un ſtood ſtill in the midſt of Heaven, and haſted not to go own about a whole Day. And there was no Day like that, efore it, or after it.* In which Place likewiſe there are ivers Phraſes wherein the Holy Ghoſt does not expreſs hings according to their true Nature, and as they re in themſelves; but according to their Appear-nces, and as they are conceived in Common Opi-ion. As,

1. When he ſays, *Sun ſtand thou ſtill upon Gibeon*, or ver *Gibeon*. Now the whole Earth being ſo little in omparison to the Body of the Sun, and but as a Point, in

Joſ. 10. 12. 14. *Galilæus* maintains the Literal Senſe of this Place, towards the end of that Treatiſe, which he calls, *Nov. Antiq. pat. doctrina.*

in reſpect of that Orb wherein the Sun is ſuppoſed t move; and *Gibeon* being, as it were, but a Point o this Globe of Earth; therefore the Words cannot b underſtood properly, but according to appearance 'Tis probable that *Joſhua* was then at *Azecha*, a littl Eaſt from *Gibeon*, and the Sun being ſomewhat beyon the Meridian, did ſeem unto him as he was in tha Place, to be over againſt *Gibeon*; and in reference t this Appearance, and Vulgar Conceit, does he com mand it to ſtand ſtill upon that Place.

Toſtat. in locum, Quæſt. 16, 17. *Arius Montanus in locum.*

2. And ſo ſecondly for that other Expreſſion; *An thou Moon in the Valley of Ajalon.* This Planet was no a little Eaſt from the Sun, it being about three or fou Days old (as † Commentators gueſs.) *Ajalon* wa three Miles from *Gibeon* Eaſtward, and *Joſhua* com manded the Moon to ſtand ſtill there; becauſe unt him it did then ſeem to be over-againſt that Valley whereas, 'tis certain, if he had been there himſelf, i would ſtill have ſeemed to be as much diſtant fro him. Juſt as men commonly ſpeak in ſhewing anothe the Stars: We point to a Star over ſuch a Chimney or ſuch a Tree, becauſe to us it appears ſo; wherea the Star in it ſelf is not ſenſibly more over them, tha it is over us. So that in this Phraſe likewiſe the Ho ly Ghoſt doth conform himſelf unto the appearance o things, and our groſſer Conceit.

† *Toſtat. ib. Quæſt.* 18. *Serrarius in Joſh.* 10. *Quæſ.* 21. 22.

3. *And the Sun ſtood ſtill in the midſt of Heaven.* Now to ſpeak properly, and as the Thing is in it ſelf, Hea ven has no midſt but the Centre; and therefore thi alſo muſt be intepreted in reference to the Opinion o the Vulgar; and by the midſt of Heaven, we are to un derſtand ſuch a Place as was not very near to either o the Ends, the Eaſt or Weſt.

4. *And there was no Day like that, before it, or afte it*: Which Words are not to be underſtood abſolute ly, for there are always longer Days under the Poles but in reſpect to the Opinion of the Vulgar; that is, there was never any Day ſo long which theſe ignoran People knew of.

3. A

3. As for this laſt Place concerning the Sun's re-
urning Ten Degrees in the Dial of *Abaz*: I think it 2King.20.
ay probably be affirmed, That it is to be underſtood 11.
nly concerning the Shadow: Which though it do ne- Iſa. 38. 8.
eſſarily happen in all Horizontal Dials, for any Lati-
ude betwixt the Tropicks: And ſo conſequently in
ll declining Dials, the Elevation of whoſe Pole is leſs
an the Sun's greateſt Declination; as *Clavius de Ho-*
l. cap. 21. obſerves: Yet the Circumſtances of this
elation in Scripture, make the Event to differ from
hat other which is common and natural: Which a-
ainſt its Nature did ſeem to go backwards, when as
he Sun it ſelf was not in the leaſt manner altered from
s uſual Courſe. Of this Opinion were *Abarbinel, A-*
ius Montanus, Burgenſis, Vatablas Sanctius, &c.

The Reaſons for it may be theſe;

1. The Miracle is propoſed only concerning the
hadow; *Wilt thou that the Shadow ſhall aſcend or return*
y Ten Degrees: There being not in the Offer of this
Vonder, any the leaſt mention made concerning the
un's going backwards.

2. 'Tis likely we ſhould have had ſome Intimation
oncerning the extraordinary Length of the Day, as it
s in that of *Joſhua*; but in this Relation, the chief
Matter that the Story takes notice of, is the Alteration
of the Shadow.

3. Had it been by the ſuppoſed return of the Sun's
Body, this had been a greater Miracle than thoſe which
were performed upon more ſolemn Occaſions; it had
been more wonderful than its ſeeming Reſt in *Joſhua*'s
Time; than the ſupernatural Eclipſe at our Saviour's
Death, when the Moon was in the Full. And then
it is not likely, that the Holy Ghoſt in relating of this
Miracle, ſhould chiefly inſiſt in expreſſing how the
Shadow returned, and that only in the Dial of *A-*
baz.

4. This Sign did not appear in the Sun it ſelf; be-
cauſe in the 2. *Chron.* 32 31. 'tis ſaid, That *the Am-*
baſ-

baſſadors of the King of Babylon did come unto Hezekiah, to enquire of the wonder that was done in the Land; and therefore it ſeems the Miracle did not conſiſt in any Change of the Heavens.

5. If it had been in the Sun, it would have been as well diſcerned in other parts of the World, as in the Land of *Judea*. And then,

1. What need the King of *Babylon* ſend thither to enquire after it? If you reply, becauſe it was occaſioned by *Hezekiah*'s Recovery; I anſwer, 'tis not likely that the Heathens would ever believe ſo great a Miracle ſhould be wrought meerly for a Sign of one Man's Recovery from a Diſeaſe: But would rather be apt to think that it was done for ſome more remarkable Purpoſe, and that by ſome of their own Gods, unto whom they attributed a far greater Power than unto any other. 'Tis more probable, they might hear ſome flying Rumor of a Miracle that was ſeen in *Judea*: Which becauſe it happened only in *Hezekiah*'s Houſe and Dial, and that too upon his Recovery from a dangerous Sickneſs, they might be more apt to believe that it was a Sign of it.

2. Why have we no mention made of it in the Writings of the Ancients? It is no way likely, that ſo great a Miracle as this was (if it were in the Sun) ſhould have been paſſed over in Silence; eſpecially, ſince it happened in thoſe later times, when there were many Heathen Writers that flouriſhed in the World; *Heſiod*, *Archilochus*, *Symonides*; and not long after, *Homer*, with divers others; and yet none of them have the leaſt mention of any ſuch Prodigy. We have many Relations of Matters that were leſs obſervable, which were done about that time; the Hiſtory of *Numa Pompilius*, *Gyges*; the Fight betwixt the three Brethren, with divers ſuch Stories. And 'tis ſcarce credible, that this ſhould have been omitted amongſt the reſt.

Nay,

Nay, we have (as many gueſs) ſome Hints from rophane Antiquity, of the Miracle wrought by *oſhua*. Unto which, 'tis thought the Ancients did lude in the Fable of *Phaeton*; when the Sun was ſo regular in his Courſe, that he burnt ſome part of the Vorld. And queſtionleſs then, this which happened later times, would not have been ſo wholly orgotten. 'Tis an Argument urged by * *Origen*, That ne Eclipſe at our Saviour's Paſſion was not univerſal, ecauſe no Prophane Author of thoſe times mentions . Which Conſequence is the very ſame with that hich is urged in this other caſe; but by the way, is Antecedent was falſe, ſince † *Tertullian* affirms, hat it was recorded amongſt the *Roman* Anals.

* *Tractat.* 35. *in Mat.*

† *Apologet.* c. 21.

Now as for that Story in *Herodotus*, where after he ad related the Flight of *Senacherib*, he tells us, how ne Sun did Four Times in the Space of 10340 Years nvert his Courſe, and riſe in the *Weſt*; which would eem ſo unto other Nations, if he had only returned, s many conclude, from this Scripture: As for this tory, (I ſay) it cannot well be urged as pertinent to ne preſent Buſineſs, becauſe it ſeems to have Reference nto times that never were.

Lib. 2.

So that all theſe things being well conſidered, we hall find it more probable, that this Miracle doth conſt in the Return of the Shadow.

If you object, That the Scripture does expreſly ay, *the Sun it ſelf returned ten degrees*; I anſwer, 'tis frequent Manner of Speech in Scripture, to put the Cauſe for the Effect; as that in *Jonas*, where 'tis ſaid, That *the Sun did beat upon the head of Jonas*; that is, ne Beams of the Sun. So that of the Pſalmiſt, *The un ſhall not ſmite thee by day*, that is, the Heat which roceeds from the Sun's Reflection. In the ſame Senſe nay the Phraſe be underſtood in this Place; and the un may be ſaid to return back, becauſe the Light, hich is the Effect of it, did ſeem to do ſo; or rather,

Iſa. 38. 8.

Jonah 4. 8.

Pſal. 121. 6.

ther, becauſe the Shadow, which is the Effect of that did change its Courſe.

This later Scripture then, will not at all make to the preſent Purpoſe: As for thoſe of the two forme kinds, I have already anſwered, That they are ſpoke in reference to the Appearance of Things, and vulga Opinion. For the further Illuſtration of which, ſhall endeavour to confirm theſe two Particulars.

1. That the Holy Ghoſt in many other Places o Scripture, does accommodate his Expreſſions unto th Error of our Conceits: And does not ſpeak of diver Things as they are in themſelves, but as they appea unto us. Therefore 'tis not unlikely, that theſe Phra ſes alſo may be liable unto the ſame Interpretation.

2. That divers Men have fallen into great Abſurdi ties, whilſt they have looked for the Grounds of Phi loſophy from the Words of Scripture; and therefor it may be dangerous in this Point alſo, to adhere ſ cloſely unto the Letter of the Text.

PROP. III.

That the Holy Ghoſt, in many Places of Scri pture, does plainly conform his Expreſſions unt the Errors of our Conceits; and does not ſpeak of divers Things as they are in themſelves, bu as they appear unto us.

THere is not any particular by which Philoſophy hath been more endamaged, than the ignorant Superſtition of ſome Men: Who in ſtating the Con troverſies of it, do ſo cloſely adhere unto the meer Words of Scripture. *Quam plurima occurrunt in libris ſacris ad naturam pertinentia*, &c. They are the Words of † *Valleſius*. "There are ſundry Things in Holy

† *Proem. ad Phil. ſacram.*

"Writ

Writ concerning natural Points, which moſt Men think are not ſo to be underſtood, as if the Holy Ghoſt did intend to unfold unto us any thing in that kind: But referring all to the Salvation of our Souls, does ſpeak of other Matters according to common Opinion." And a little after, *Ego, divi-a hæc eloquia*, &c. "I for my part am perſuaded, that theſe Divine Treatiſes were not written by the Holy and Inſpired Penmen, for the Interpretation of Philoſophy, becauſe God left ſuch things to be found out by Men's Labour and Induſtry. But yet whatſoever is in them concerning Nature is moſt true: As proceeding from the God of Nature, from whom nothing could be hid." And queſtionleſs, all ioſe things which the Scripture does deliver concern-ig any natural Point, cannot be but certain and infal-ble, being underſtood in that Senſe, wherein they ere firſt intended; but now that it does ſpeak metimes according to common Opinion, rather than e true Nature of the things themſelves, was intima-d before; wherefore (by the way) * *Fromondus* his riumph upon the latter Part of this Quotation, is but ain, and to no purpoſe. 'Tis a good Rule ſet down y a learned † Commentator, to be obſerved in the nterpretation of Scripture: *Scriptura Sacra ſæpe non tam d veritatem ipſam, quam ad hominum opinionem, ſermonem commodat*; that it does many times accommodate its xpreſſions, not ſo much to the Truth it ſelf, as to len's Opinions. And in this Senſe is that Speech of *regory* concerning Images and Pictures, attributed by *Calvin* unto the Hiſtory of the Creation; *viz. Li-um eſſe ideotarum*, that it is a Book for the ſimpler and norant People. For it being written to inform them, well as others, 'tis requiſite that it ſhould uſe the oſt plain and eaſie Expreſſions. To this purpoſe kewiſe is that of † *Merſennus, Mille ſunt Scriptura loca*, c. "There are very many Places of Scripture, which are not to be interpreted according to the Let-

* *Veſt. Tract.* 3. *c.* 2.

† *Sanctius in Iſa.* 13. 5. *Item in Zachar. l.* 9. *n.* 45.

* *Comment. in Gen. c.* 1.

† *In Gen. c.* 1. *v.* 10. *art.* 6.

"ter;

Vid. Hiero. in Jer. 28. Aquinas in Job. 26. 7.

"ter; and that for this Reaſon, becauſe God would "apply himſelf unto our Capacity and Senſe: *Preſertim in iis, quæ ad res naturales, oculiſque ſubjectas pertinent*; more eſpecially in thoſe things which concern Nature, and are ſubject to our Eyes. And therefore in the very ſame Place, though he be eager enough againſt *Copernicus*, yet he concludes that Opinion not to be a Hereſy; becauſe (ſaith he) thoſe Scriptures which ſeem to oppoſe it, are not ſo evident, but that they may be capable of another Interpretation: Intimating, that it was not unlikely they ſhould be underſtood in reference to outward Appearance and common Opinion: And that this manner of Speech is frequently uſed in many other Places of Scripture may be eaſily manifeſt from theſe following Examples.

Thus though the Moon may be proved by infallible Obſervation, to be leſs than any of the viſible Stars yet becauſe of its Appearance, and vulgar Opinion therefore doth the Scripture in compariſon to them call it one of the great Lights. Of which Place

Gen. 1.16. Pſal. 136, 7.

ſaith *Calvin*, *Moſes populariter ſcripſit, nos potius reſpexit quam Sydera.* *Moſes* did not ſo much regard the Nature of the thing, as our Capacity; and therefore uſes a popular Phraſe: So as ordinary People without the Help of Arts and Learning, might eaſily underſtand him; and in another Place, *Non fuit Spiritus Sancti concilium Aſtrologiam docere*: "It was not the "purpoſe of the Holy Ghoſt to teach us Aſtronomy

Comment. in Pſal. 136.

"But being to propound a Doctrine that concern "the moſt rude and ſimple People, he does (both by "*Moſes* and the Prophets) conform himſelf unto their "Phraſes and Conceits: Leſt any ſhould think to excuſe his own Ignorance with the Pretence of Difficulty: As Men commonly do in thoſe things which "are delivered after a learned and ſublime Manner.

† *De oper. Dei, par. 2. l. 6. c. 1.*

Thus *Zanchy* † likewiſe, *Moſes majorem rationem habuit noſtri humanique judicii*, &c. "When *Moſes* calls the

"Moo

Moon a great Light, he had a more especial Reference to Men's Opinions of it, than to to the Truth of the thing it self; because he was to deal with such, who do usually judge rather by their Sense than by their Reason." Nor will that Distinction *Fromondus* and others avoid this Interpretation, hen he tells us of *magnum Materiale*, which refers the Bulk and Quantity of the Body; and *magnum rmale*, which imports the Greatness of its Light. For e grant, that it is really unto us a greater Light than ny of the Stars, or than all of them together: Yet ere is not one of them, but is in its self a bigger ight than this: And therefore when we say this peech is to be understood according to its Appearance, e do not oppose this to Reality: But 'tis implied, hat this Reality is not absolute, and in the Nature of he thing it self; but only relative, and in reference o us. I may say a Candle is a bigger Light than a tar, or the Moon, because it is really so to me. However any one will think this to be spoken, only in relation to its Appearance, and not to be understood as the thing were so in it self. But (by the way) it oes concern *Fromondus* to maintain the Scripture's Authority, in revealing of natural Secrets; because, from hence it is that he fetches the chief Argument for hat strange Assertion of his, concerning the Heaviness of he Wind; Where *Job* says, that *God makes the weight for he wind.* Thus likewise, because the common People usually think the Rain to proceed from some Waers in the *Expansum*, therefore doth *Moses* in reference to this erroneous Conceit, tell us of Waters above the Firmament, and the Windows of Heaven: Of which saith *Calvin*, *Nimis serviliter literæ e astringunt*, &c. "Such Men too servilely tie themselves unto the Letter of the Text, who hence conclude, that there is a Sea in the Heavens: When as we know that *Moses* and the Prophets, to accommodate themselves unto the Capacity of ruder People,

De Meteor. l. 4. c. 2. art. 5.

Job 28.25.

Comment. in Psa. 148. 4.

" do uſe a vulgar Expreſſion ; and therefore it wou
" be a prepoſterous Courſe, to reduce their Phraſes u
" to the exact Rules of Philoſophy. " Let me ad
that from this Miſtake, 'tis likely did ariſe that groun
leſs Obſervation of the ancient *Jews*, who would n
admit any to read the beginning of *Geneſis*, till
was arrived to Thirty Years of Age. The true Re
ſon of which was this : Not becauſe that Book w
harder than any other, but becauſe *Moſes* conformi
his Expreſſion to vulgar Conceits, and they examini
of them by more exact Rules of Philoſophy, we
fain to force upon them many ſtrange Allegories, a
unnatural Myſteries.

Thus alſo, becauſe for the moſt part we conceiv
the Stars to be innumerable, therefore doth the Ho
Ghoſt often ſpeak of them in reference to this Opin
Jer. 35. 22. on. So *Jeremy*, *As the Hoſt of Heaven cannot be nu
bred, neither the Sand of the Sea meaſured, ſo will I mult
ply the Seed of David.* So likewiſe, when God woul
comfort *Abraham* with the Promiſe of a numberleſs P
Gen. 15. 5. ſterity, he bids him look up to Heaven, and tells hi
that his Seed ſhould be like thoſe Stars for Number
* *In* 1. *cap. Sphæræ.* which, ſaith * *Clavius*, *Intelligendum eſt ſecundum com
munem ſententiam vulgi, exiſtimantis infinitam eſſe multit
dinem ſtellarum, dum eas nocte ſerena confuſe intuetur*, is t
be underſtood according to the common Opinion
the Vulgar, who think the Stars to be of an infini
Multitude, whilſt they behold them all (as they ſee
confuſed) in a clear Night. And though many of o
Divines do commonly interpret this Speech to be
Hyperbole; yet being well conſidered, we ſhall find th
Abraham's Poſterity, in ſome few Generations, we
far more than there are viſible Stars in the Firmament
and of ſuch only does God ſpeak, becauſe he bi
Abraham look up to the Heavens.

Now all theſe, even unto ſix Differences of Magn
tude, are reckoned to be but 1022. True indeed, a
the firſt viewing of the Heavens, it may ſeem an i

credibl

edible thing that they ſhould be of no greater a lumber; but the reaſon of this is, becauſe they ap-ear ſcattered and confuſed, ſo that the Eye cannot ace them in any ſuch order, as to reckon them up, take any diſtinct Survey of them. Now 'tis a nown Truth, *Quod fortius operatur pluralitas partium, i ordo abeſt; nam inducit ſimilitudinem infiniti, & impe-t comprehenſionem*; That a plurality of Parts without rder, has a more ſtrong Operation, becauſe it has a nd of ſeeming Infinity, and ſo hinders Comprehen-on. And then beſides, there are more Appearances Stars many times, than there are Bodies of them: or the Eye, by reaſon of its weakneſs and diſability diſcern any thing at ſo great a diſtance; as alſo, cauſe of thoſe Beams which proceed from ſuch re-ote Bodies in a twinkling and wavering manner, d ſo mix and confound themſelves at their entrance to that Organ; it muſt needs receive more Repre-ntations than there are true Bodies. But now, if a an do but leiſurely and diſtinctly compare the Stars the Heaven with thoſe of this Number that are ted in a Cœleſtial Globe, he ſhall ſcarce find any the Sky which are not marked with the Globe; y, he may obſerve many in the Globe, which he n ſcarce at all diſcern in the Heavens.

Sir *Fr. Bac.* Table of Colours, *Num.* 5.

Now this Number of the Stars is commonly diſtri-ted into 48 Conſtellations; in each of which, ough we ſhould ſuppoſe Ten thouſand Stars, (which n ſcarce be conceived) yet would not all this Num-r equal that of the Children of *Iſrael*. Nay, 'tis Aſſertion of *Clavius*, that *Abraham*'s Poſterity in ne few Generations were far more than there ld be Stars in the Firmament, though they ſtuck cloſe that they touched one another. And he ves it thus: A great Circle in the Firmament does tain the Diameter of a Star of the firſt Magnitude 960 times. In the Diameter of the Firmament, re are contained 4760 Diameters of ſuch a Star:

In prim. ca. Sphæra.

Now if we multiply this Circumference by this Diameter, the Product will be 71209600, which is the full Number of Stars, that the eighth Sphere (according to *Ptolemy*'s Grounds) would contain, if they ſtood ſo cloſe that they touched one another.

Num. 1. 46. The Children of *Iſrael* were reckoned at their going out of *Egypt* 603550, of ſuch as were One and Twenty Years old and upwards, and were able to go to War; beſides Children, and Women, and Youths and old Men, and the *Levites*; which in probability did always treble the other Number. Now if they were ſo many at one time, we may well conceive that in all thoſe ſeveral Generations, both before and ſince, the Number was much augmented; and long before this time, did far exceed this ſuppoſed Multitude of the Stars. From all which, we may infer That the Scripture-Expreſſions in this kind, are to be underſtood according to Appearance and common Opinion.

Another Place uſually cited for the ſame purpoſe to ſhew that the Holy Ghoſt does not ſpeak exactly concerning Natural Secrets, is that in the *Kings* and *Chronicles*, which relates unto us the Meaſure of *Solomon*'s Brazen Sea, whoſe Diameter was ten Cubits and its Circumference thirty; whereas to ſpeak Geometrically, the more exact proportion betwixt the Diameter and the Circumference, is not as Ten to Thirty, but rather as Seven to Twenty two.

1 *King.* 7. 23. 2 *Chr.* 4. 2.

* *Roſſ. l.* 1. *ſect.* 1. *c.* 8. † *Antiq. Jud. lib.* 8. *cap.* 2.

But againſt this 'tis * objected by our Adverſaries 1. This Sea was not perfectly round, but rather inclining to a Semicircular Form, as † *Joſephus* affirms.

I reply: If it were ſo, yet this is ſo much from helping the Matter, that it makes it much worſe for then the Diſproportion will be far greater.

But *Secondly*, Scripture, which is to be believed before *Joſephus*, does tell us in expreſs Terms, that it was round all about, 1 *Kings* 7. 23.

2. T

2. The Proportion of the Diameter to the Circumference, is not exactly the same as Seven to Two and twenty, but rather less. I answer, though it be, yet 'tis nearer unto that, than any other Number. *Roff. ibid.*

3. The Scripture does but according to its usual Custom, suppress the less Number, and mention only that which is bigger and more full. So in some * Places, *Abraham*'s Posterity is said to remain in the Land of *Egypt* for Four hundred Years; when as notwithstanding, † other Scriptures tell us, that they tarried there thirty Years longer. Thus likewise in one * Place, the Number of *Jacob*'s House who came into *Egypt*, is reckoned to be Seventy; whereas ∴ elsewhere, they are said to be Seventy five. *Ibid.*

* *Gen.* 15. 13. *Acts* 7. 6.

† *Exod.* 12. 41. *Gal.* 3. 17.

* *Gen.* 46. 27.

∴ *Acts* 7. 4.

I answer: All this is so far from destroying the force of the present Argument, that it does rather confirm it, and more clearly evidence unto us, that the Scripture does not only, not speak exactly in these subtle and more secret Points of Philosophy; but also, in the ordinary obvious numbring of things, does conform unto common Custom, and often use the round Number for the whole.

4. 'Tis yet objected by * another Adversary, That we have no reason to expect the Holy Ghost should reveal unto us this Secret in Nature; because neither *Archimedes*, nor any other, had then found it out. I reply, and why then should we think that the Scripture must needs inform us of the Earth's Motion; when as neither *Pythagoras*, nor *Copernicus*, nor any else, had then discovered it?

* *Fromond. Vesta.* 4. *tract.* 3. *c.* 2.

5. In taking the compass of this Vessel, they measured somewhat below the Brim, where it was narrower than at the Top, and so the Circumference there might be exactly but Thirty Cubits; whereof its Diameter was Ten. *Ibid.*

I answer: 'Tis evident this is a meer Shift, there being not the least Ground for it in the Text. And then besides, why might not we affirm, That the Dia-

meter was measured from that place, as well as the Circumference? since 'tis very probable that the Holy Ghost did speak *ad idem*, and not tell us the breadth of one place, and the compass of another. So that all our Adversaries Evasions cannot well avoid the force of the Argument that is taken from this Scripture.

Again, common People usually conceive the Earth to be such a Plain, as in its utmost Parts is terminated by the Heavens, so that if a Man were in the farthermost Coasts of it, he might touch the Sky. And hence also, they think that the Reason why some Countries are hotter than others, is, because they lie nearer unto the Sun. Nay, *Strabo* tells us of some Philosophers too, who in this Point have grosly erred affirming, that there was a Place towards the utmost Coasts of *Lusitania*, where a Man might hear the noise that the Sun made, as he quench'd his Beams in his descent to the Ocean; which, though it be an absurd Mistake, yet we may note, that the Holy Ghost in the Expression of these things, is pleased to conform himself unto such kind of vulgar and false Conceits and therefore often speaks of the * *ends of Heaven*, and the † *ends of the World*. In this sense, they that come from any far Country, are said to come from the *ends of Heaven*, Isaiah 13. 5. And in another Place *From the side of the Heavens*, Deut. 4. 32. All which Phrases do plainly allude unto the Error of vulgar Capacities (saith *Sanctius*) which hereby is better instructed, than it would be by more proper Expressions.

*Psa. 19. 6. *Mat.* 24. 31. †*Psa.* 22. 27, &c.

Comment. in Isa. 13. 5.

Thus likewise, because ignorant People cannot well apprehend how so great a Weight as the Sea and Land should hang alone in the open Air, without being founded upon some *Basis* to uphold it; therefore in this respect also does Scripture apply it self unto their Conceits, where it often mentions the *Foundations of the Earth*. Which Phrase, in the Letter of it, does manifestly allude unto Men's Imaginations in this kind.

Job 38. 4. *Psa.* 102. 25.

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Thus alſo the Common People uſually conceive the arth to be upon the Water; becauſe, when they have avelled any way as far as they can, they are at length opped by the Sea. Therefore doth Scripture in reerence to this, affirm, That *God ſtretched the Earth up- the Waters, founded the Earth upon the Seas, and eſtaliſhed it upon the Floods.* Of which Places ſaith *Calin, Non diſputat Philoſophicè David, de terræ ſitu; ſed opulariter loquens, ad rudium captum ſe accommodat*: Twas not *David*'s intent to ſpeak Philoſophically conerning the Earth's Situation; but rather by uſing a opular Phraſe, to accommodate his Speech unto the apacities of the ruder People. *Pſal.* 136. 6. *Pſal.* 24. 2.

In this ſenſe likewiſe, are we to underſtand all thoſe laces of Scripture, wherein the Coaſts of Heaven re denominated from the Relations of Before, Behind, he right Hand, or the left. Which do not imply, aith *Scaliger*, any abſolute difference in ſuch Places, ut are ſpoken meerly in reference to Men's Eſtimatins, and the common Opinion of thoſe People for whom the Scriptures were firſt penned. Thus becauſe was the Opinion of the *Jewiſh* Rabbies, that Man vas created with his Face to the Eaſt, therefore the *Hebrew* word קדם ſignifies *Ante*, or the Eaſt; אחור *Poſt*, or the Weſt; ימין *Dextra*, or the South, שמאל *Siniſtra*, or the North. You may ſee all of them put ogether in that Place of *Job*: *Behold I go forward, nd he is not there, and backward, but I cannot perceive im; on the left hand, where he doth work, but I cannot ehold him. He hideth himſelf on the right hand, that I annot ſee him.* Which Expreſſions, are by ſome Interreters referred unto the Four Coaſts of Heaven, acording to the common uſe of thoſe Original Words. From hence it is, that many of the Ancients have concluded Hell to be in the North, which is ſignified by the Left Hand: Unto which ſide our Saviour tells us, that the Goats ſhall be divided. Which Opinion likewiſe ſeems to be favoured by that Place in *Job*, where *Subtil. Exercit.* 67. *Job* 23. 8, 9. *Mat.* 25. 33.

Job 36. 6, 7. where 'tis ſaid, *Hell is naked before God, and deſtruction hath no covering.* And preſently 'tis added, *He ſtretched out the North over the empty place.*

Upon theſe grounds, St. *Jerom* interprets that Speech of the Preacher, *Eccleſ.* 11. 3. *If the tree falls towards the South, or towards the North, in the place where the tree falleth, there ſhall it be.* Concerning thoſe who ſhall go either to Heaven or Hell. And in this Senſe alſo do ſome expound that of *Zachary*, 14. 4. Where 'tis ſaid, *That the mount of Olives ſhall cleave in the midſt; half of it ſhall remove towards the North, and half of it towards the South.* By which is intimated, that amongſt thoſe *Gentiles* who ſhall take upon them the Profeſſion of Chriſt, there are two Sorts; ſome that go to the *North*, that is, to Hell; and others to the *South*, that is to Heaven. And therefore it is (ſay they) that God ſo * often threatens Evil out of the *North*; and upon this ground it is (ſaith † *Beſoldus*) that there is no Religion that worſhips that way. We read of the *Mahumetans*, that they adore towards the *South*; the *Jews* towards the *Weſt*; Chriſtians towards the *Eaſt*, but none to the *North*.

* *Jer*, 1. 14, 15. *Item cap.* 4. 6. & 31.

† *De nat. pop. c.* 4.

But of this only by the way. However, certain it is that the Holy Ghoſt does frequently in Scripture ſet forth the ſeveral Coaſts of Heaven, by thoſe relative Terms of Right Hand and Left Hand, *&c.* which Expreſſions do not denote any real intrinſical Difference betwixt thoſe Places, but are rather fitted for the Apprehenſion of thoſe Men, from whoſe Fancy it is that they have ſuch Denominations. And though *Ariſtotle* concludes theſe ſeveral Poſitions to be natural unto the Heavens; yet his Authority in this particular is not available, becauſe he delivers it upon a wrong ground, ſuppoſing the Orbs to be living Creatures, and aſſiſted with Intelligences. We may obſerve, that the meaning of theſe Coaſts by the Relations of Right Hand and Left Hand, *&c.* is ſo far from having any ground in the Nature of thoſe ſeveral Places, that

De Cæl. l. 2. *c.* 2.

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heſe Relations are not only variouſly applied unto hem by divers Religions (as was ſaid before,) but alſo by divers Arts and Profeſſions. Thus becauſe Aſtronomers make their Obſervations toward the South parts of the *Horizon*, where there be moſt Stars that riſe and ſet; therefore do they account the *Weſt* to be at their Right Hand, and the *Eaſt* at their Left. The *Coſmographers* in taking the Latitude of Places, and reckoning their ſeveral Climates muſt look towards the *North* Pole; and therefore in their Phraſe, by the Right Hand is meant the *Eaſt*; and by the Left Hand, the *Weſt*: And thus (ſaith *Plutarch*, are * we to underſtand theſe Exprſſions in *Pythagoras*, *Plato*, *Ariſtotle*. The Poets count the *South* to be towards the Left, and the *North* the Right Hand. Thus † *Lucan* ſpeaking of the *Arabians* coming unto *Theſſaly*, ſays:

Ignotum vobis Arabes veniſtis in orbem:
Umbras mirati nemorum, non ire ſiniſtras.

* *Deplac. Philoſ. l.2. cap. 10.*
† *Lib. 3.*

The *Augurs* taking their Obſervations at the *Eaſt*, count the *South* to be at their Right Hand, and the *North* their Left: So that theſe Denominations have not any real ground in the Nature of the things, but are impoſed upon them by the Scripture Phraſe, in Reference to the Account and Opinion of the *Jews*.

Thus alſo, becauſe heretofore it was generally received, that the Heart was the principal Seat of the Faculties; therefore doth the Spirit apply himſelf unto this common Tenent; and in many Places, attributes Wiſdom and Underſtanding to the Heart. Whereas, to ſpeak properly, the Reaſon and diſcurſive Faculties have their principal Reſidence in the Head (ſaith *Galen* and *Hypocrates*, together with the Generality of our later Phyſicians,) becauſe they are hindred in their Operations by the Diſtempers of that part, and recovered by Medicines applied unto it.

D. Hakwel, Apol. l. 1. c. 1. Sect. 2.

Prov. 8. 5. 10. 8. Eccleſ. 1. 13, 16, 17. & 8. 5.

So likewiſe are we to underſtand thoſe other Places: *Iſa. 59. 5.* where ſome Tranſlations read it, *Ova Aſpidum ruperunt*, they have broken the Vipers Eggs; alluding

luding to that common but fabulous Story of the Viper, who breaks his Paſſage through the Bowels of the Female. So *Pſal.* 58. 4, 5. where the Prophet ſpeaks of the deaf Adder, *that ſtops her Ears againſt the voice of the Charmer.* Both which Relations (if we may believe many Naturaliſts) are as falſe as they are common; and yet becauſe they were entertained with the general Opinion of thoſe Days, therefore doth the Holy Ghoſt vouchſafe to allude unto them in Holy Writ. 'Tis a plain miſtake of *Fromondus*, when in Anſwer to theſe Places, he is fain to ſay, that they are uſed proverbially only, and do not poſitively conclude any thing. For when *David* writes theſe Words, that they are *like the deaf Adder which ſtoppeth her ears*, &c. this Affirmation is manifeſtly implied, That the deaf Adder does ſtop her Ears againſt the Voice of the Charmer: Which becauſe it is not true in the Letter of it, (as was ſaid before) therefore 'tis very probable that it ſhould be interpreted in the ſame Senſe wherein here it is cited.

Veſta Trac. 3. cap. 3.

In reference to this alſo, we are to conceive of thoſe other Expreſſions; *Cold cometh out of the North*; *Job* 37. 9. and again, *Fair weather comes out of the North*, *Ver.* 22. So *Ver.* 17. *Thy garments are quieted when he warmeth the Earth by the South Wind.* And *Prov.* 25. 23. *The North Wind driveth away rain.* Which Phraſes do not contain in them any abſolute general Truth, but can ſo far only be verified, as they referred to ſeveral Climates: And though unto us who live on this ſide of the Line, the *North* Wind be coldeſt and drieſt; and on the contrary, the *South* Wind moiſt and warm, by Reaſon that in one in theſe Places there is a ſtronger Heat of the Sun to exhale moiſt Vapours, than in the other; yet it is clean otherwiſe with the Inhabitants beyond the other Tropick; for there the *North* Wind is the hotteſt, and moiſt, and the *South* the coldeſt and dry: So that with them, theſe Scriptures cannot properly be affirmed, that *cold or that fair weather cometh*

out

out of the North; but rather on the contrary. All which notwithſtanding, does not in the leaſt manner derogate from the Truth of theſe Speeches, or the Omniſciency of the Speaker, but do rather ſhew the Wiſdom and Goodneſs of the Bleſſed Spirit, in vouchſafing thus to conform his Language unto the Capacity of thoſe People unto whom theſe Speeches were firſt directed: In the ſame ſenſe are we to underſtand all thoſe places where *the Lights of Heaven* are ſaid to be darkned, *and the Conſtellations not to give their light*, *Iſa.* 13. 10. Not as if they were abſolutely in themſelves deprived of their Light, and did not ſhine at all; but becauſe of their Appearance to us; and therefore in another Place anſwerable to theſe, God ſays, *he will cover the Heavens*, and ſo make the Stars thereof dark, *Ezek.* 37. 2. Which argues, that they themſelves were not deprived of this Light (as thoſe other Speeches ſeem to imply) but we. *Joel* 2. 31. *Item* c. 3. 15.

In reference to this likewiſe are we to conceive of thoſe other Expreſſions, that *the Moon ſhall bluſh, and the Sun be aſhamed*, *Iſa.* 24. 23. That *they ſhall be turned into Blood*, *Matth.* 24. 29. Not that theſe things ſhall be ſo in themſelves (ſaith St. *Jerom*,) but becauſe they ſhall appear ſo unto us. Thus alſo *Mark* 13. 25. *The Stars ſhall fall from Heaven*; that is, they ſhall be ſo wholly covered from our Sight, as if they were quite fallen from their wonted Places. Or if this be underſtood of their real Fall, as it may ſeem probable by that Place in the *Revelations*, 6. 13. *And the Stars of Heaven fell unto the Earth, even as a Fig-Tree caſteth her untimely Figs, when ſhe is ſhaken by a mighty Wind:* Then is it to be interpreted not of them that are truly Stars, but them that appear ſo: Alluding unto the Opinion of the unskilful Vulgar (ſaith * *Sanctius*) that think the Meteors to be Stars. And † *Merſennus* ſpeaking of the ſame Scripture, ſays, *Hoc de veris Stellis minime volunt Interpretes intelligi, ſed de Cometis & aliis ignitis Meteoris*: Interpreters do by no means underſtand this of true Stars, *Comment. in Joel*, c. 3. * *Commen. in Iſa.* c. 13. 5. † *Comment. in Gen.* c. 3. v. 10. ar. 6.

Stars, but of the Comets and other fiery Meteors: Though the falling of theſe be a natural Event, yet may it be accounted a ſtrange Prodigy, as well as an Earthquake, and the darkning of the Sun and Moon, which are mentioned in the Verſe before.

In reference to this, doth the Scripture ſpeak of ſome common natural Effects, as if their true Cauſes were altogether inſcrutable, and not to be found out, becauſe they were generally ſo eſteemed by the Vulgar. Thus of the Wind it is * ſaid, *That none know whence it cometh, nor whither it goeth.* In another † Place God is ſaid *to bring it out of his treaſures*; and ∴ elſewhere it is called *the* ° *breath of God*; and ſo likewiſe of the Thunder: Concerning which, † *Job* propoſes this Queſtion, *The Thunder of his Power who can underſtand?* and therefore too ∵ *David* does ſo often ſtile it, *the voice of God.* All which Places ſeem to imply, that the Cauſe of theſe things was not to be diſcovered, which yet later Philoſophers pretend to know: So that according to their Conſtruction, theſe Phraſes are to be underſtood in relation unto their Ignorance unto whom theſe Speeches were immediately directed.

* *Joh.* 3. 8.
† *Jer.* 10. 13. *Item* c. 51. 16.
∴ שם
* *Job.* 37. 10.
† *Jo.* 26. 14.
∵ *Pſal.* 2. 9. 3, 4. &c.
Eccleſ. 1. 7.

For this Reaſon is it; Why, though there be in Nature many other Cauſes of Springs and Rivers than the Sea, yet *Solomon* (who was a great Philoſopher, and perhaps not ignorant of them) does mention only this; becauſe moſt obvious, and eaſily apprehended by the Vulgar. Unto all theſe Scriptures, I might add that in *Amos* 5. 8. which ſpeaks of the Conſtellation commonly called the Seven Stars; whereas later Diſcoveries have found that there are but Six of them diſcernable to the bare Eye, as appears by *Galilæus* his Glaſs: The Seventh of them being but a deceit of the Eye, ariſing from their too great nearneſs; and if a Man try in a clear Night to number them diſtinctly, he ſhall find that there will ſometimes appear but Six, and ſometimes more.

Job, 9. 9. *Item* 38. 31.
Vide Fromond. Met. l. 3. *c.* 1. *art.* 1.

True indeed, the Original Word of this Scripture

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כימה, does not neceſſarily imply any ſuch Number in its Signification, but yet our *Engliſh* Tranſlation renders it the Seven Stars; and if it had been expreſly ſo in the Original too, it might have ſpoken true enough, becauſe they are uſually eſteemed of that Number. And when it had been ſaid, *He made the Seven Stars and Orion*, we might have eaſily underſtood the Words thus: He made thoſe Conſtellations that are commonly known unto us under ſuch Names.

From all theſe Scriptures 'tis clearly manifeſt, that it is a frequent Cuſtom for the Holy Ghoſt to ſpeak of natural Things, rather according to their Appearance and common Opinion, than the Truth it ſelf. Now it is very plain, and our Enemies themſelves do grant it, that if the World had been framed according to the Syſtem of *Copernicus*, *futurum eſſet ut vulgus, de Solis motu & Terra ſtatu proinde ut nunc loqueretur.* The vulgar Phraſe would have been the ſame as now it is, when it ſpeaks of the Sun's Motion, and the Earth's ſtanding ſtill. *Fromond. Ant. c. 6.*

Wherefore 'tis not improbable, that ſuch kind of Scripture-Expreſſions are to be underſtood only in relation to outward Appearances, and Vulgar Opinion.

PROP. IV.

That divers Learned Men have fallen into great Abſurdities, whilſt they have looked for the Sects of Philoſophy from the Words of Scripture.

IT has been an Ancient and common Opinion amongſt the *Jews*, that the Law of *Moſes* did contain in it, not only thoſe things which concern our Religion and Obedience, but every Secret alſo that

Schickard. Bechin. Habern. Disp. 5. Num. 8.

that may possibly be known in any Art or Science; so that there is not a Demonstration in Geometry, or Rule in Arithmetick; not a Mystery in any Trade, but it may be found out in the *Pentateuch*. Hence it was (say they) that *Solomon* had all his Wisdom and Policy: Hence it was that he did fetch his Knowledge concerning the Nature of Vegetables, from the Cedar of *Lebanon*, to the Hyssop that grows upon the Wall. Nay from hence, they thought a Man might learn the Art of Miracles, to remove a Mountain, or recover the Dead. So strangely have the learneder Sort of that Nation been befooled, since their own Curse hath lighted upon them.

Not much unlike this foolish Superstition of theirs, is that Custom of many Artists amongst us; who upon the Invention of any new Secret, will presently find out some obscure Text or other to father it upon; as if the Holy Ghost must needs take notice of every particular which their partial Fancies did over-value.

Nor are they altogether guiltless of this Fault, who look for any Secrets of Nature from the Words of Scripture; or will examine all its Expressions by the exact Rules of Philosophy.

Unto what strange Absurdities this False Imagination of the Learneder *Jews* hath exposed them, may be manifest by a great multitude of Examples. I will mention only some few of them. Hence it is that they prove the Shin-Bone of *Og* the Giant to be above three Leagues long; or (which is a more modest Relation) that *Moses* being fourteen Cubits in stature, having a Spear ten Ells in length, and leaping up ten Cubits, could touch this Giant but on the Ancle. All which they can confirm unto you by a Cabalistical Interpretation of this Story, as it is set down in Scripture. Hence it is that they tell us of all those strange Beasts which shall be seen at the coming of the Messias: As first, the Ox, which *Job* calls *Behemoth*,

Schickard. ib. Disp. 6. num. 2.

Buxtor. Synag. Juda. c. 36.

noth, that every Day devours the Graſs on a thouſand Mountains, as you may ſee it in the * *Pſalm*, where *David* mentions the Cattel, or בהמות upon a Thouſand Hills. If you ask how this Beaſt does to find Paſture enough, they anſwer, that he remains conſtantly in one place, and where there is as much Graſs grows up in the Night, as was eaten in the Day. * *Pſal.* 50. 10.

They tell us alſo of a Bird, which was of that quantity, that having upon a time caſt an Egg out of her Neſt, there were beaten down by the fall of it Three hundred of the talleſt Cedars, and no leſs than Threeſcore Villages drowned. As alſo of a Frog as big as a Town capable of Sixty Houſes; which Frog, notwithſtanding his greatneſs, was devoured by a Serpent, and that Serpent by a Crow; which Crow, as ſhe was flying up to a Tree, eclipſed the Sun, and darkened the World; by which you may gueſs what a pretty Twig that Tree was. If you would know the Proper Name of this Bird, you may find it in *Pſal.* 50. 11. where it is called עוף, or in our Tranſlation, the Fowl of the Mountains. It ſeems it was ſomewhat of kin to that other Bird they tell us of, whoſe Legs were ſo long, that they reached unto the bottom of that Sea, where there had been an Axe-Head falling for Seven Years together, before it could come to the bottom. *Vide Parap. Chald.*

Many other Relations there are, which contain ſuch horrible Abſurdities, that a Man cannot well conceive how they ſhould proceed from Reaſonable Creatures. And all this ariſing from that wrong Principle of theirs, That Scripture did exactly contain in it all kind of Truths; and that every Meaning was true, which by the Letter of it, or by Cabaliſtical Interpretations might be found out.

Now as it hath been with them, ſo likewiſe hath it happened in proportion unto others, who by a Superſtitious adhering unto the bare Words of Scripture, have

have expoſed themſelves unto many ſtrange Errors. Thus * St. *Baſil* holds, That next to the Sun, the Moon is bigger than any of the Stars, becauſe *Moſes* does call them only two great Lights.

* *Enarrat. in Gen.*

Thus others maintain, That there are Waters properly ſo called, above the Starry Firmament, becauſe of thoſe Vulgar Expreſſions in Scripture, which in their Literal Senſe do mention them. Of this Opinion were many of the Ancients, *Philo*, *Joſephus*, and ſince them the Fathers: (a) *Juſtin Martyr*, (b) *Theodoret*, (c) *Auſtin*, (d) *Ambroſe*, (e) *Baſil*, and almoſt all the reſt. Since them ſundry other Learned Men, as *Beda*, *Strabo*, *Damaſcen*, *Tho. Aquinas*, *&c.* If you ask for what purpoſe they were placed here, *Juſtin Martyr* tells us for theſe two ends: Firſt, to cool the Heat that might otherwiſe ariſe from the Motion of the Solid Orbs; and hence it is, ſay they, that *Saturn* is colder than any of the other Planets, becauſe though he move faſter, yet he is nearer to theſe Waters. Secondly, to preſs and keep down the Heavens, leſt the frequency and violence of Winds might break and ſcatter them aſunder: Which Opinion, together with both its Reaſons, are now accounted abſurd and ridiculous.

(a) *Reſponſ. adqueſ.* 93. *Orthod.*
(b) *Que.* 11. *ſup. Gen.*
(c) *De Civ. Dei lib.* 11. *cap. ult.*
(d) *Hexam. l.* 2. *c.* 2.
(e) *Homil.* 3. *in Gen.*

(f) St. *Auſtin* concludes the viſible Stars to be innumerable, becauſe Scripture Phraſes ſeem to imply ſo much.

(f) *De Civ. Dei, l.* 16. *c.* 23.
(g) *Reſpon. adqueſt.* 93.

That the Heavens are not round, was the Opinion of (g) *Juſtin Martyr*, (h) *Ambroſe*, (i) *Chryſoſtom*, (k) *Theodoret*, (l) *Theophilact*, doubted of by St. *Auſtin* (m), and divers others. Nay, St. *Chryſoſtom* was ſo confident of it that he propoſes the Queſtion in a triumphant manner, Πῶς εἰσιν οἱ σφαῖραν εἰδὼς οὐρανὸν εἶδον ἀποφαινόμενοι. Where are thoſe Men that can prove the Heavens to have a Spherical Form? The Reaſon of which was this, Becauſe 'tis ſaid in one Scripture, *That God ſtretched forth the Heavens as a Curtain*, Pſal. 104. 2. *and ſpreadeth them a Tent to dwell in*, Iſa. 40. 22. And ſo in that Place

(h) *Hexam. l.* 1 *c.* 6.
(i) *Homil.* 14. *in Ep. ad Hebr.*
(k) *In c.* 8. *Hebr.*
(l) *In id. c.*
(m) *In Gen. ad lit. l.* 1. *c.* 9. *Item l.* 2. *c.* 6.

he Epiſtle to the *Hebrews*, 8. 2. they are called, *a ent or Tabernacle:* Which becauſe it is not ſphæ.ical, herefore they conclude alſo, that the Heavens are ot of that Form; whereas now, the contrary is as vident as Demonſtration can make a Thing. And herefore, * St. *Jerom* in his time, ſpeaking of the ſame rror, gives it this plain Cenſure: *Eſt in Eccleſia ſtulti quium, ſi quis Cœlum putet fornicis modo curvatum, E- iæ quem non intelligit ſermone deceptus.* 'Tis *fooliſh ſpeak- g* in the Church, if any through miſapprehenſion of oſe Words in *Iſaiah*, ſhall affirm the Heavens not to e round.

* *Lib.* 3. *Comment. in Galat. c.* 5.

That the Seas not overflowing the Land is a Mira- le, was the Opinion of (a) *Baſil*, (b) *Chryſoſtom*, (c) *The- doret*, (d) *Ambroſe*, (e) *Nazianzen*, and ſince them, (f) *A- uinas*, (g) *Luther*, *Calvin*, *Marlorate*, with ſundry thers: Which they proved from theſe Scripture Ex- reſſions: That in *Job* 38. 8, 11. *Who hath ſhut up the ea with Doors, when it brake forth, as if it had iſſued out f the Womb; when I did break up for it my decreed Place; nd ſet Bars, and Doors, and ſaid, Hitherto ſhalt thou me, and no further, and here ſhall the Pride of thy Waves e ſtaid.* So likewiſe, *Prov.* 8. 29. *God gave to the Sea is Decree, that the Waters ſhould not paſs his Command- ent.* And *Jerem.* 5. 22. *I have placed the Sand for a ound of the Sea by a perpetual Decree, that they cannot paſs ; and though the Waves thereof toſs themſelves, yet can ey not prevail; though they roar, yet can they not paſs ver, that they turn not again to cover the Earth.* In all hich Places, ſay they, 'tis imply'd, that the Water of ſelf, were it not withheld from its own natural In- lination by a more ſpecial Power of God, would verflow the Land.

(a) *Homil.* 4. *Hexam.* (b) *Commen. in Job.* (c) *In* Pſal. 103. (d) *Hexam. l.* 3. *c.* 2, 3. (e) *Orat.* 34 (f) *Aquinas part* 1. *queſt.* 69. *art.* 1. (g) *Commen. in* Pſal. 24. *Item in* Pſal. 136. 6.

Others infer the ſame Concluſion from that in *Ec- leſiaſtes*, where the Rivers are ſaid to come from the ea, which they could not do, unleſs that were higher. anſwer: They ſhould as well conſider the latter part f that Scripture, which ſays, that the Rivers return

to that place from whence they came, and then th force of this Conſequence will vaniſh. To this pu poſe ſome urge that Speech of our Saviour, where h bids *Simeon* to launch forth into the Deep; the *Lat* Word is, *in altum*; from whence they gather, that th Sea is higher than the Land. But this favours ſo muc of Monkiſh Ignorance, that it deſerves rather to b laughed at, than to be anſwered.

Luke 5, 4. Εἰς τὸ βάθος.

But now if we conſider the true Properties of th Element, according to the Rules of Philoſophy, w ſhall find, that its not overflowing the Land is ſo f from being a Miracle, that it is a neceſſary Conſ quence of its Nature; and 'twould rather be a Mir cle, if it ſhould be otherwiſe, as it was in the Gener Deluge. The Reaſon is, becauſe the Water of it ſe muſt neceſſarily deſcend to the loweſt place; which cannot do, unleſs it be collected in a Sphærical Fort as you may plainly diſcern in this Figure.



Where the Sea at *D*, may ſeem to be higher tha Mountain at *B*, or *C*, becauſe the riſing of it in midſt, does ſo intercept our Sight from either of th Places, that we cannot look in a Strait Line, fr the one to the other. So that it may ſeem to be leſs than a Miracle, by which the Sea (being a he Body) was withheld from flowing down to thoſe l er Places of *B*, or *C*. But now, if you conſider t

e aſcending of a Body is its Motion from the Cen-
e, and deſcent is its approaching unto it; you ſhall
nd, that for the Sea to move from *D*, to *B* or *C*, is
Motion of Aſcent, which is contrary to its Nature,
ecauſe the Mountains at *B*, or *C*, are farther off from
e Centre, than the Sea at *D*; the Lines *A B*, and *A*
, being longer than the other *A D*. So that for the
ea to keep always in its Channel, is but agreeable
its Nature, as being a heavy Body. But the mean-
g of thoſe Scriptures is, to ſet forth the Power and
Viſdom of God; who hath appointed theſe Channels
r it, and beſet it with ſuch ſtrong Banks to with-
and the fury of its Waves. Or if theſe Men do ſo
uch rely in Natural Points, upon the bare Words of
cripture, they might eaſily be confuted from thoſe
ther Places, where God is ſaid to have founded the
arth upon the Seas, and eſtabliſh'd it upon the
loods. From the Literal Interpretation of which,
any of the Ancients have fallen into another Error;
firming the Water to be in the lower place: and as
Baſis, whereon the weight of the Earth was born up.
Of this Opinion were * *Clemens Alexandrinus*, † *A-*
anaſius, ∴ *Hillary*, * *Euſebius*, and others. So that
ſeems, if a Man ſhould reſolutely adhere to the
are Words of the Scripture, he might find Contra-
iction in it; of which the Natural Meaning is alto-
ether incapable. † St. *Jerom* tells us of ſome who
ould prove Stars to have Underſtanding, from that
lace in *Iſaiah*, 45, 12. *My Hands have ſtretched out*
he Heavens, and all their Hoſt have I commanded.
low (ſay they) none but Intelligent Creatures are
apable of Precepts; and therefore the Stars muſt
eeds have Rational Souls. Of this Opinion was
Philo the *Jew*: Nay, many of the Rabbies conclude,
at they do every Hour ſing Praiſes unto God with
n audible real Voice; becauſe of that in *Job* 38. 7.
hich ſpeaks of *the Morning Stars ſinging together.* And
ſal. 19. 3, 4. where 'tis ſaid of the Heavens, That

* *Recog.* 8.
† *Orat. cont. Idolos.*
∴ *In* Pſal. 136. 6.
* *In* Pſal. 24.
†*Comment. in* Iſa. *l.* 13.
† *Deplant. Noe.*
Toſtatus in Joſh. c. 10. *queſt.* 13, 14.

there is no Speech nor Language where their Voice is not heard, and their Words are gone to the ends of the World. And whereas we tranſlate that Place in the Tenth of *Joſhua*, concerning the ſtanding ſtill of the Heavens; the original Word, דמם does properly ſignifie Silence, and according to their Opinion, *Joſhua* did only bid them hold their peace. From ſuch grounds 'tis likely did * *Origen* fetch his Opinion, that the Stars ſhould be ſaved. I might ſet down many other the like Inſtances, were it not for being already weary of raking into the Errors of Antiquity, or uncovering the Nakedneſs of our Forefathers. That Excuſe of † *Acoſta* may juſtly ſerve to mitigate the Miſtakes of theſe Ancient Divines: *Facilè condonandum eſt patribus, ſi cum cognoſcendo colendóque Creatori toti vacarent, de Creaturâ minus apiè aliqua ex parte opinati ſunt.* Thoſe Good Men were ſo wholly buſied about the Knowledge and Worſhip of the Creator, that they had not leiſure enough for an Exact Search into the Eſſence of the Creatures. However, theſe Examples that have been already cited, may ſufficiently manifeſt how frequently others have been deceived, in concluding the Points of Philoſophy from the Expreſſions of Scripture. And therefore 'tis not certain, but that in the preſent Caſe alſo, it may be inſufficient for ſuch a manner of Arguing.

* *Tom.* 1. *in Johan.*

† *De nat. novi orbis, l.* 1. *c.* 2.

PROP. V.

That the Scripture, in it Proper Conſtruction, does not any where affirm the Immobility of the Earth.

THE ſame Anſwer which was inſiſted on before concerning the Conformity of Scripture Expreſſions to Mens Capacity and Common Opinion, may well

well enough satisfy all those other Arguments, which seem thence to affirm the Earth's Settledness and Immobility; since this is as well agreeable to outward appearance and vulgar apprehension as the other. But now for more full satisfaction, I shall set down the Particular Places that are urged for it; which being throughly examined, we may plainly discern that none of them, in their proper Meaning, will serve to infer any such Conclusion.

One of these Sayings is that of the Preacher, *Eccles.* 1. 4. *One Generation cometh, and another passeth, but the Earth endureth for ever*; where the Original Word is, עמד, and the Vulgar, *Stat*; from whence our * Adversaries conclude that it is immovable.

I answer: The Meaning of the Word, as it is here apply'd, is *permanent*; or as we translate it, *endureth*. For it is not the purpose of this Place to deny all kind of Motion to the whole Earth, but that of Generation and Corruption, to which other things in it are liable. And though *Pineda*, and others keep a great deal of impertinent stir about this Scripture, yet they grant this to be the natural Meaning of it: Which you may more clearly discern, if you consider the chief Scope of this Book; wherein the Preacher's Intent is, to shew the extraordinary Vanity of all Earthly Contentments, *ver.* 2. the utter Unprofitableness of all a Man's Labour, *ver.* 3. and this he illustrates by the shortness and uncertainty of his Life, in which respect he is below many of his Fellow Creatures, as may be manifested from these four Comparisons.

* *Vallesius Sacra Phil. c.* 62. *Fuller, Miscell. l.* 1. *c.* 15. *Pineda Comment. in locum.*

1. From the Earth, which though it seem to be but as the Sediment of the World, as the Rubbish of the Creation; yet is this better than Man in respect of his lastingness; for *one Generation passeth away, and another cometh*; *but the Earth* that abideth for ever, *v.* 4.

2. From the Sun; who though he ſeem frequently to go down, yet he conſtantly ſeems to riſe again, and ſhines with the ſame Glory, *v.* 5. *But Man dieth, and waſteth away, yea, Man giveth up the Ghoſt, and where is he? he lieth down, and riſeth not till the Heavens be no more.*

Job 14. 10, 12.

3. From the Wind, the Common Emblem of Uncertainty; yet it is more conſtant than Man, for that *knows its Circuits, and whirleth about continually,* v. 6. *Whereas our Life paſſeth away as doth the Wind, but returneth not again.*

Pſal. 78. 39.

4. From the Sea; though it be as uncertain as the Moon, by whom 'tis governed, yet is it more durable than Man and his Happineſs. For though the Rivers run into it, and from it, yet is it ſtill of the ſame quantity that it was at the beginning, *v.* 7. But Man grows worſer as he grows older, and ſtill nearer to a decay. So that in this reſpect he is much inferior to many other of his Fellow Creatures.

From whence it is manifeſt, that this Conſtancy, or Standing of the Earth is not oppoſed to its Local Motion, but to the changing or paſſing away of divers Men in their ſeveral Generations. And therefore thence to conclude the Earth's Immobility were as weak and ridiculous as if one ſhould argue thus: One Miller goes, and another comes, but the Mill remains ſtill; *ergo*, the Mill hath no Motion.

Mr. Carpenter's *Geog. l.* 1. *c.* 4.

Or thus: One Pilate goes, and another comes, but the Ship remains ſtill; *ergo*, the Ship doth not ſtir.

* *R. Moſes* tells us, how that many of the *Jews* did from this place conclude, that *Solomon* thought the Earth to be Eternal, becauſe he ſaith it abideth לעולם for ever; and queſtionleſs, if we examine it impartially, we ſhall find that the Phraſe ſeems more to favour this Abſurdity, than that which our Adverſaries would collect from hence, that it is without Motion.

* *Perplex. l.* 2. *c.* 29.

But

But Mr. *Fuller* urging this Text againſt *Copernicus*; tells us, if any ſhould interpret theſe Phraſes concerning the Earth's ſtanding ſtill, *v.* 4. and the Sun's Motion, *v.* 5. in reference only to Appearance, and Common Opinion; he muſt neceſſarily alſo underſtand thoſe two other Verſes which mention the Motion of the Wind and Rivers in the ſame Senſe. As if he ſhould ſay; Becauſe ſome things appear otherwiſe than they are, therefore every thing is otherwiſe than it appears: Or, Becauſe Scripture ſpeaks of ſome Natural Things, as they are eſteem'd according to Man's Falſe Conceit, therefore 'tis neceſſary that every Natural Thing mention'd in Scripture muſt be interpreted in the like Senſe: Or, becauſe in one place we read of the Ends of a Staff, 1 *Kings* 8. 8. and in many other places of the Ends of the Earth, and the Ends of Heaven; therefore the Earth and Heavens have as properly Ends as a Staff. 'Tis the very ſame Conſequence of that in the Objection. Becauſe in this place of *Eccleſiaſtes* we read with the Reſt of the Earth, and the Motion of the Sun; therefore theſe Phraſes muſt needs be underſtood in the ſame proper Conſtruction as thoſe afterwards, where Motion was attributed to the Wind and Rivers. Which Inference you ſee is ſo weak, that the Objector need not triumph ſo much in its ſtrength as he doth.

Another Proof like unto this is taken from St. *Peter*, *Epiſt.* 2. *cap.* 3. *ver.* 5. where he ſpeaks of the Earth ſtanding out of the Water, and in the Water, γῆ σωεστῶσα, and therefore the Earth is immovable.

I anſwer: 'Tis evident that the Word here is equivalent with *fuit*; and the Scope of the Apoſtle is to ſhew, that God made all the Earth, both that which was above the Water, and that which was under it. So that from this Expreſſion, to collect the Reſt and Immobility of the Earth, would be ſuch an Argument as this other. Such a Man made that part of a Mill-Wheel, or a Ship, which ſtands below the Water, and that

that part which ſtands above the Water; therefore thoſe Things are immovable.

To ſuch vain and idle Conſequences does the Heat of Oppoſition drive our Adverſaries.

A Third Argument ſtronger than either of the former, they conceive may be collected from thoſe *Scriptures; where 'tis ſaid, *The World is eſtabliſhed, that it cannot be moved.*

* 1 *Chron.* 16. 30. *Pſal.* 93. 1. *Item* 96. 10.

To which I anſwer: Theſe Places ſpeak of the World in general, and not particularly of our Earth; and therefore may as well prove the Immobility of the Heavens, they being the greateſt part of the World; in compariſon to which, our Earth is but as an inſenſible point.

If you reply, that the Word in theſe Places is to be underſtood by a *Synechdoche*, as being meant only of this Habitable World, the Earth:

I anſwer: Firſt, this is only ſaid, not proved: Secondly, *David* but a little before ſeems to make a difference between the World and the Earth, *Pſal.* 90. 2. where he ſays, *Before thou badſt formed the Earth and the World.* But Thirdly, in another Place there is the ſame Original Word apply'd expreſly to the Heavens; and which is yet more, the ſame Place does likewiſe mention this ſuppoſed Settledneſs of the Earth, *Prov.* 3. 19. *The Lord by Wiſdom hath founded the Earth; and by Underſtanding hath he eſtabliſhed the Heavens.* So that theſe Places can no more prove an Immobility in the Earth than in the Heavens.

If you yet reply, That by the Heavens there is meant the Seat of the Bleſſed, which does not move with the reſt:

I anſwer: Though by ſuch an Evaſion a Man might poſſibly avoid the force of this Place; yet, Firſt, 'tis but a groundleſs ſhift, becauſe then that Verſe will not contain a full enumeration of the Parts in the World, as may ſeem more agreeable to the Intention of it; but only ſhew, that God created this Earth where we live,

live, and the Heaven of Heavens. So that the Heaven of the Stars and Planets ſhall be ſhifted out from the number of the other Creatures. Secondly, there is another place which cannot be ſo avoided, *Pſal.* 89. 37. where the Pſalmiſt uſes this Expreſſion, יכון *It ſhall be eſtabliſhed as the Moon.* So *Pſal.* 8. 4. *The Moon and the Stars,* אשר כוננתה *which thou haſt eſtabliſhed.* Thus likewiſe, *Prov.* 8. 27. *when he eſtabliſhed the Heavens:* And in the next Verſe, our *Engliſh* Tranſlation reads it, *when he eſtabliſhed the Clouds.* And yet our Adverſaries will affirm the Moon, and Stars, and Clouds to be ſubject unto Natural Motions: Why then ſhould the very ſame Expreſſions be counted as ſufficient Arguments to take it away from the Earth?

If it be replied, That by eſtabliſhing the Heavens, is meant only the holding of them up, that they do not fall down to us (as *Lorinus* explains that in the Eighth *Pſalm*, and quotes *Euthymius* for the ſame Interpretation;) *fundandi verbum ſignificat decidere non poſſe, aut dimoveri a loco ubi collocata ſunt.* I anſwer, why may not we as well interpret the Words thus of the Earth; ſo that by eſtabliſhing of it, is meant only the keeping of it up in the vaſt Places of the open Air, without falling to any other Place.

Lorinus Comment. in Pſal. 8.

From hence it is plain, That theſe Scriptures are to be underſtood of ſuch an Immobility in the Earth, as may likewiſe agree with the Heavens: The ſame Original Word being ſo promiſcuouſly applied to both.

Ay, but (you will ſay) there are ſome other Places which do more peculiarly apply this Settledneſs and Eſtabliſhment to the Earth. So *Pſal.* 119. 90. *Thy faithfulneſs is unto all generations: Thou haſt eſtabliſhed the Earth, and it abideth.* Thus likewiſe, *Pſal.* 104. 5. *Who laid the foundations of the Earth, that it ſhould not be removed for ever.* The latter of which, being well weighed in its Original (ſaith Mr. *Fuller*) does in three Em-

Miſcel. l.1 cap. 15.

Emphatical Words ſtrongly conclude the Earth's Immobility.

As Firſt, when he ſays יסד *fundavit*, he hath founded it; wherein it is implied, that it does not change his Place. To which may be added all thoſe Texts, which ſo frequently ſpeak of *the foundations of the Earth*; as alſo that Expreſſion of the *Pſalmiſt*, where he mentions *the Pillars of the Earth*, *Pſal.* 75. 3.

The Second Word is בכונה tranſlated *Baſis*; and by the *Septuagint*, ὅτι τῷ ἀσφάλειαν δοῦναι; that is, he hath founded it upon its own Firmneſs; and therefore it is altogether without Motion.

The Third Expreſſion is בל-תמוט from the Root מוט which ſignifies, *declinare*; implying, that it could not wag with the leaſt kind of Declination.

To theſe I anſwer ſeverally:

Firſt, for the word, יסד *fundavit*, it cannot be underſtood properly, as if the natural Frame of the Earth, like other artificial Buildings, did need any Bottom to uphold it; for *he hangeth the earth upon nothing*, *Job* 26. 7. But it is a *Metaphor*, and ſignifies God's placing or ſituating this Globe of Land and Water. As *David* tells us of *the Pillars of the earth*; ſo *Job* mentions *Pillars of the Heavens*, *Job* 26. 11. And yet that will not prove them to be immoveable.

True indeed, we read often concerning the Foundations of the Earth: But ſo we do likewiſe of the Ends, Sides, and Corners of the Earth; and yet theſe Scriptures will not prove it to be of a long or ſquare Form. Beſides, we read alſo of the Foundations of Heaven, מוסדות 2 *Sam.* 22. 8. And yet we muſt not hence infer, that they are without all Motion: As alſo of the *planting of the Heavens*, *Iſa.* 51. 6. which may as well prove them to be immoveable, as that which follows in the ſame Verſe concerning the Foundations of the Earth.

Which Phraſe (if I have obſerved right) in ſeveral Places of Scripture, is to be underſtood according to theſe three Interpretations. 1. It

1. It is taken sometimes for the lower Parts of the Earth, as appears by that Place, 2 *Sam.* 22. 16. *The channels of the Sea appeared, the foundations of the World were discovered.* So *Psal.* 18. 15.

2. Sometimes for the Beginning and first Creation of it. *Isa.* 40. 2. *Hath it not been told you from the beginning, have ye not understood from the foundations of the Earth?* And in many other Places, *Before the Foundations of the World was laid*; that is, before the first Creation. Joh. 17. 24. Ephes. 1. 4.

3. Sometimes it signifies the Magistrates and chief Governors of the Earth. So, many interpret that Place in *Micah*, where 'tis said, 6. 2. *Hear O ye mountains the Lord's controversy, and ye strong foundations of the Earth.* So *Psal.* 82. 5. *The foundations of the Earth are out of course*; and in *Sam.* 2. 8. They are called Pillars. *For the Pillars of the Earth are the Lords, and he hath set the World upon them.* Hence it is, that the *Hebrews* derive their Word for Master, or Lord, from a Root which signifies a *Basis* or Bottom. אדון, *ab* אדן. And the *Greek* Word for King, does in its Primitives import as much as the Foundation of the People, βάσιλεύς, *quasi* βάσις τοῦ λαοῦ. But now, none of all the several Interpretations of this Phrase, will in the least manner conduce to the Confirmation of the present Argument. *Etimol. mag.*

As for the Second Word, מכונתה *Basis ejus*: I answer, the proper Signification of it, is *locus dispositus, sedes*, or *statio*, an appointed Seat or Station; and according to this Sense, is it most frequently used in Scripture. And therefore, the Heavens are sometimes called מכון the Seat of God's Habitation. And for this Reason likewise, do *Aquila* and *Symmachus* translate it by the Word ἕδρα, a Seat or appointed Situation, which may as well be attributed to the Heavens.

The Third Expression is בל תמוט, that it should not be moved, from the Primitive מוט, which does not signifie barely to move, but *declinare*, or *vacillare*, to decline or slip aside from its usual Course. Thus is it used

uſed by *David*, *Pſal.* 17. 5. where he prays, *Hold up my goings in thy paths,* בל נמטו פעמי *That my footſteps ſlide not*: He does not mean that his Feet ſhould not move. So *Pſal.* 121. 3. *He will not ſuffer thy foot to be moved.* Thus likewiſe, *Pſal.* 16. 8. *Becauſe the Lord is at my right hand, I ſhall not be moved.* Which laſt Place is tranſlated in the New Teſtament by the *Greek* Word σαλεύω, which ſignifies *fluctuare*, or *vacillare*, to be ſhaken by ſuch an uncertain Motion as the Waves of the Sea. Now as *David's* Feet may have their uſual Motion, and yet in this Senſe be ſaid not to move, that is, not to decline or ſlip aſide; ſo neither can the ſame Phraſe applied to the Earth, prove it to be immoveable.

Act. 2. 25.

Nor do I ſee any Reaſon, why that of *Didacus Aſtunica* may not be truly affirmed, That we may prove the natural Motion of the Earth, from that Place in *Job* 9. 6. *Qui commovet terram e loco ſuo*, as well as its Reſt and Immobility from theſe.

Comment. in Job.

From all which, it is very evident, that each of theſe Expreſſions, concerning the founding or eſtabliſhing both of Heaven or Earth, were not intended to ſhew the Unmoveableneſs of either; but rather, to manifeſt the Power and Wiſdom of Providence, who had ſo ſettled theſe Parts of the World in their proper Situations, that no natural Cauſe could diſplace them, or make them decilne from their appointed Courſe. As for ſuch who do utterly diſlike all new Interpretation of Scripture, even in ſuch Matters as do meerly concern Opinion, and are not fundamental, I would only propoſe unto them a Speech of St. *Hierom*, concerning ſome that were of the ſame Mind in his Time. *Cum novas ſemper expetant voluptates, & gulæ eorum vicina Marianon ſufficiant, cur in ſolo ſtudio Scripturarum, veteri ſapore contenti ſunt.*

Thus have I in ſome meaſure cleared the chief Arguments from Scripture, againſt this Opinion. For which notwithſtanding, I have not thence cited any;

be-

becauſe I conceive the Holy Writ, being chiefly intended to inform us of ſuch things as concern our Faith and Obedience, we cannot thence take any proper Proof for the Confirmation of Natural Secrets.

PROP. VI.

That there is not any Argument from the Words of Scripture, Principles of Nature, or Obſervations in Aſtronomy, which can ſufficiently evidence the Earth to be in the Centre of the Univerſe.

OUR Adverſaries do much inſult in the ſtrength of thoſe Arguments which they conceive do unanſwerably conclude the Earth to be in the Centre of the World. Whereas, if they were but impartially conſidered, they would be found altogether inſufficient for any ſuch Concluſion, as ſhall be clearly manifeſted in this following Chapter.

The Arguments which they urge in the Proof of this, are of Three ſorts; Either ſuch as are taken,

1. From Expreſſions of Scripture.
2. From Principles of Natural Philoſophy.
3. From common Appearances in Aſtronomy.

Thoſe of the firſt kind are chiefly Two: The firſt is grounded on that common Scripture-Phraſe, which ſpeaks of the Sun, as being above us. So *Solomon* often mentioning human Affairs, calls them, *the works which are done under the Sun.* From whence it appears, that the Earth is below it, and therefore nearer to the Centre of the *Univerſe*, than the Sun. *Eccleſ.* 1. 14, &c.

I anſwer: Though the Sun in compariſon to the abſolute Frame of the World, be in the midſt; yet this does not hinder, but that in reſpect to our Earth, he may be truly ſaid to be above it; becauſe we uſually meaſure

measure the height or lowness of every thing, by its being further off, or nearer unto this Centre of our Earth. From which, since the Sun is so remote, it may properly be affirmed that we are under it, though notwithstanding that be in the Centre of the World.

A second Argument of the same kind, is urged by *Fromondus.*

Antar. c. 12. item Vesta. tract. 5. c. 2.

'Tis requisite, that Hell (which is in the Center of the Earth) should be most remotely situated from the Seat of the Blessed. But now this Heaven, which is the Seat of the Blessed, is Concentrical to the Starry Sphere: And therefore it will follow, that our Earth must be in the midst of this Sphere; and so consequently in the Center of the World.

I answer: This Argument is grounded upon these Uncertainties;

1. That Hell must needs be situated in the Center of our Earth.

2. That the Heaven of the Blessed must needs be Concentrical to that of the Stars.

3. That Places must be as far distant in Situation as in Use.

Which because they are taken for granted, without any Proof, and are in themselves but weak and doubtful; therefore the Conclusion (which always follows the worser part) cannot be strong, and so will not need any other Answer.

The second sort of Arguments taken from Natural Philosophy, are principally these Three.

Arg. 1. 1. First, from the Vileness of our Earth, because it consists of a more sordid and base Matter than any other part of the World; and therefore must be situated in the Center, which is the worst place, and at the greatest distance from those purer incorruptible Bodies, the Heavens.

I answer: This Argument does suppose such Propositions for Grounds, which are not yet proved, and therefore not to be granted. As, 1. That

1. That Bodies must be as far distant in Places, as in Nobility.

2. That the Earth is of a more ignoble Substance than any of the other Planets, consisting of a more base and vile Matter.

3. That the Center is the worst Place.

All which are (if not evidently false) yet very uncertain.

2. From the Nature of the Center, which is the place of Rest, and such as in all Circular Motions is its self immovable, and therefore will be the fittest Situation for the Earth; which by reason of its heaviness, is naturally unfit for Motion. *Arg.* 2.

I answer: This Argument likewise is grounded upon these Two false Foundations; As,

1. That the whole Frame of Nature does move round, excepting only the Earth.

2. That the whole Earth, considered as whole, and in its proper Place, is heavy, or more unfit for a Natural Motion, than any of the other Planets.

Which are so far from being such general Grounds from which Controversies should be discussed, that they are the very thing in Question betwixt us and our Adversaries.

3. From the Nature of all heavy Bodies, which is to fall towards the lowest Place. From whence they conclude, that our Earth must be in the Center. *Arg.* 3.

I answer: This may prove it to be a Center of Gravity, but not of Distance, or that it is in the midst of the World. Yea, (but say our Adversaries) *Aristotle* for this urges a Demonstration, which must needs be infallible. Thus the Motion of light Bodies does apparently tend upward towards the Circumference of the World: But now the Motion of heavy Bodies is directly contrary to the ascent of the other; wherefore it will necessarily follow, that these do all of them tend unto the Center of the World.

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I anſwer: Though *Ariſtotle* were a Maſter in the Art of *Syllogiſms*, and he from whom we received the Rules of Diſputation; yet in this Particular, 'tis very plain that he was deceived with a Fallacy, whilſt his Argument does ſuppoſe that which it does pretend to prove.

That light Bodies do aſcend unto ſome Circumference which is higher and above the Earth, is plain and undeniable. But that this Circumference is the ſame with that of the World, or Concentrical unto it, cannot be reaſonably affirmed, unleſs he ſuppoſe the Earth to be in the Center of the *Univerſe*, which is the thing to be proved.

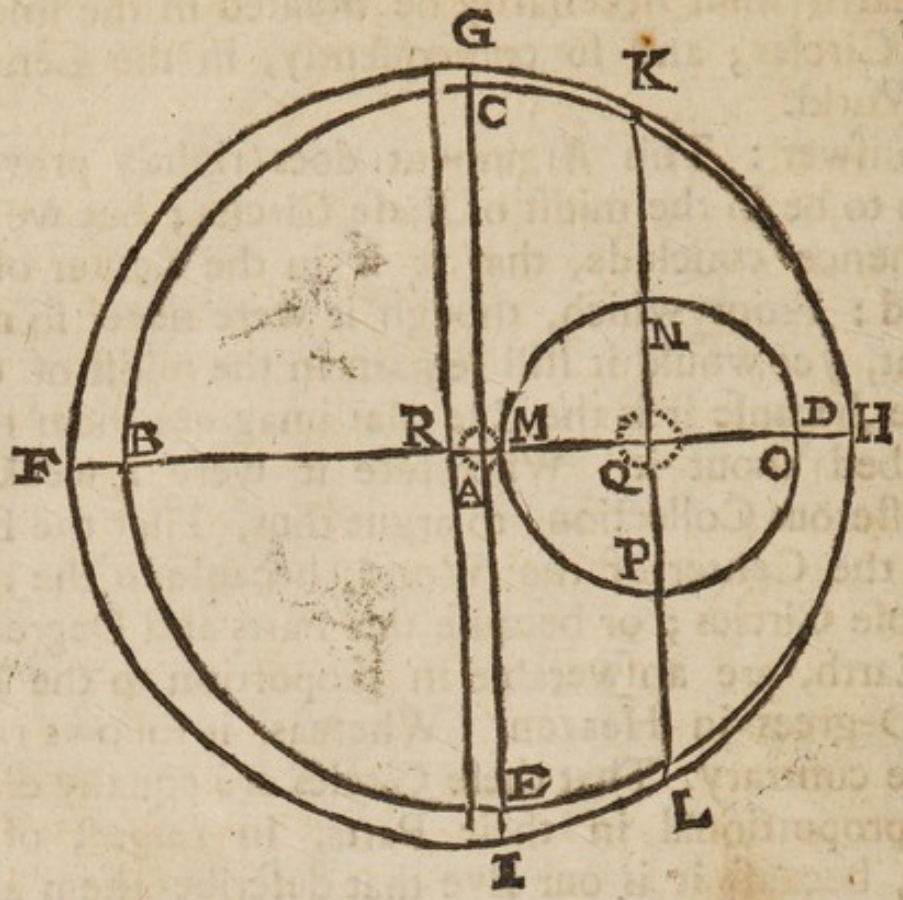
I would fain know from what Grounds our Adverſaries can prove, that the Deſcent of heavy Bodies is to the Center; or the Aſcent of light Bodies, to the Circumference of the World. The utmoſt Experience we can have in this kind, does but extend to thoſe things that are upon our Earth, or in the Air above it. And alas! what is this unto the vaſt Frame of the whole *Univerſe*, but *punctulum*, ſuch an inſenſible Point, which does not bear ſo great a proportion to the whole, as a ſmall Sand does unto the Earth. Wherefore it were a ſenſeleſs thing, from our Experience of ſo little a part, to pronounce any thing infallibly concerning the Situation of the whole. The Arguments from *Aſtronomy*, are chiefly theſe Four; each of which are boaſted of to be unanſwerable.

Arg. 1. 1. The *Horizon* does every where divide all the great Circles of a Sphere into two equal Parts; ſo there is always half the Equinoctial above it, and half below. Thus likewiſe, there will conſtantly be ſix Signs of the *Zodiack* above the *Horizon*, and other ſix below it. And beſides, the Circles of the Heaven and Earth are each way proportionable to one another; as Fifteen *German* Miles on the Earth, are every where agreeable to one Degree in the Heavens; and one Hour in the Earth, is correſpondent to Fifteen Degrees in the

he *Equator*. From whence it may be inferred, that he Earth muſt neceſſarily be ſituated in the midſt of heſe Circles; and ſo conſequently, in the Center of he World.

I anſwer: This Argument does rightly prove the Earth to be in the midſt of theſe Circles; but we cannot hence conclude, that it is in the Center of the World: From which, though it were never ſo much diſtant, yet would it ſtill remain in the midſt of thoſe Circles, becauſe it is the Eye that imagines them to be deſcribed about it. Wherefore it were a weak and preposterous Collection, to argue thus, That the Earth s in the Center of the World, becauſe in the midſt of thoſe Circles; or becauſe the Parts and Degrees of he Earth, are anſwerable in proportion to the Parts nd Degrees in Heaven. Whereas, it follows rather on the contrary, That theſe Circles are equally diſtant nd proportional in their Parts, in reſpect of the Earth, becauſe it is our Eye that deſcribes them about he Center of it.

So that though a far greater part of the World did appear at one time than at another, yet in reſpect of thoſe Circles which our Eye deſcribes about the Earth, all that we could ſee at once, would ſeem to be but a perfect Hemiſphere; as may be manifeſted by this following Figure.



Where if we ſuppoſe *A* to be our Earth, *B C D* one of the great Circles which we fancy about it *F G H I* the Orb of fixed Stars, *R* the Center o them: Now though the Ark *G F I* be bigger than th other *G H I*, yet notwithſtanding, to the Eye on th Earth *A*, one will appear a Semicircle as well as th other; becauſe the Imagination does transfer all thoſ Stars into the leſſer Circle *B C D E*, which it doe fancy to be deſcribed above that Center. Nay, th there were a habitable Earth at a far greater diſtanc from the Center of the World, even in the place o *Jupiter*, as ſuppoſe at *Q*; yet then alſo would there b the ſame Appearance. For though the Ark *K F L* i the Starry Heaven, were twice as big as the othe *K H L*, yet notwithſtanding at the Earth *Q* the would both appear but as equal Hemiſpheres, bein transferred into that other Circle *M N O P*, which part of the Sphere that the Eye deſcribes to it ſelf abo that Earth.

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From whence we may plainly discern, That though the Earth be never so far distant from the Center of the World, yet the Parts and Degrees of that imaginary Sphere about it, will always be proportional to the Parts and Degrees of the Earth.

2. Another Demonstration like unto this former, frequently urged to the same purpose, is this. If the Earth be out of the Center of the World, then must it be situated in one of these Three Positions: Either in the *Equator*, but out of the *Axis*; or 2*dly*, in the *Axis*, but out of the *Equator*; or 3*dly*, besides both of them. But it is not placed according to any of these Situations, therefore must it needs be in the Center. *Arg.* 2. *Vid. Carp. Geog. l.* 1. *c.* 5.

1. 'Tis not in the *Equator*, and beside the *Axis*: For then, 1*st*, there will be no *Equinox* at all in some Places, when the Days and Nights shall be of an equal length; 2*dly*, the Afternoons and Forenoons will not be of the same length; because, then our Meridian Line must divide the *Hemisphere* into unequal Parts.

2. 'Tis not in the *Axis*, but out of the *Equator*; for then, first, the *Equinox* would not happen when the Sun was in the middle Line betwixt the two *Solstices*, but in some other Parallel, which might be nearer to one of them, according as the Earth did approach to one *Tropick* more than another. Secondly, there would not be such a proportion between the increase and decrease of Days and Nights, as now there is.

3. 'Tis not besides both of them: For then, all these Inconveniencies, and sundry others must with the same necessity of Consequence be inferred. From whence it will follow, That the Earth must be situated there where the *Axis* and *Equator* meet, which is in the Center of the World.

To this we grant, that the Earth must needs be placed both in the *Axis* and *Equator*; and so consequently, in the Center of that Sphere which we imagine about it. But yet this will not prove, that it is in the

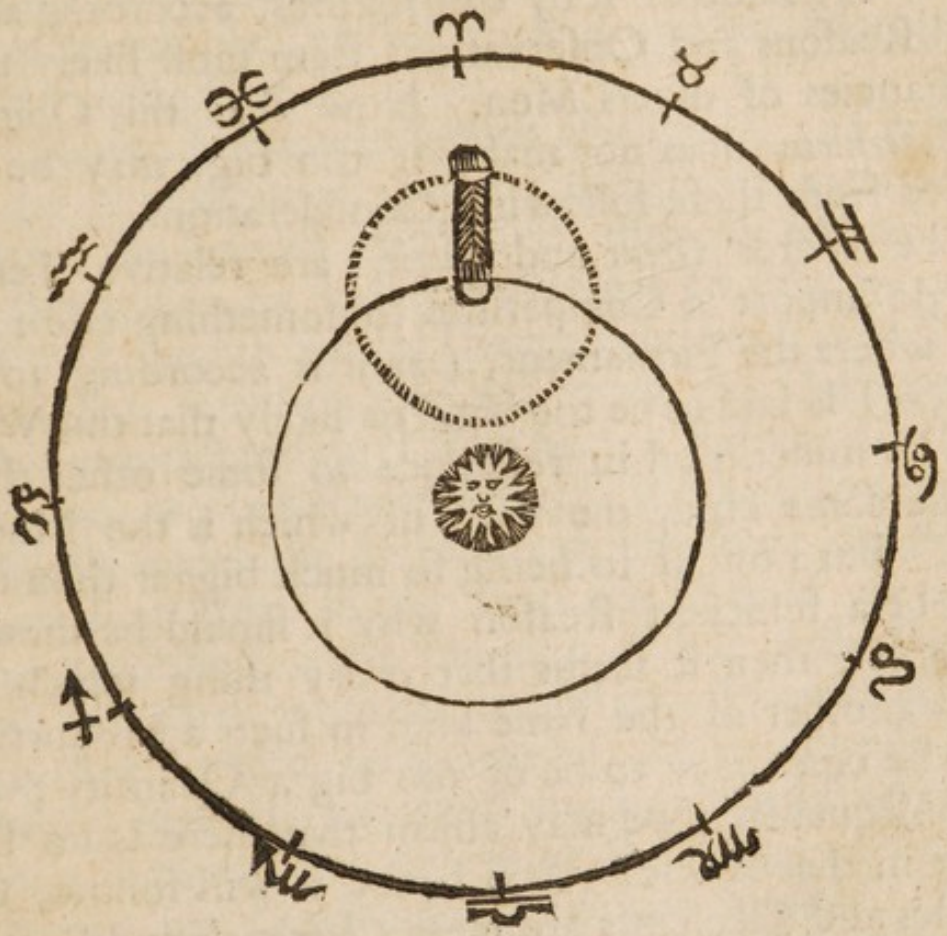
midſt of the *Univerſe*: For let our Adverſaries ſuppoſe it to be as far diſtant from that, as they conceive the Sun to be; yet may it ſtill be ſituated in the very Concourſe of theſe two Lines; becauſe the *Axis* of the World is nothing elſe, but that imaginary Line which paſſes through the Poles of our Earth, to the Poles of the World. And ſo likewiſe the *Equator* is nothing elſe but a great Circle in the midſt of the Earth, betwixt both the Poles, which by Imagination is continued even to the fixed Stars. Thus alſo, we may affirm the Earth to be in the Plane of the *Zodiack*, if by its Annual Motion it did deſcribe that imaginary Circle: And in the Plane of the *Equator*, if by its Diurnal Motion about its own *Axis*, it did make ſeveral Parallels, the midſt of which ſhould be the *Equator*. From whence it appears, that theſe two former Arguments proceed from one and the ſame Miſtake; whilſt our Adverſaries ſuppoſe the Circumference and Center of the Sphere, to be the ſame with that of the World.

Arg. 3. Another Demonſtration of the ſame kind, is taken from the Eclipſes of the Sun and Moon; which would not always happen when theſe two Luminaries are Diametrically oppoſed, but ſometimes when they are leſs diſtant than a Semicircle, if it were ſo that the Earth were not in the Center.

I anſwer: This Argument, if well conſidered, will be found moſt directly to infer this Concluſion; That in all Eclipſes, the Earth is in ſuch a ſtrait Line (betwixt the two Luminaries) whoſe Extremities do point unto oppoſite parts of the *Zodiack*. Now, tho' our Adverſaries ſhould ſuppoſe (as *Copernicus* does) the Earth to be ſituated in that which they would have to be the Sun's Orb; yet would there not be any Eclipſe, but when the Sun and Moon were Diametrically oppoſite, and our Earth betwixt them; as may clearly be manifeſted by this Figure, where you ſee the two Luminaries in oppoſite Signs: And according as any

part

part of our Earth is ſituated by its Diurnal Revolution, ſo will every Eclipſe be either viſible, or not viſible unto it.



The laſt and chief Argument, is taken from the appearance of the Stars; which in every Horizon, at each Hour of the Night, and at all times of the Year, ſeem of an equal bigneſs. Now this could not be, if our Earth were ſometimes nearer unto them by 2000000 *German* Miles, which is granted to be the Diameter of that Orb wherein the Earth is ſuppoſed to move. *Arg.* 4. *Ariſt. de cælo. lib.* 2. *c.* 14.

I anſwer: This Conſequence will not hold, if we affirm the Earth's Orb not to be big enough for the making of any ſenſible difference in the appearance of the fixed Stars.

Yea, but (you will ſay) 'tis beyond Conceit, and without all Reaſon, to think the fixed Stars of ſo vaſt a diſtance from us, that our approaching nearer unto them *Copern. l.* 1 *cap.* 5, 6.

them by 2000000 *German* Miles, cannot make any difference in the ſeeming Quantity of their Bodies.

I reply: There is no certain way to find out the exact diſtance of the Starry Firmament; but we are fain to conclude of it by Conjectures, according as ſeveral Reaſons and Obſervations ſeem moſt likely unto the Fancies of divers Men. Now that this Opinion of *Copernicus* does not make it too big, may be diſcerned from theſe following Conſiderations.

The Words *Great* and *Little*, are relative Terms, and do import a Compariſon to ſomething elſe: So that where the Firmament, (as it is according to *Copernicus*) is ſaid to be too big, 'tis likely that this Word is to be underſtood in reference to ſome other thing of the ſame kind, the leaſt of which is the Moon's Orb. But now if its being ſo much bigger than this, may be a ſufficient Reaſon why it ſhould be thought too great, then it ſeems that every thing which exceeds another of the ſame kind in ſuch a proportion, may be concluded to be of too big a Quantity; and ſo conſequently, we may affirm that there is no ſuch thing in the World. And hence it will follow, that Whales and Elephants are meer *Chimæra's*, and Poetical Fictions, becauſe they do ſo much exceed ſo many other Living Creatures. If all this eighth Sphere, (ſaith *Galilæus*) as great as it is, were a light Body, and placed ſo far from us that it appeared but as one of the leſſer Stars, we ſhould then eſteem it but little; and therefore we have no reaſon now to thruſt it out from being amongſt the Works of Nature, by reaſon of its too great Immenſity. 'Tis a frequent Speech of our Adverſaries, *Tycho*, *Fromondus*, and others, in excuſe of that incredible Swiftneſs which they imagine in their *primum mobile*, That 'twas requiſite the Motion of the Heavens ſhould have a kind of Infinity in it, the better to manifeſt the Infiniteneſs of the Creator. And why may not we as well affirm this concerning the Bigneſs of the Heavens? *Difficilius eſt accidens præ-*

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ter modulum ſubjecti intendere, quam ſubjectum ſine accidente augere (ſaith *Keplar.*) His Meaning is, that 'tis leſs abſurd to imagine the eighth Sphere of ſo vaſt a bigneſs, as long as it is without Motion, or at leaſt has but a very ſlow one; than to attribute unto it ſuch an incredible Celerity, as is altogether diſproportionable to its Bigneſs.

2. 'Tis the Acknowledgment of *Clavius*, and might eaſily be demonſtrated, That if the Center were faſtned upon the Pole of the World, the Orb wherein he ſuppoſes the Sun to move would not be able to reach ſo far in the eighth Sphere (being conſidered according to *Ptolomy*'s *Hypotheſis*) as to touch the Pole-Star; which notwithſtanding (ſaith he) is ſo near the Pole it ſelf, that we can ſcarce diſcern it to move: Nay, that Circle which the Pole-Star makes about the Pole, is above Four times bigger than the Orb of the Sun. So that according to the Opinion of our Adverſaries, though our Earth were at that diſtance from the Center, as they ſuppoſe the Sun to be, yet would not this *Eccentricity* make it nearer to any one part of the Firmament, than the Pole-Star is to the Pole; which according to his Confeſſion, is ſcarce ſenſible. And therefore according to their Opinion, it would cauſe very little difference in the appearance of thoſe Stars, the biggeſt of which does not ſeem to be of above five Seconds in its Diameter.

Comment. in Sphær. cap. 1.

3. 'Tis conſiderable, That the Spheres of *Saturn*, *Jupiter*, *Mars*, are, according to the general Opinion, of very great Extenſion; and yet each of them is appointed only to carry about its particular Planet, which are but very little in compariſon of the fixed Stars. Now if for the Situation of theſe fixed Stars, there ſhould be allotted a proportionable part of the World, 'tis certain that their Orb muſt be far bigger than it is commonly ſuppoſed, and very near to this Opinion of *Copernicus*.

4. We uſually judge the bigneſs of the higher Orbs by their different Motions: As becauſe *Saturn* finiſhes his Courſe in Thirty Years, and *Jupiter* in Twelve, therefore we attribute unto thoſe Orbs ſuch a different proportion in their Bigneſs. Now if by this Rule we would find out the Quantity of the eighth Sphere, we ſhall diſcern it to be far nearer unto that Bigneſs which *Copernicus* ſuppoſeth it to have, than that which *Ptolomy*, *Tycho*, and others ordinarily aſcribe unto it: For the Starry Heaven (ſay they) does not finiſh his Courſe under 26000 Years; whereas *Saturn*, which is next unto it, does compaſs his Orb in Thirty Years. From whence it will probably follow, that there is a very great diſtance betwixt theſe in place, becauſe they have ſuch different Terms of their Revolutions.

But againſt this Anſwer unto the laſt Argument, our Adverſaries thus reply:

Fromond. Veſta. tract. 5. cap. 1. 1. If the fixed Stars are ſo far diſtant from us, that our approaching nearer unto them by 1000000 *German* Miles, does not make any ſenſible difference in their appearance; then *Galilæus*'s Perſpective could not make them ſeem of a bigger Form than they do to the bare Eye, which yet is contrary to common Experience.

Ibid. 2 From hence it may be inferred, That the leaſt fixed Star is bigger than all this Orb wherein we ſuppoſe the Earth to move; becauſe there is none of them but are of a ſenſible Bigneſs in reſpect of the Firmament, whereas this it ſeems is not.

Ibid. 3. Since God did at firſt create the Stars *for the uſe of all Nations that are under the whole Heavens*, Deut. 4. 19 it might have argued ſome Improvidence in him, if he had made them of ſuch vaſt Magnitudes; whereas they might as well beſtow their Light and Influences and ſo conſequently be as ſerviceable to that end for which they were appointed, if they had been made with leſs Bodies, and placed nearer unto us. And 'tis a common *Maxim*, that Nature in all her Operations

does

does avoid Superfluities, and use the most compendious Way.

I answer:

1. To the First, whether the Perspective do make the fixed Stars appear bigger than they do to the bare Eye, cannot certainly be concluded, unless we had such an exact Glass, by which we might try the Experiment. But if in this kind we will trust the Authority of others, * *Keplar* tells us from the Experience of skilful Men, that the better the Perspective is, by so much the less will the fixed Stars appear through it, being but as meer Points, from which the Beams of Light do disperse themselves like Hairs. And 'tis commonly affirmed by others, that the Dog-star, which seems to be the biggest Star amongst those of the first Magnitude, does yet appear through this Glass but as a little Point no bigger than the fiftieth Part of *Jupiter*. Hence it is, that though the common Opinion hold the Stars of the first Magnitude to be two Minutes in their Diameter, and *Tycho* three; yet † *Galilæus*, who hath been most versed in the Experiments of his own Perspective concludes them to be but five Seconds.

* *Astron. Copern. lib. 4. par. 1.*

† *System. mundi, Coll. 3.*

2. To the Second: First we affirm, the fixed Stars to be of a vast Magnitude. But however, this Argument does not induce any Necessity that we should conceive them so big as the Earth's Orb. For it might easily be proved, that though a Star of the Sixth Magnitude were but equal in Diameter unto the Sun (which is far enough from the Greatness of the Earth's Orb;) yet the starry Heav'n would be at such a distance from us, that the Earth's Annual Motion could not cause any Difference in its Appearance.

Suppose the Diameter of the Sun to be about half a Degree, as our Adversaries grant; whereas a Star of the Sixth Magnitude is 50 Thirds, which is comprehended in that of the Sun 2160 Times. Now if the Sun were removed so far from us, that its Diameter would seem but as one of that number whereof it now

Vid. Gal. Ibid.

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contains 2160; then muſt his Diſtance from us, be 2160 times greater than now it is: Which is all one, as if we ſhould ſay, that a Star of the Sixth Magnitude is ſevered from us by ſo many Semidiameters of the Earth's Orb. But now according to common Conſent, the Diſtance of the Earth from the Sun, does contain 128 Semidiameters of the Earth, and (as was ſaid before) this ſuppoſed Diſtance of the fixed Stars does comprehend 2160 Semidiameters of the Earth's Orb. From whence it is manifeſt, that the Semidiameter of the Earth, in compariſon to its Diſtance from the Sun, will be almoſt doubly bigger than the Semidiameter of the Earth's Orb, in compariſon to this Diſtance of the Stars. But now, the Semidiameter of the Earth, does make very little difference in the Appearance of the Sun, becauſe we ſee common Obſervations upon the Surface of it, are as exactly true to the Senſe, as if they were made from the Centre of it. Wherefore, that Difference which would be made in theſe fixed Stars, by the Annual Courſe of the Earth, muſt needs be much more unobſervable, or rather altogether inſenſible.

2. The Conſequence of this Argument is grounded upon this falſe Suppoſition, That every Body muſt neceſſarily be of an equal Extenſion to that Diſtance from whence there does not appear any ſenſible difference in its Quantity. So that when I ſee a Bird flying ſuch a height in the Air, that my being nearer unto it, or farther from it, by Ten or Twenty Foot, does not make it ſeem unto my Eyes either bigger or leſs; then I may conclude, that the Bird muſt needs be either Ten or Twenty Foot thick: Or when I ſee the Body of a Tree that may be half a Mile from me, and perceive that my approaching nearer to it by 30 or 40 Paces, does not ſenſibly make any different Appearance, I may then infer, that the Tree is Forty Paces thick; with many the like abſurd Conſequences,

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hat would follow from that Foundation upon which his Argument is bottomed.

To the Third I anſwer: 'Tis too much Preſumption, to conclude that to be Superfluous, the Uſefulneſs of which we do not underſtand. There be many ſecret ends in theſe great Works of Providence, which human Wiſdom cannot reach unto; and as *Solomon* ſpeaks of thoſe things that are under the Sun, ſo may we alſo of thoſe things that are above it; *That no man can find out the Works of God; for though a man labour to ſeek it out*, yea further, *Though a wiſe man think to know it, yet ſhall he not be able to find it.* He that hath moſt inſight into the Works of Nature, is not able to give a ſatisfying Reaſon, why the Planets or Stars ſhould be placed juſt at this particular Diſtance from the Earth, and no nearer or farther. And beſides, this Argument might as well be urged againſt the *Hypotheſis* of *Ptolomy* or *Tycho*, ſince the Stars, for ought we know, might have been as ſerviceable to us, if they had been placed far nearer, than either of thoſe Authors ſuppoſe them. Again, were there any force in ſuch a Conſequence, it would as well conclude a great Improvidence of Nature, in making ſuch a Multitude of thoſe leſſer Stars, which have lately been diſcovered by the Perſpective. For to what purpoſe ſhould ſo many Lights be created for the Uſe of Man, ſince his Eyes were not able to diſcern them? So that our Diſability to comprehend all thoſe ends which might be aimed at in the Works of Nature, can be no ſufficient Argument to prove their Superfluity. Though Scripture do tell us that theſe things were made for our Uſe, yet it does not tell us, that this is their only end. 'Tis not impoſſible, but that there may be elſewhere ſome other Inhabitants, by whom theſe leſſer Stars may be more plainly diſcerned. And (as was ſaid before) why may not we affirm that of the Bigneſs, which our Adverſaries do concerning the Motion of the Hea-

Eccleſ. 8. 17.

Heavens? That God, to ſhew his own Immenſity did put a kind of Infinity in the Creature.

There is yet another Argument to this purpoſe, urged by *Al. Roſſ.* which was not referred to any of the former kind, becauſe I could ſcarcely believe I did rightly underſtand it; ſince he puts it in the Front of his other Arguments, as being of Strength and Subtilty enough to be a Leader unto all the reſt; and yet in the moſt likely Senſe of it, 'tis ſo extremely ſimple to be preſſed in a Controverſy, that every Freſh-Man would laugh at it. The Words of it are theſe: *Quod minimum eſt in circulo debet eſſe centrum illius; at terra longe minor eſt Sole, & Æquinoctialis terreſtris eſt omnium in Coelo circulus minimus; ergo,* &c.

Lib. 1. Sect. 2. c. 1.

By the ſame reaſon, it would rather follow, that the *Moon* or *Mercury* were in the Centre, ſince both theſe are leſs than the Earth. And then, whereas he ſays that the Æquinoctial of the Earth is the leaſt Circle in the Heavens, 'tis neither true nor pertinent, and would make one ſuſpect, that he who ſhould urge ſuch an Argument, did ſcarce underſtand any thing in Aſtronomy.

There are many other Objections like unto this, not worth the citing: The chief of all have been already anſwered; by which you may diſcern, that there is not any ſuch great Neceſſity as our Adverſaries pretend, why the Earth ſhould be ſituated in the midſt of the Univerſe.

PROP. VII.

'Tis probable that the Sun is in the Centre of the World.

THE chief Reaſons for the Confirmation of this Truth, are implyed in the Conveniences of this

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Hypotheſis above any other; whereby we may reſolve the Motions and Appearances of the Heavens into more eaſie and natural Cauſes.

Hence will the Frame of Nature be freed from that Deformity which it has according to the Syſtem of *Tycho*; who though he make the Sun to be in the midſt of the Planets, yet without any good Reaſon denies it to be in the midſt of the fixed Stars; as if the Planets, which are ſuch eminent parts of the World, ſhould be appointed to move about a diſtinct Centre of their own, which was beſide that of the Univerſe.

Hence likewiſe are we freed from many of thoſe Inconveniences in the *Hypotheſis* of *Ptolemy*, who ſuppoſed in the Heavens, *Epicycles* and *Eccentricks*, and other Orbs, which he calls the Deferents of the *Apoge* and *Perige*. As if Nature in framing this great Engine of the World, had been put unto ſuch hard ſhifts, that ſhe was fain to make uſe of Wheels and Screws, and other the like artificial Inſtruments of Motion.

There be ſundry other particulars, whereby this Opinion concerning the Sun's being in the Centre, may be ſtrongly evidenced; which becauſe they relate unto ſeveral Motions alſo, cannot therefore properly be inſiſted on in this Place. You may eaſily enough diſcern them, by conſidering the whole Frame of the Heavens, as they are according to the Syſtem of *Copernicus*; wherein all thoſe probable Reſolutions that are given for divers Appearances amongſt the Planets, do mainly depend upon this Suppoſition, that the Sun is in the Centre. Which Arguments (were there no other) might be abundantly enough for the Confirmation of it. But for the greater Plenty, there are likewiſe theſe Probabilities conſiderable.

1. It

1. It may ſeem agreeable to Reaſon, that the Ligh which is diffuſed in ſeveral Stars through the Circum ference of the World, ſhould be more eminently con tained, and (as it were) contracted in the Cen ter of it, which can only be by placing the Sun there.

* *In prim. c. Spher.*

2. 'Tis an Argument of * *Clavius*, and frequently urged by our Adverſaries, That the moſt Natural ſituation of the Sun's Body was in the midſt, betwix the other Planets; and that for this Reaſon, becauſe from thence he might more conveniently diſtribute amongſt them both his Light and Heat. The force of which may more properly be apply'd to prove him in the Center.

3. 'Tis probable that the Planetary Orbs (which are ſpecial parts of the *Univerſe*) do move about the Center of the World, rather than about any other Center which is remote from it. But now 'tis evident that the Planets *Saturn*, *Jupiter*, *Mars*, *Venus*, *Mercury* do by their Motion encompaſs the Body of the Sun 'Tis likely therefore that this is ſituated in the midſt of the World.

As for the three upper Planets, 'tis found by Obſervation, that they are always neareſt to the Earth when in oppoſition to the Sun, and fartheſt from us when in conjunction with it; which difference is ſo eminent, that *Mars* in his *Perige* does appear ſixty times bigger than when he is in the *Apoge*, and at the greateſt diſtance.

Now, that the Revolution of *Venus* and *Mercury* alſo is about the Sun, may from hence be evidenced: Firſt, becauſe they are never at any great diſtance from him. Secondly, becauſe they are ſeen ſometimes above, and ſometimes below him. Thirdly, becauſe *Venus*, according to her different ſituation, does change her Appearance as the Moon.

4. There

4. There is yet another Argument, which † *Ariſtotle* himſelf does repeat from *Pythagoras*. The moſt excellent Body ſhould have the beſt place; but the Sun is the moſt excellent Body, and the Center is the beſt place; therefore 'tis likely the Sun is in the Center. In the Frame of Nature (which is ſuppoſed to be of an Orbicular Form) there are but two places of any eminency, the Circumference and the Centre. The Circumference being of ſo wide a Capacity, cannot ſo fitly be the peculiar Seat of a Body, that is ſo little in reſpect of it: And beſides, that which is the moſt Excellent part of the World, ſhould be equally preſerved in it ſelf, and ſhared in its Virtues by all the other parts, which can only be done by its being placed in the midſt of them. This is intimated unto us in that frequent Speech of *Plato*, that the Soul of the World does reſide in the innermoſt place of it: And that in * *Macrobius*, who often compares the Sun in the World to the Heart in a Living Creature.

† *De Cælo. l.* 2. *c.* 13.

* *Saturnal. l.* 1. *c.* 17, &c.

Unto this *Ariſtotle* anſwers by a diſtinction: There is *medium magnitudinis*, ſo the Centre is the middle of a Sphere, And there is *medium naturæ*, or *informationis*, which is not always the ſame with the other; for in this Senſe the Heart is the Middle of a Man; becauſe from thence (ſaith he) as from the Centre, the Vital Spirits are conveyed to all the Members: And yet we know that it is not the Centre of Magnitude, or at an equal diſtance from all the other parts.

And beſides, the Middle is the worſt place, becauſe moſt circumſcribed, ſince that is more excellent which does limit any thing, than that which is bounded by it. For this Reaſon is it, that *Matter* is amongſt thoſe Things which are terminated, and *Form*, that which does circumſcribe.

But againſt this Anſwer of *Ariſtotle*, it is again replyed:

1. Though

Keplar, Astr. Copern. l. 4. part. 2.

1. Though it be true, that in Living Creatures the best and chiefest part is not placed always just in the midst, yet this may be, because they are not of an Orbicular Form, as the World is.

2. Though that which bounds another Thing be more excellent than that which is terminated by it, yet this does not prove the Center to be the worst place, because that is one of the Terms or Limits of a Round Body, as well as the Circumference.

There are likewise other Arguments to this purpose, much insisted on by eminent Astronomers, taken from that Harmonical Proportion which there may be betwixt the several distance and bigness of the Orbs, if we suppose the Sun to be in the Centre.

Mæslin. præ. ad Narrat. Rhetici, Keplar, mysterium Cosmographicum.

For according to this (say they) we may conceive an Excellent Harmony both in the number and the distance of the Planets: (And if God made all other things *numero & mensurâ*, much more then those greater Works, the Heavens); for then the Five Mathematical Bodies, so much spoken of by * *Euclid*, will bear in them a proportion answerable to the several distances of the Planets from one another.

* *Lib.* 13. *prop.* 14, 15, &c.

Thus a *Cube* will measure the distance betwixt *Saturn* and *Jupiter*; a *Pyramis* or *Tetraëdron*, the distance betwixt *Jupiter* and *Mars*; a *Dodecaëdron*, the distance betwixt *Mars* and the Earth; an *Icosaëdron*, the distance betwixt the *Earth* and *Venus*; and an *Octaëdron* the distance betwixt *Venus* and *Mercury*; that is, if we conceive a Circumference described immediately without the *Cube*, and another within it, the distance between these two will shew what proportional distance there is betwixt the Orb of *Saturn*, and that of *Jupiter*. Thus also if you conceive a Circumference described on the outside of a *Pyramis* or *Tetraëdron*, and another within it, this will shew such a proportional distance as there is betwixt the Orb of *Mars* from that of *Jupiter*. And so of the rest.

Nov

Now if any ask why there are but ſix Planetary Orbs? *Keplar* anſwers: *Quia non oportet plures quàm quinque proportiones eſſe, totidem nempè quot regularia ſunt in Matheſi corpora. Sex autèm termini conſummant hunc proportionum numerum*. Becauſe there are but five Proportions, ſo many as there are Regular Bodies in Mathematicks, each of whoſe Sides and Angles are equal to one another. But now there are ſix Terms required to conſummate this number of Proportions; and ſo conſequently, there can be but ſix primary Planets.

Thus likewiſe by placing the Sun in the Center, we may conceive ſuch a proportion betwixt the Bodies of the Planets, as will be anſwerable unto their ſeveral Spheres: Then *Mercury*, which has the leaſt Orb, will have the leaſt Body; *Venus* bigger than that, but leſs than any of the other; our *Earth* bigger than *Venus*, but leſs than the reſt; *Mars* bigger than the *Earth*, but leſs than *Jupiter*; *Jupiter* bigger than *Mars*, and leſs than *Saturn*, *Saturn* being the higheſt, ſhould alſo be the biggeſt. All which Harmony would be diſturbed by putting in the Sun amongſt them; and therefore it may be more convenient for him to ſit ſtill in the Center.

There are ſundry other Arguments in this kind to be found out, by a Conſideration of this whole *Hypotheſis*: He that does rightly underſtand it, may therein eaſily diſcern many ſtrong Probabilities, why the Sun ſhould be in the midſt of the World, rather than in any other Poſition.

PROP. VIII.

That there is not any ſufficient Reaſon to prov the Earth incapable of thoſe Motions which Co pernicus aſcribes unto it.

THE two chief Motions in the World, which a more eſpecially remarkable above the reſt, a the *Diurnal*, and *Annual*.

The *Diurnal*, which makes the difference betwi Night and Day, is cauſed by the Revolution of o Earth upon its own *Axis*, in the ſpace of four ar twenty Hours.

The *Annual*, which makes the difference betwi Winter and Summer, is likewiſe cauſed by the Eart when being carried through the *Ecliptick* in its ow Orb, it finiſhes its Courſe in a Year.

The firſt is uſually ſtiled, *Motus revolutionis*: T ſecond, *Motus circumlationis*: There is likewiſe a thir which *Copernicus* calls, *Motus inclinationis*: But this b ing throughly conſidered, cannot properly be ſtiled Motion, but rather an Immutability, it being th whereby the *Axis* of the Earth does always keep p rallel to it ſelf, from which ſituation it is not his a nual Courſe that does make it in the leaſt manner decline.

As for the Difficulties which concern the Second theſe, they have been already handled in the Six Propoſition, where the Earth's *Eccentricity* was mai tained.

So that the chief buſineſs of this Chapter, is to d fend the Earth's Diurnal Motion, againſt the Ob ctions of our Adverſaries. Sundry of which Objec ons, to ſpeak (as the truth is) do bear in them a gr ſhew of probability, and ſuch too (as it ſeems) w very efficacious; ſince *Ariſtotle* and *Ptolomy*, *&c.* M

of Excellent Parts and Deep Judgments, did ground upon them, as being of infallible and neceſſary conſequence.

I ſhall reckon them up ſeverally, and ſet down ſuch Anſwers unto each, as may yield ſome ſatisfaction to every indifferent ſeeker of Truth.

1. Firſt then, 'tis objected from our Senſes; If the Earth did move, we ſhould perceive it. The Weſtern Mountains would then appear to aſcend towards the Stars, rather than the Stars to deſcend below them.

I anſwer: The Sight judges of Motion according as any thing does deſert the Plain whereon it ſelf is ſeated; which Plain every where keeping the ſame ſituation and diſtance, in reſpect of the Eye, does therefore ſeem immovable unto it, and the Motion will appear in thoſe Stars and parts of the Heaven, through which the Vertical Line does paſs.

The Reaſon of ſuch Deceit may be this: Motion being not a proper Object of the Sight, nor belonging to any other peculiar Senſe, muſt therefore be judged of by the *Senſus communis*, which is liable to miſtake in this reſpect; becauſe it apprehends the Eye it ſelf to reſt immovable, whilſt it does not feel any Effects of this Motion in the Body: As it is when a Man is carried in a Ship; ſo that Senſe is but an ill Judge of Natural Secrets. 'Tis a good Rule of *Plato*, Εἰς τὸν νῦν ἀφορᾷν δεῖ φιλόσοφον καὶ μὴ εἰς τὸ ὄψιν: A Philoſopher muſt not be carried away by the bare Appearance of things to Sight, but muſt examine them by Reaſon. If this were a good Conſequence, The Earth does not move, becauſe it does not appear ſo to us, we might then as well argue, That it does move when we go upon the Water, according to the Verſe:

Provehimur portu, terræque, urbesque recedunt.

Or if ſuch Arguments would hold, it were an eaſ matter to prove the Sun and Moon not ſo big as Hat, or the fixed Stars as a Candle.

Al. Roſſ. l. 1. ſect. 1. c. 1. Yea, but if the Motion of the Heavens be onl apparent, and not real, then the Motion of th Clouds will be ſo too, ſince the Eye may be as we deceived in the one as the other.

I anſwer: 'Tis all one, as if he ſhould infer that th Senſe was miſtaken in every thing, becauſe it was in one thing: And this would be an excellent Argu ment to prove that Opinion of *Anaxagoras*, that th Snow was black.

The Reaſon why that Motion which is cauſed b the Earth does appear as if it were in the Heavens, i becauſe the *Senſus communis* in judging of it, do conceive the Eye to be it ſelf immovable (as was ſai before) there being no Senſe that does diſcern the E fects of any Motion in the Body; and therefore does conclude every thing to move, which it does pe ceive to change its diſtance from it: So that the Clou do not ſeem to move ſometimes, when as notwith ſtanding they are every where carried about with ou Earth, by ſuch a ſwift Revolution; yet this can be n hindrance at all, why we may not judge aright their other particular Motions, for which there is n the ſame Reaſon. Tho to a Man in a Ship, the Tre and Banks may ſeem to move, yet it would be but weak Argument, to conclude from hence, that ther fore ſuch a one could not tell whether his Friend do really ſtir, whom he ſees to walk up and down in th Ship: Or that he might as well be deceived in judgin the Oars to move when they do not.

Ibid. 'Tis again reply'd by the ſame Objector, That it not credible the Eye ſhould be miſtaken in judging the Stars and Heavens; becauſe thoſe being lig

Bodie

Bodies, are the primary and proper Objects of that ense.

I anſwer: The Deceit here is not concerning the ight or Colour of thoſe Bodies, but concerning their Motion; which is neither the primary nor proper Object of the Eye, but reckoned amongſt the *Objecta Communia.*

2. Another Common Argument againſt this Motion, is taken from the Danger that would thence ariſe, nto all high Buildings, which by this would quickly e ruinated, and ſcattered abroad.

I anſwer: This Motion is ſuppoſed to be natural; *Coper. l. 1. c. 8.* nd thoſe Things which are according to Nature, have ontrary effects to other Matters, which are by force nd violence. Now it belongs unto Things of this tter kind to be inconſiſtent and hurtful; whereas noſe of the firſt kind muſt be regular, and tending o conſervation. The Motion of the Earth is always qual and like it ſelf; not by ſtarts and fits. If a Glaſs f Beer may ſtand firmly enough in a Ship, when it noves ſwiftly upon a ſmooth Stream, much leſs then vill the Motion of the Earth, which is more natural, nd ſo conſequently more equal, cauſe any danger unto thoſe Buildings that are erected upon it. And therefore to ſuſpect any ſuch Event, would be like the Fear f *Lactantius*, who would not acknowledge the being f any *Antipodes*, leſt then he might be forced to grant *Gilbert de Magn. l. 6. c. 5.* nat they ſhould fall down unto the Heavens. We ave equal Reaſon to be afraid of high Buildings, if e whole World above us were whirled about with ch a mad Celerity as our Adverſaries ſuppoſe; for en there would be but ſmall hopes that this little point f Earth ſhould eſcape from the reſt.

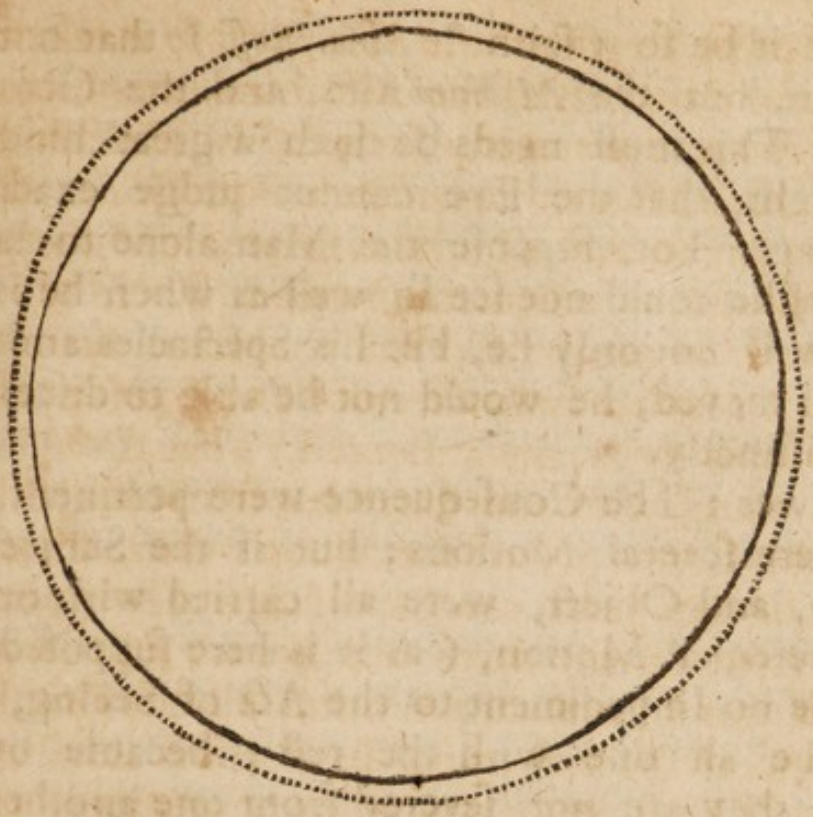
But ſuppoſing (ſaith * *Roſſe*) that this Motion were atural to the Earth, yet it is not natural to Towns nd Buildings, for theſe are artificial. * *Lib. 1. ſect. 1. c. 3.*

To which I anſwer: Ha, ha, he.

3. Another Argument to this purpoſe is taken fron the reſt and quietneſs of the Air about us; which coul not be, if there were any ſuch ſwift Motion of th Earth. If a Man riding upon a fleet Horſe, do pe ceive the Air to beat againſt his Face, as if there wer a Wind, what a vehement Tempeſt ſhould we cont nually feel from the *Eaſt*, if the Earth were turne about with ſuch a ſwift Revolution as is ſuppoſed.

Unto this 'tis uſually anſwered, That the Air alſo carried along with the ſame Motion of the Earth For if the Concavity of the Moon's Orb, which is ſo ſmooth and glabrous a Superficies, may (accordin to our Adverſaries) drive along with it the greate part of this Elementary World, all the Regions Fire, and all the vaſt upper Regions of Air, and (ſome will have it) the two lower Regions, togeth with the Sea likewiſe; for from hence (ſaith *Ale Roſſe*, *l.* 1. *ſect.* 1. *c.* 3.) is it, that betwixt the *Tr picks* there is a conſtant Eaſtern Wind, and a cont nual flowing of the Sea Weſtward: I ſay, if the M tion of the Heavens, which are ſmooth Bodies, ma be able to carry with it ſo great a part of the Eleme tary World; Or if the rugged parts of the Moon Body be able to carry with it ſo great a part of t Air, as *Fromondus* (*Ant. c.* 16.) affirms; much mo then may our Earth, which is a rugged Mountaino Body, be able to turn about ſo little a part of t World, as that Vaporous Air next unto it.

Suppo



Suppoſe the inward Circle to repreſent the Earth; and the outward the Thicker Air, which encompaſſes it. Now it is eaſily conceivable, that the Revolution of ſo great a Body as this Globe of Earth, may turn about by its meer Motion (if there were nothing elſe) ſo little a part of the adjoining Air, as is here repreſented: And yet,

1. The Diſproportion betwixt the Thickneſs of the Earth, and this Orb of Air, is far greater than could be expreſs'd in the Figure, being but as twenty Miles; which is at moſt the thickneſs of this Air, unto 3456 Miles, which is the Semidiameter of our Earth, and ſo is but as an inſenſible number in reſpect of this other.

2. Beſides the meer Motion of the Earth, which in probability (being ſuch a rugged Body) might be enough to carry ſo little a part of the Air along with it; there is alſo (as we ſuppoſe) a Magnetical Vigor which proceeds from it, whereby 'tis more able to make all Things that are near unto it, to obſerve the ſame Revolution.

*Li. 1. ſect. 1. cap. 5.

But if it be ſo (ſaith * *Alex. Roſſ.*) that not onl the Man, but the *Medium* alſo, and the Object b moved: This muſt needs be ſuch a great hindranc to the ſight, that the Eye cannot judge exactly c any thing. For, ſuppoſe the Man alone to be in Motion, he could not ſee ſo well as when he is ſtill but now if not only he, but his Spectacles and Boo were all moved, he would not be able to diſcern an thing diſtinctly.

I anſwer: The Conſequence were pertinent, if a theſe were ſeveral Motions; but if the Subject an *Medium*, and Object, were all carried with one an the ſame equal Motion, (as it is here ſuppoſed) thi could be no Impediment to the Act of Seeing, but i would be all one with the reſt; becauſe by thi Means, they are not ſevered from one another, an therefore the *Species* are not diſturbed. 'Tis an excel lent Saying of *Galilæus*, and may ſerve for the Reſo lution of many ſuch Doubts as theſe: *Motus eatenu tanquam motus operatur, quatenus relationem habet ad ea res quæ ipſo diſtituuntur, in ijs vero rebus, quæ totæ æqua liter de eo participant, nihil operatur, & ita ſe habet ac nullus eſſet.* If a Man be within ſome Room of Ship, he may read altogether as eaſily when the Shi moves, as when it ſtands ſtill.

Syſt. mundi, Colloq. 2.

4. Another Argument againſt this Circular Motio of the Earth, is grounded upon that common Prin ciple amongſt the *Ariſtotelians*: *Unius corporis ſimplic unus tantum eſt motus.* One kind of Body has but on kind of Motion. But now the Earth and Water ha a Motion of Deſcent; the Air a Motion of Aſcent and therefore none of them can have any Circula Motion natural unto them.

I anſwer: Firſt, Theſe right Motions of Elemen tary Bodies belong only to the Parts of them, an that too when they are out of their proper places; f that the whole to which they belong, may notwith ſtanding this, have another Motion of its own. Bu

Secondly

Secondly, this Saying which *Ariſtotle* calls a Principle, will not conſiſt with other evident Experiments of Nature. Thus, though a Loadſtone, in reſpect of its Matter and Condenſity, naturally tends downward; yet this does not hinder, but that in reſpect of ſome other Qualities, as its deſire of Union and Coition to another Loadſtone, it may alſo naturally move upwards. From whence it will follow, that the ſame Elementary Body may have divers Natural Motions.

5. The Gravity and Magnitude of this Earthy Globe do make it altogether unfit for ſo ſwift a Motion.

I anſwer: Firſt, Heavineſs can only be applied unto thoſe Bodies which are out of their proper Places, or unto ſuch parts as are ſevered from the whole to which they belong. And therefore the Globe of Earth, (conſidered as whole, and in its right place) cannot truly be called heavy. I deny not, but that there is in it, and ſo likewiſe in the other Planets, an Ineptitude to Motion, by reaſon of the Matter and Condenſity of their Bodies: And ſo likewiſe there is as truly (though not according to the ſame Degrees) in the leaſt particle of a Material condenſed Subſtance: So that this cannot reaſonably be pretended as a juſt Impediment, why the Earth ſhould be incapable of ſuch a Motion. Secondly, and though this Globe be of ſo vaſt a Magnitude, yet as Nature beſtows upon other Creatures (for Inſtance, an Eagle and a Fly) Spirits, and motive Powers, proportionable to their ſeveral Bodies; ſo likewiſe may ſhe endow the Earth with a Motive Faculty anſwerable to its Greatneſs. Or if this may make the Earth incapable of ſo ſwift a Motion as is ſuppoſed, much more then will the Heavens be diſabled for that greater Swiftneſs which is imagined in them. I might add, the Globe of the Sun and *Jupiter* are obſerved to move about their own Centers; and therefore the Earth, which is far leſs than either of them, is not, by reaſon of its too

great

great Magnitude, made unfit for ſuch a Revolution. Thirdly: As for the ſwiftneſs of the Earth's Courſe, it does not exceed (all Circumſtances well conſidered) the Celerity of ſome other Motions, with which we are acquainted; as that of the Clouds, when driven by a Tempeſtuous Wind; that of a Bullet ſhot from a Cannon, which in the ſpace of a Minute does fly 4 Miles: Or as another hath obſerved, in the ſecond Scruple of an Hour it may paſs the Fifteenth part of a *German* Mile. Than which, there is not any Point in the Earth's Equinoctial that moves faſter: And though a Bullet be much ſlower in moving a greater diſtance, yet for ſo little a ſpace, while the force of the Powder is moſt freſh and powerful, it does equal the ſwiftneſs of the Earth. And yet,

Mæſlin præfat. ad Narrat Rhet. Fromond. Veſta. tract. 1. cap. 3.

1. A Bullet or Cloud is carried in its whole Body, being fain to break its way through the Air round about it: But now the Earth, (in reſpect of this firſt Motion) does remain ſtill in the ſame Situation, and move only about its own Center.

2. The Motion of a Bullet is violent, and againſt its Nature, which does ſtrongly incline it to move downwards: Whereas the Earth, being conſidered as whole, and in its proper place, is not heavy, nor does it contain any Repugnancy to a Circular Motion.

6. The chief Argument on which our Adverſaries do moſt inſiſt, is this. If there were ſuch a Motion of the Earth as is ſuppoſed, then thoſe Bodies which are ſevered from it in the Air, would be forſaken by it. The Clouds would ſeem to riſe and ſet as the Stars: The Birds would be carried away from their Neſts: No heavy Body could fall perpendicular: An Arrow or Bullet being ſhot from Eaſt to Weſt by the ſame violence, will not be carried an equal diſtance from us, but we ſhould by the Revolution of our Earth, overtake that which was ſhot to the Eaſt, before it could fall. If a Man leaping up, ſhould abide in the Air but one ſecond Scruple of an Hour, or the Sixtieth

Ariſt. de Cælo, lib. 2. cap. 13.

Sixtieth part of a Minute, the Earth in that ſpace would withdraw it ſelf from him almoſt a quarter of a Mile. All theſe, and many other ſuch ſtrange Inferences, which are directly contrary to Senſe and Experience, would follow from this Motion of the Earth.

There are Three ſeveral Ways moſt frequently uſed for the Reſolving of theſe kind of Doubts.

1. From thoſe Magnetical Qualities, which all Elementary Bodies do partake of.

2. From the like Motion of other things, within the Room of a Sailing Ship.

3. From the like Participation of Motion in the open Parts of a Ship.

1. For thoſe *Magnetical* Properties, with which all theſe Bodies are endowed. For the better underſtanding of this, you muſt know, That beſides thoſe common Elementary Qualities of Heat, Coldneſs, Dryneſs, Moiſture, *&c.* which ariſe from the Predominancy of ſeveral Elements, there are likewiſe other Qualities (not ſo well known to the Ancients) which we call *Magnetical*, of which every Particle in the Terreſtrial Globe does neceſſarily participate: And whether it be joined to this Globe by Continuity or Contiguity, or whether it be ſevered from it, as the Clouds in the ſecond Region, a Bird, or Bullet in the Air; yet does it ſtill retain its Magnetical Qualities, together with all thoſe Operations that proceed from them.

Now from theſe Properties, do we ſuppoſe the Circular Motion of the Earth to ariſe.

If you ask what Probabilities there are, to prove that the Earth is endowed with any ſuch Affections; I anſwer: 'Tis likely, that the lower Parts of this Globe do not conſiſt of ſuch a ſoft fructifying Earth, as there is in the Surface, (becauſe there can be no ſuch uſe for it, as here, and Nature does nothing in vain,) but rather of ſome hard rocky Subſtance; ſince

ſince we may well conceive, that theſe lower Parts are preſſed cloſe together by the weight of all thoſe heavy Bodies above them. Now 'tis probable, that this rocky Subſtance is a Loadſtone, rather than a *Jaſpis*, *Adamant*, *Marble*, or any other; becauſe Experience teacheth us, that the Earth and Loadſtone do agree together in ſo many Properties. Suppoſe a Man were to judge the Matter of divers Bodies, each of which ſhould be wrapt up in ſome Covering from his Eye, ſo that he might only examine them by ſome other outward Signs: If in this Examination he ſhould find any particular Body which had all the Properties that are peculiar to a Loadſtone, he ſhould in reaſon conclude it to be of that Nature, rather than any other. Now there is altogether as much reaſon why we ſhould infer, that the inward Parts of the Earth do conſiſt of a Magnetical Subſtance. The Agreement of theſe two you may ſee largely ſet forth in the Treatiſe of D. *Gilbert*. I will inſtance only in one Example; which of it ſelf may ſufficiently evidence, that the Globe of Earth does partake of the like Affections with the Loadſtone. In the Mariners Needle you may obſerve the Magnetical Motions of *Direction*, *Variation*, *Declination*; the two laſt of which are found to be different, according to the Variety of Places. Now this Difference cannot proceed from the Needle it ſelf, becauſe that is the ſame every where. Nor can we well conceive how it ſhould be cauſed by the Heavens; for then the Variation would not be always alike in the ſame place, but diverſe, according to thoſe ſeveral Parts of the Heaven, which at ſeveral times ſhould happen to be over it: And therefore it muſt neceſſarily proceed from the Earth, which being it ſelf endowed with Magnetical Affections, does diverſly diſpoſe the Motions of the Needle, according to the difference of that Diſponent Virtue which is in its ſeveral Parts.

Now

Now to apply this unto the particular Inſtances of he Objection; We ſay, though ſome parts of this reat Magnet, the Earth, may according to their Matter be ſevered from the whole; yet are they alvays joined to it by a Communion of the ſame Magetical Qualities; and do no leſs obſerve theſe kind of Motions, when they are ſeparated from the whole, han if they were united to it. Nor need this ſeem ncredible, that a heavy Bullet, in ſuch a ſwift violent Courſe, ſhould be able to obſerve this Magnetical Revolution of the whole Earth; when as we ſee that hoſe great Bodies of *Saturn*, *Jupiter*, &c. hanging in he vaſt Spaces of the Æthereal Air, do ſo conſtantly nd regularly move on, in their appointed Courſes. Though we could not ſhew any Similitude of this Moion in theſe Inferior Bodies, with which we are acquainted; yet we muſt know, there may be many hings which agree to the whole Frame, that are not iſcernible in the divers parts of it. 'Tis natural unto he Sea to ebb and flow; but yet there is not this Moion in every Drop or Bucket of Water. So if we conſider every part of our Bodies ſeverally, the Humours, Bones, Fleſh, *&c.* they are all of them apt to tend lownwards, as being of a condenſed Matter; but yet conſider them according to the whole Frame, and hen the Blood or Humours may naturally aſcend upvards to the Head, as well as deſcend to any of the lowr Parts. Thus the whole Earth may move round, hough the ſeveral parts of it have not any ſuch particular Revolution of their own. Thus likewiſe, tho' ach condenſed Body being conſidered by it ſelf, may eem to have only a Motion of Deſcent; yet in refeence to that whole Frame of which it is a part, it nay alſo partake of another Motion that may be naural unto it.

But ſome may here object; Though the Earth were ndowed with ſuch Magnetical Affections, yet what robability is there that it ſhould have ſuch a Revolution?

tion? I anſwer; 'Tis obſerved of thoſe other Magnetical Bodies of *Saturn*, *Jupiter*, and the Sun, that they are carried about their own Centers; and therefore 'tis not improbable, but that it may be ſo with the Earth alſo; which if any deny, he muſt ſhew a Reaſon why in this reſpect they ſhould be unlike.

Yea, but though the Earth did move round, what ground is there to affirm that thoſe Bodies which are ſevered from it, as a Bullet, or the Clouds, ſhould follow it in the ſame Courſe?

I anſwer; Thoſe Spots which are diſcovered about the Sun, and are thought to be Clouds or Evaporations from his Body, are obſerved to be carried about according to his Revolution. Thus the Moon is turned round by our Earth; the Four leſſer Planets by the Body of *Jupiter*. Nay, thus all the Planets in their ſeveral Orbs, are moved about by the Revolution of the Sun, upon its own Axis, ſaith *Keplar*;) and therefore much more may an Arrow or Bullet be carried round by the Magnetical Motion of our Earth.

The Second Way, whereby ſome anſwer unto the Inſtances of this Argument, is, by ſhewing the like Motions of other things within ſome Room of a ſailing Ship. Thus Experience teaches (ſay they) that a Candle, as alſo the Fumes that come from it, will always keep the ſame Situation in the ſwifteſt Motion of a Ship, as if it did reſt immoveably, and the Flame will not more eſpecially bend one way, or have any troubled Fluctuation; but burn as ſtrait and quietly, as if it did ſtand ſtill. Again, it has been found (ſay thoſe that have been verſed in theſe kind of Experiments,) that the ſame force will caſt a Body but at an equal Diſtance, whether or no the Body do move with, or againſt the Motion of the Ship. As alſo that any Weight being let fall, will deſcend in as true a Perpendicular, as if the Ship did ſtand ſtill. If a Man leaping up, do tarry in the Air one ſecond Minute of an Hour; yet the Ship will not in its greateſt

Swift-

Swiftneſs (as it ſhould according to the Calculation of our Adverſaries) be carried from him at leaſt fifteen Foot. If we ſuppoſe a Man to jump in ſuch a Ship, he will not be able to paſs farther, when he jumps againſt the Motion of it, than when he jumps with it. All which Particulars may argue, that theſe things are carried along together, by the common Motion of the Ship. Now if Bodies may be thus jointly moved by ſuch a Preternatural Motion, much more then will they accompany the Earth in its diurnal Revolution, which we ſuppoſe to be Natural unto them, and as a Law impoſed by God in their firſt Creation.

If the Flame of a Candle, or the Smoak that comes from it, (things that are ſo eaſily moveable) are notwithſtanding carried ſo equally, and without any Diſturbance, by the Motion of a Ship; then alſo the Clouds in the Air, and all other light Bodies, may well enough be turned about by the Revolution of our Earth.

If an equal Force will caſt an heavy Body but at an equal Diſtance, whether or no it move with, or againſt the Motion of the Ship; then may we eaſily conceive, that an Arrow or Bullet being ſhot with the ſame Violence, will paſs but the ſame Space on the Earth, whether or no it be ſhot towards the *Eaſt* or *Weſt*.

If a heavy Body, while the Ship does move, will fall down in a ſtrait Line, then it is not the Revolution of our Earth that can hinder a Perpendicular Deſcent.

If a Man leaping up in a Ship, may abide in the Air one ſecond Scruple of an Hour, and yet this Ship in its greateſt Swiftneſs not withdraw it ſelf fifteen Foot; then will not the Earth in that Space go from him almoſt a quarter of a Mile.

But againſt this 'tis objected, That the Earth has the Similitude of an open Ship, and not of any Room that is cloſe. And though it be true, that when the Roof

Fromondus Veſt. Tract. 2. cap. 2.

Roof and the Walls do all move together, the Ai which is included betwixt them, muſt be carried alon by the ſame Motion; yet it is not ſo with the Earth becauſe that hath not any ſuch Walls or Roof, wherei it may contain and carry along with it the *Mediu* And therefore Experience will rather argue againſt th ſuppoſed Revolution. Thus 'tis obſerved, that a Ston being let fall from the Maſt of a Ship that move ſwiftly, will not deſcend to the ſame Point, as if th Ship did ſtand ſtill. From whence it will follow, tha if our Earth had ſuch a circular Motion, then any hea vy Body being let fall from ſome high Tower, or othe ſteep Place, would not deſcend unto that Point o Earth which was directly under it at the Beginning.

To this we anſwer; That the Air which moves a long with our Earth, is as well limited in certai Bounds, as that which is included in a Room. If yo ask where theſe Bounds are terminated; I anſwe neither by the utmoſt parts of the World, nor yet b the Concavity of the Moon's Orb (as *Fromondus* woul have us affirm;) but by the Sphere of vaporous A that encompaſſes our Earth; or which is all one, b the Orb of Magnetical Vigor, which proceeds from i And beſides, 'tis conſiderable that all Earthly Bodi are not only contained within theſe Limits, as thin are in a cloſe Room, but alſo as parts in that whole t which they belong.

2. Though the carrying along of the *Medium* ma ſolve the Motion of light Bodies in a Ship, as th Flame of a Candle, Smoak, or the like; yet this ca not concur to that which hath been ſaid of heav Bodies, as a Man leaping up, a Bullet deſcending, & ſince it is not the Motion of the meer Air that is ab to make theſe partake of the ſame Motion with the Shi Unto that Argument which he urges from the E periment of a Stone falling in an open Ship, we a ſwer:

1. Thou

1. Though the Inſtance of a Ship may ſerve as a roof for this Opinion, it being an Argument *a mino- ad majus*, from an accidental Motion to a natural; et it will not ſerve againſt it. For though it were ot thus in accidental Motions; yet this would not inder but that it might be ſo in thoſe that are ſuppo- ed to be proper and natural.

2. As for that Experiment it ſelf, 'tis but a ground- ſs Imagination, and was never yet confirmed by any articular Experience; becauſe 'tis certain the Event ould be clean otherwiſe, as ſhall be proved in the hird Way of Anſwering.

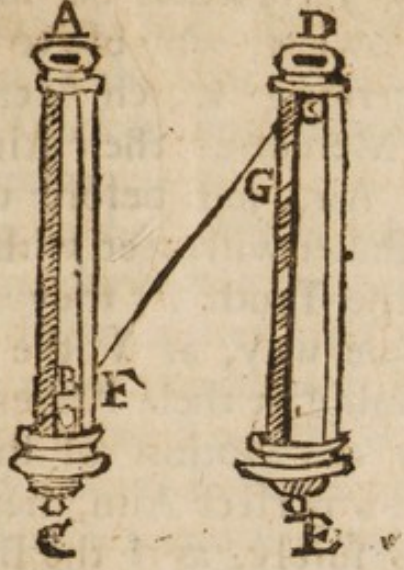
3. The Third and Laſt Way of clearing the Doubts the ſixth Argument, is by ſhewing the like Partici- ation of Motion, in thoſe things that are in the open arts of a Ship. To which purpoſe *Galilæus* urges his Experiment: If any one ſhould let fall a Stone om an high Maſt, he would find *lapidem in eundem mper Navis locum decidere, ſeu conſiſtat illa, ſeu quanta- unque velocitate moveatur:* That the Stone would al- ays deſcend unto the very ſame Place, whether or o the Ship did move or ſtand ſtill. The reaſon of hich is, becauſe the Motion of the Ship is likewiſe mpreſſed in the Stone: Which Impreſſion is not equal- prevalent in a light Body, as a Feather, or Wool, ecauſe the Air which has power over them, is not arried along by the ſame Motion of the Ship. Thus kewiſe will it be in this other Experiment: If a Man pon a runningHorſe ſhould in his ſwifteſt Courſe let all a Bullet or Stone, theſe heavy Bodies, beſides their wn Deſcent, would alſo participate that tranſverſe Motion of the Horſe. For as thoſe things that are hrown from us, do continue their Motion when they re out of the Hand in the open Air; ſo likewiſe uſt it be when the force is conferred by that Motion hich the Arm has from the Horſe. While a Man is iding, his Arm is alſo carried by the ſame Swiftneſs

Syſt. Mund. Colloq. 2.

of the Horſe; therefore, if he ſhould only open h
Hand and let fall any thing, it would not deſcend in
ſtrait Line, but muſt neceſſarily be driven forwar
by reaſon of that Force impreſſed in it by the Swiftne
of the Horſe, which is alſo communicated to th
Arm; it being all one in Effect, whether or no th
Arm be moved by a particular Motion of its own,
it is in caſting of things from us; or by the commo
Motion of the Body, as it is in dropping of any thin
from us, either when we are on the Top of ſome ſai
ing Ship, as in the *Former*; or on ſome runnin
Horſe, as in this *Latter* Inſtance.

What hath been ſaid concerning the Motion of D
ſcent, is likewiſe appliable, both to that which
upward, and that which is *tranſverſal*. So that whe
'tis objected, if the Earth did move, then a Bullet th
were ſhot up perpindicularly would be forſaken by i
and not deſcend to the Place from whence it aroſe
We anſwer, that the Cannon which is upon the Earth
together with the Bullet in it, do partake of the ſam
circular Motion with the Earth; and this perhaps ou
Adverſaries will grant, whilſt we ſuppoſe the Bullet t
remain ſtill in the Cannon; all the Difficulty will be t
ſhew how it muſt neceſſarily obſerve the ſame Motio
when it is ſhot out into the open Air. For the bett
Gall. Syſt. Colloq. 2. Explication of this, you may note this following F
gure.

Whe



Where we ſuppoſe *A C* to be a Cannon perpendicu-
ly, erected with a Bullet in it at *B*, which if it were
moveable, we grant that the Bullet being diſcharged,
ſt aſcend in a juſt Perpindicular. But now conceive
Cannon to move along with the Earth, then in that
ce of Time while the Bullet by the Force of the
wder is aſcending to the Top of the Bore, the Can-
n will be transferred to the Situation *D E*; ſo that
Bullet muſt be moved according to the Line *F G*,
ich is not directly upright, but ſomewhat declining.
w the Motion of the Bullet in the Air, muſt ne-
arily be conformed unto that Direction that is im-
ſſed in it by the Cannon from whence it is ſhot,
ſo conſequently it muſt be continued according to
Line *F G*, and therefore will always keep perpen-
larly over the Point from which it did aſcend.
f you reply, that the Motion of the Bullet in the
nnon muſt needs be ſo ſwift, that the Earth can-
carry the Cannon from *C* to *E*, in the ſame Space
Time wherein the Bullet does move from *B* to *A*.
nſwer; 'tis not material whether the Earth be of a
ter or leſſer Swiftneſs than the Bullet, becauſe the
lination muſt always be proportionable to the Mo-
of the Earth; and if we ſuppoſe this to be ſlower
n the Bullet, then the Declination of the Line *F G*,
be ſo much the leſs.

This Truth may yet farther be illuſtrated by th Practice of thoſe Fowlers, who uſe to kill Birds as th are flying: Concerning which Art, 'tis common thought that theſe Men direct their Aims to ſome ce tain Space in the Air, juſt before the Birds, whe they conceive the Bullet will meet with them in the Flight; whereas the Truth is, they proceed in th caſe, the very ſame way, as if the Birds did ſtan ſtill, by a direct aiming at their Bodies, and followin of their Flight by the Motion of the Piece, till length, having got a perfect Aim, they diſcharge, an do hit altogether as ſurely, as if the Birds were ſitti upon a Tree. From whence we may obſerve, that th Motion of the Piece, as in our aiming it is made follow the Birds in their Flight (though it be but ſlow yet is communicated to the Bullet in the Air.

But here it may ſeem very difficult to give any re ſon according to thoſe Grounds concerning the Flig of Birds; which being animated, have a Liberty fly here or there, to tarry for a good Space of Tim in the open Air, and ſo tis not eaſie to conceive wh means there is, by which they ſhould participate of t Earth's diurnal Revolution.

To this *Galilæus* anſwers, that the motion of t Air, as it does turn about the Clouds, ſo doth it al carry with it the Birds, together with ſuch other li things that are in it. For if ſome violent Wind able to drive with ſuch Swiftneſs a full laden Ship, throw down Towers, to turn up Trees, and the lik much more then may the diurnal Motion of the A (which does ſo far exceed in Swiftneſs the moſt temp ſtuous Wind) be able to carry with it the Bodies Birds.

Ob. But if all things be turned about by this Revolutio then it ſhould ſeem there is no ſuch thing as a rig motion, whether of Aſcent, or Deſcent in a ſtr Line.

I anſwe

I anſwer; The moving of heavy or light Bodies, *Sol.*
ay be conſidered in a double Relation.

1. According to the Space wherein they move, and
e grant their Motions not to be ſimple, but mixed of
direct and circular.

2. According to the Body or *Medium* wherein they
ove, and then they may properly be ſaid to have
ght Motions, becauſe they paſs through the *Medium*
a ſtrait Line; and therefore it is, that unto us they
em directly to aſcend or deſcend. *Ariſtotle* himſelf
ould not deny, but that Fire may aſcend in a ſtrait
ine unto its Sphere; and yet participate alſo of that
ircular Motion which he ſuppoſes to be communicated
om the Heaven, unto the upper part of the Air,
nd its own Region. So likewiſe muſt it be for the
eſcent of any thing. Suppoſe a Ship in its ſwifteſt
otion, and a Man in it, having ſome Veſſel filled
ith Water, ſhould let fall into it a little Ball of Wax,
r ſome other matter which may be ſlow in its ſinking,
o that in one Minute it ſhould ſcarce deſcend the
pace of a Cubit, though the Ship (it may be) in the
ame time may paſs at leaſt a hundred Cubits; yet
ould this ſtill ſeem unto the Eye to deſcend in a ſtrait
ine; and the other Motion which is communicated
nto it by the Ship, would not at all be diſcernible in
t. And though in this Caſe, the Motion were in it
elf compoſed of a circular and direct; yet in reſpect
f us it would appear, and ſo might be ſtiled, exactly
rait.

Now if it be thus in thoſe which are generally
ranted to be preternatural Motions; we need not
oubt then the poſſibility of the like effect in that
otion which we conceive to be proper and natural,
oth to the Earth, and the things that belong un-
o it.

There is yet another Objection to this purpoſe ur-
ed by * *Malapertius*, a late Jeſuit; who, though he
do with much eagerneſs preſs this Argument concern-

* *Auſtriaca Syder. par. 2. prop. 25*

ing a Bullet or Stone, againſt the Opinion of *Copernicus*; yet he grants that it might eaſily be reſolved, the Defenders of it would affirm that the Air di move round with the Earth. But this, ſays he, the dare not avouch; for then the Comets would alway ſeem to ſtand ſtill, being carried about with the Re volution of this Air; and then they could not riſe o ſet, as Experience ſhews they do.

To this it may be anſwered, That moſt Comets ar above that Sphere of Air which is turned round wit our Earth, as is manifeſt by their height. The Mo tion that appears in them, is cauſed by the Revolutio of our Earth, whereby we are turned from them.

As for thoſe which are within the Orb of our Ai theſe do ſeem to ſtand ſtill. Such a one was tha mentioned by † *Joſephus*, which did conſtantly han over *Jeruſalem*; and that likewiſe which appeared a boat the time of *Agrippa*'s Death, and for many Day together did hang over the City of *Rome*. Where fore ∴ *Seneca* does well diſtinguiſh out of *Epigenes*, be twixt two ſorts of Comets; the one being low, an ſuch as ſeem immovable; the other higher, and ſuc as did conſtantly obſerve their Riſings and Settings, a the Stars.

† *De bello Judaico, l. 7. cap. 12.*

Dion. l. 54.

∴ *Nat. Qu. lib. 7. cap. 6.*

I have done with all the Arguments of any Not or Difficulty, that are urged againſt this Diurnal Mo tion of the Earth. Many other Cavils there are, no worth the naming, which diſcover themſelves to b rather the Objections of a captious, than a doubtfu Mind. Amongſt which, I might juſtly paſs ove thoſe that are ſet down by *Alex. Roſſe*. But becaul this Author does proceed in his whole Diſcourſe wit ſo much Scorn and Triumph, it will not be ami therefore to examine what infallible Evidence there in thoſe Arguments upon which he grounds his Boaſ ings.

Lib. 1. ſect. 2. cap. 6.

We have in one Chapter no leſs than theſe Nine.

I.

1. If the Earth did move, then would it be hotter than the Water, becauſe Motion does produce Heat: And for this Reaſon likewiſe, the Water would be ſo hot and rarified, that it could not be congealed; ſince that alſo does partake of the ſame Motion with the Earth. *Arg.* 1.

2. The Air which is next the Earth, would be purer, as being rarified with Motion. *Arg.* 2.

3. If the Earth did move the Air, it would cauſe ſome Sound; but this is no more audible, than *Pythagoras*'s Harmony of the Heavens. *Arg.* 3.

4. 'Twould have been in vain for Nature to have endowed the Heavens with all Conditions requiſite for Motion, if they had been to ſtand ſtill. As firſt, they have a round Figure. Secondly, they have neither Gravity nor Levity. Thirdly, they are Incorruptible. Fourthly, they have no Contrary. *Arg.* 4.

5. All Similary Parts are of the ſame Nature with the whole: But each part of the Earth does reſt in its place; therefore alſo doth the whole. *Arg.* 5.

6. The Sun in the World is as the Heart in a Man's Body; but the Motion of the Heart ceaſing, none of the Members do ſtir: Therefore alſo if the Sun ſhould ſtand ſtill, the other Parts of the World would be without Motion. *Arg.* 6.

7. The Sun and Heavens do work upon theſe Inferior Bodies by their Light and Motion. So the Moon does operate upon the Sea. *Arg.* 7.

8. The Earth is the Foundation of Buildings, and therefore muſt be firm and ſtable. *Arg.* 8.

9. 'Tis the conſtant Opinion of Divines, That the Heavens ſhall reſt after the Day of Judgment; which they prove from *Iſa.* 6. 20. *Thy Sun ſhall no more go down, neither ſhall thy Moon withdraw it ſelf.* So likewiſe, *Rev.* 10. 6. The Angel ſwears *that there ſhall be time no longer*; and therefore the Heavens muſt reſt, ſince by their Motion it is that Time is meaſured. And St. *Paul* ſays, *Rom.* 8. 20. *That all the Creatures* *Arg.* 9.

are subject to Vanity. Now this can be no other in th Heavens, than the Vanity of Motion, which the Wi Man speaks of, *Eccles.* 1. 4. *The Sun riseth, and the Su goeth down,* &c.

To these it may be Answered:

Ad 1. & 2. In the first you may note a manifest Contradictio when he will have the Earth to be hotter than th Water, by reason of this Motion; when as notwith standing, he acknowledges the Water to move alon with it: And therefore too in the next Line, he in fers that the Water, because of that Heat and Rare faction which it receives from this Motion with th Earth, must be incapable of so much Cold, as to b congealed into Ice.

But unto that which may be conceived to be hi Meaning in this and the next Argument; I answer If he had fully understood this Opinion which he op poses, he would easily have apprehended that it coul not be prejudiced by either of these Consequences For we suppose that not only this Globe of Earth an Water, but also all the vaporous Air which environs it, are carried along by the same Motion. And there fore, though what he says concerning the Heat which would be produced by such a Motion, were true, yet it would not be pertinent, since our Earth and Water, and the Air next unto them, are not by this means severed from one another, and so do no come within the compass of this Argument.

If any reply, That this will notwithstanding hold true concerning the upper part of the Air, where there is such a Separation of one Body from another; and so consequently, an answerable Heat. I answer,

1. 'Tis not generally granted, That Motion in all kind of Bodies does produce Heat; some restrain it only to solid Bodies, affirming, That in those which are fluid, it is rather the cause of Coldness. This is the reason, say they, why running Waters are ever to our sense the coolest; and why, amongst those Winds

which

which proceed from the ſame Coaſts of Heaven, about the ſame time of the Year, the ſtrongeſt always is the coldeſt? If you object, that running Waters are not ſo ſoon frozen as others, they anſwer; This is not becauſe they are thereby heated, but becauſe unto Congelation it is requiſite that a Body ſhould ſettle and reſt, as well as be cold.

2. If we ſhould grant a moderate heat in thoſe parts of the Air, we have not any Experiment to the contrary, nor would it prejudice the preſent Opinion, or common Principles.

As the ſound of this Motion is not more heard than the Harmony of the Heavens; ſo neither is there any Reaſon why this Motion ſhould cauſe a ſound, more than the ſuppoſed Motion of the Heavens, which is likewiſe thought to be continued unto the Air hard by us. *Ad.* 3.

This will prove the Earth to move as well as the Heavens: For that has, firſt, a round Figure, as is generally granted. Secondly, being conſidered as whole, and in its proper place, it is not heavy, as was proved before. And as for the two other Conditions, neither are they true of the Heavens, nor if they were, would they at all conduce to their Motion. *Ad.* 4.

1. This Argument would prove that the Sea did not Ebb and Flow, becauſe there is not the ſame kind of Motion in every Drop of Water; or that the whole Earth is not Spherical, becauſe every little piece of it is not of the ſame Form. *Ad.* 5.

This is rather an Illuſtration than a Proof; or if it do prove any thing, it may ſerve as well for that purpoſe unto which it is afterward applied, where the Motion of every Planet is ſuppoſed to depend upon the Revolution of the Sun. *Ad.* 6.

That the Sun and Planets do work upon the Earth by their own real daily Motion, is the thing in Queſtion; and therefore muſt not be taken for a common Ground. *Ad.* 7.

We

Ad. 8. We grant that the Earth is firm and ſtable from all ſuch Motions whereby it is joggled or uncertainly ſhaken.

Ad. 9. 1. For the Authority of thoſe Divines, which he urges for the Interpretation of theſe Scriptures; this will be but a weak Argument againſt that Opinion which is already granted to be a Paradox.

2. The Scriptures themſelves, in their right meaning, will not at all conduce to the preſent purpoſe.

As for that in *Iſaiah*, if we conſult the Coherence, we ſhall find that the Scope of the Prophet is to ſet forth the Glory of the Church Triumphant. Wherein he ſays there ſhall not be any need of the Sun or Moon, but God's Preſence ſhall ſupply them both: *For the Lord ſhall be unto thee an everlaſting Light, and thy God thy Glory, ver.* 19. and as for this Sun and Moon, it ſhall not go down, or withdraw it ſelf, but he ſhall be an *everlaſting Light* without Intermiſſion. So that 'tis evident he ſpeaks of that Light which ſhall hereafter be inſtead of the Sun and Moon.

Vid. Revel. 21.23. *item* c.22. *ver.*5.

As for that in the *Revelations*, we yield that *time ſhall ceaſe*; but to ſay that this depends upon the Ceſſation of the Heavens, is to beg the Queſtion, and to ſuppoſe that which is to be proved; *viz.* That Time is meaſured by the motion of the Heavens, and not of the Earth. *Perrerius* (from whom this laſt Argument was borrowed without Acknowledgment) might have told him in the very ſame place, that Time does not abſolutely and univerſally depend upon the Motion of the Heavens, *ſed in motu & ſucceſſione, cujuſlibet durationis*, but in any ſuch Succeſſion, by which Duration may be meaſured.

Gen. c.1. *l.* 2. *quæſt.* 6.

As for that in the *Romans*, we ſay, That there are other Vanities to which the Heavenly Bodies are ſubject: As firſt, unto many Changes and Alterations; witneſs thoſe Comets which at ſeveral times have been diſcerned amongſt them; and then likewiſe to

that

that general Corruption, in which all the Creatures ſhall be involved at the laſt Day. *When they ſhall paſs away with a great noiſe, and the Elements ſhall melt with fervent Heat.* 2 Pet. 3. 10, 12.

Thus you ſee, there is not any ſuch invincible ſtrength in theſe Arguments, as might cauſe the Author of them to triumph before-hand with any great Noiſe of Victory.

Another Objection like unto theſe is taken from the Etymology of ſeveral Words. Thus the Heavens are called *Æthera, ab ἀεὶ θεῖν*, becauſe they are always in motion, and the Earth *Veſta, qui vi ſtat*, becauſe of its Immobility.

To which I anſwer: 'Twere no difficult matter to find ſuch Proofs for this Opinion, as well as againſt it.

Thus we may ſay that the *Hebrew* Word ארץ is derived from רוץ *quia currit*; and *Terra, non quod terratur, ſed quod perenni curſu omnia terat*, ſaith *Calcagnius*. However, though we ſuppoſe the Etymology to be never ſo true and genuine, yet it can at the beſt but ſhew what the more common Opinion was of thoſe Times when ſuch Names were firſt impoſed.

But ſuppoſe all this were ſo, That the Earth had ſuch a diurnal Revolution; yet how is it conceivable that it ſhould at the ſame time have two diſtinct Motions? *Ob.*

I anſwer: This may eaſily be apprehended, if you conſider how both theſe Motions do tend the ſame way from Weſt to Eaſt. Thus a Bowl being turned out of the Hand, has two Motions in the Air; one, whereby it is carried round; the other, whereby it is caſt forward. *Sol.*

From what hath been delivered in this Chapter, the indifferent Reader may gather ſome Satisfaction for thoſe Arguments which are uſually urged againſt this Diurnal Motion of the Earth.

PROP.

PROP. IX.

That it is more probable the Earth does move, than the Sun or Heavens.

AMongſt thoſe many Arguments that may be urged for the Confirmation of this Truth, I ſhall ſet down only theſe Five.

1. If we ſuppoſe the Earth to be the cauſe of this Motion, then will thoſe vaſt and glorious Bodies of the Heavens be freed from that inconceivable, unnatural ſwiftneſs, which muſt otherwiſe be attributed unto them.

Vid. Meſt. Epit. Aſtr. l. 1. in fine.

For if the Diurnal Revolution be in the Heavens, then it will follow according to the common *Hypotheſis*, that each Star in the *Equator* muſt in every Hour move at the leaſt 4529538 *German* Miles. So that according to the Obſervation of *Cardan*, who tells us that the Pulſe of a well-tempered Man does beat 4000 times in an Hour; one of theſe Stars in that ſpace, whilſt the Pulſe beats once, muſt paſs 1132 *German* Miles (ſaith *Alphraganus:*) Or according to *Tycho*, 732 *German* Miles. But theſe Numbers ſeem to be ſomewhat of the leaſt, and therefore many others do much enlarge them, affirming that every Star in the *Equator*, in one beating of the Pulſe, muſt move 2528 of theſe Miles.

De Prop. l. 5. prop. 58.

Comment. in prim. cap. Sphæra.

'Tis the Aſſertion of *Clavius*, That though the diſtance of the Orbs, and ſo conſequently their ſwiftneſs, ſeem to be altogether incredible; yet it is rather far greater in it ſelf than Aſtronomers uſually ſuppoſe it; and yet, ſaith he, according to the common Grounds, every Star in the *Equator* muſt move 42398437½ Miles in an Hour. And though a Man ſhould conſtantly travel 40 Miles a Day, yet he would not be able to go ſo far as a Star does in one Hour

unde

under 2904 Years : Or if we will ſuppoſe an Arrow to be of the ſame ſwiftneſs, then muſt it compaſs this great Globe of Earth and Water 1884 times in an Hour. And a Bird that could but fly as faſt, might go round the World ſeven times in that ſpace, whilſt one could ſay, *Ave Maria, gratia plena, Dominus tecum.*

Which though it be a pretty round pace, yet you muſt conceive that all this is ſpoken only of the eighth Sphere ; and ſo being compared to the ſwiftneſs of the *Primum Mobile*, is but a ſlow and heavy Motion.

For (ſaith the ſame Author) the thickneſs of each Orb is equal to the diſtance of its Concave Superficies from the Center of the Earth. Thus the Orb of the Moon does contain as much ſpace in its thickneſs, as there is betwixt the neareſt parts of that and the Center. Thus alſo the eighth Sphere is as thick as that whole ſpace betwixt the Center of the Earth and its own Concave Superficies. So likewiſe muſt it be in thoſe Three other Orbs, which he ſuppoſes to be above the Starry Heaven. Now if we proportion their ſwiftneſs according to this difference in their bigneſs, you may then conceive (if you can) what a kind of Celerity that muſt be, by which the *Primum Mobile* will be whirled about.

Tycho makes the diſtance of the Stars to be much leſs, and their Motion ſlower ; and yet he is fain to confeſs, that it is *omni cogitatione celerior.*

Clavius likewiſe ſpeaking concerning the Swiftneſs of the Starry Orb, does acknowledge, *Quod velocitas ejus captum humani ingenij excedit.* What then could he think of the *Primum Mobile* ?

Dr. *Gilbert* being it ſeems aſtoniſhed at the conſideration of this ſtrange Swiftneſs, ſays of it, that it is *motus ſupra omnes cogitationes, ſomnia, fabulas & licentias poeticas inſuperabilis, ineffabilis, incomprehenſibilis.* A Man may more eaſily conceive the poſſibility of any Fable or Fiction, how Beaſts and Trees might talk together,

De magnete, l. 6. c. 3.

gether, than how any Material Body ſhould be moved with ſuch a Swiftneſs.

Not but that 'tis poſſible for God to turn them about with a far greater Velocity. Nay 'tis poſſible for Art to contrive a Motion, which ſhall be equally ſlow in that proportion as this is ſwift. But however, the Queſtion here is not what can be done, but what is moſt likely to be done according to the uſual Courſe of Nature. 'Tis the part of a Philoſopher, in the Reſolution of Natural Events, not to fly unto the Abſolute Power of God, and tell us what he can do, but what according to the uſual way of Providence, is moſt likely to be done, to find out ſuch Cauſes of Things, as may ſeem moſt eaſy and probable to our Reaſon.

If you ask what repugnancy there is in the Heavens, unto ſo great a ſwiftneſs: We anſwer, Their being ſuch vaſt material condenſed Subſtances, with which this inconceivable Motion cannot agree.

Since Motion and Magnitude are two ſuch Geometrical Things, as bear a mutual proportion to one another; therefore it may ſeem convenient, that ſlowneſs ſhould be more agreeable to a great Body, and ſwiftneſs to a leſſer: And ſo it ſhould be more conſonant to the Principles of Nature, that the Earth, which is of a leſſer quantity, ſhould be appointed to ſuch a motion as is ſomewhat proportionable to its bigneſs, than that the Heavens that are of ſuch a vaſt magnitude, ſhould be whirled about with ſuch an incredible ſwiftneſs, which does as far exceed the proportion of their bigneſs, as their bigneſs does exceed this Earth, that is but a Point or Centre to them. 'Tis not likely that Nature in theſe conſtant and great Works, ſhould ſo much deviate from that uſual Harmony and Proportion which ſhe obſerves in leſſer Matters. If this Globe of Earth only were appointed to move every Day round the Orb of the fixed Stars, though it be but a little Body, and ſo more capable of a ſwift motion;

tion ; yet that ſwiftneſs would be ſo extreamly diſproportionable unto it, that we could not with Reaſon conceive it poſſible, according to the uſual courſe of Nature. But now that the Heavens themſelves, of ſuch ſtrange bigneſs, with ſo many Stars, which do ſo far exceed the magnitude of our Earth, ſhould be able to turn about with the ſame celerity: Oh! 'tis altogether beyond the Fancy of a Poet or a Madman.

For Anſwer unto this Argument, our Adverſaries tell us, That there is not in the Heavens any repugnancy to ſo ſwift a motion; and that whether we conſider the nature of thoſe Bodies; or, ſecondly, the ſwiftneſs of this motion.

1. For the Nature of thoſe Bodies, either their { *Qualities.* / *Quantity.*

1. There is not in them the Qualities of Lightneſs or Heavineſs, or any the leaſt Contrariety that may make them reluctant to one another.

2. Their Magnitude will help them in their ſwiftneſs: For the greater any Body is, the quicker will it be in its motion, and that not only when it is moved by an inward Principle, as a Millſtone will deſcend faſter than a little Pibble; but alſo when its motion does proceed from ſome External Agent; as the Wind will drive a great Cloud, or a heavy Ship, when it is not able to ſtir a little Stone. *Roſſ. l. 1. ſect. 1. c. 1.*

2. As for the ſwiftneſs of this Motion, the poſſibility of it may be illuſtrated by other Particulars in Nature: As,

1. The Sound of a Cannon, in a little time is carried for twenty Miles diſtance. *Idem. l. 2. ſect. 1. c. 5.*

2. Though a Star be ſituated ſo remotely from us, yet the Eye diſcerns it in a moment, which is not without ſome motion, either of the Species of the Star, or the Rays of the Eye. Thus alſo the Light does in an inſtant paſs from one ſide of the Heaven to another. *Idem, l. 1. ſect. 1. c. 2.*

3. If

3. If the force of Powder be able to carry a Bullet with ſo great a ſwiftneſs, we need not doubt then, but that the Heavens are capable of ſuch a celerity as is uſually attributed unto them.

Unto theſe it may be anſwered:

1. Where they ſay that the Heavenly Bodies are without all gravity, we grant it, in the ſame ſenſe as our Earth alſo, being conſidered as whole, and in its proper place, may be deny'd to be heavy: Since this Quality in the exacteſt Senſe, can only be aſcribed unto ſuch parts as are ſevered from the whole to which they belong. But however, ſince the Heavens or Stars are of a material Subſtance, 'tis impoſſible but there ſhould be in them ſome ineptitude to motion; becauſe Matter is of it ſelf a dull and ſluggiſh thing; and by ſo much the more, as it is kept cloſe and condenſed together. And though the Followers of *Ptolomy* do with much confidence deny the Heavens to be capable of any reluctancy to Motion, yet it were eaſy to prove the contrary out of their own Principles. 'Tis not conceivable how the upper Sphere ſhould move the nether, unleſs their Superficies were full of rugged parts (which they deny): Or elſe one of the Orbs muſt lean upon the other with its weight, and ſo make it partake of its own Motion. And beſides, they tell us, that the farther any Sphere is diſtant from the *primum mobile*, the leſs is it hindred by that in its proper Courſe, and the ſooner does it finiſh its own Revolution. From whence it will eaſily follow, that theſe Bodies have reſiſtency from one another.

I have often wondred why amongſt the Enchanted Buildings of the Poets, they have not feigned any Caſtle to be made of the ſame Materials with the Solid Orbs, ſince in ſuch a Fabrick there would have been theſe Eminent Conveniences:

1. It muſt needs be very pleaſant, by reaſon of its perſpicuity, becauſe it is more diaphanous than the Air it ſelf, and ſo the Walls of it could not hinder the Proſpect any way.

2. B

2. Being ſo ſolid and impenetrable, it muſt needs e excellent againſt all violence of Weathers, as alſo gainſt the Aſſaults of the Enemy, who ſhould not be ble to break it with the moſt furious Batteries of the am, or pierce it with any Cannon Shot.

3. Being void of all Heavineſs, a Man may carry up and down with him, as a Snail does his Houſe; nd ſo whether he follow the Enemy, or fly from him, e has ſtill this Advantage, that he may take his Caſtle nd Defence along with him.

But then again, there are on the other ſide as many nconveniences. For,

1. Its Perſpecuity would make it ſo open, that a an ſhould not be able to retire himſelf into any pri- ate part of it. And then,

2. Being ſo extremely ſolid, as well as inviſible, a an ſhould be ſtill in danger of knocking his Head gainſt every Wall and Pillar; unleſs it were alſo in- ngible, as ſome of the *Peripateticks* affirm.

3. Its being without all Gravity, would bring this nconvenience, that every little Puff of Wind would ow it up and down; ſince ſome of the ſame Sect e not aſhamed to ſay, that the Heavens are ſo utter- devoid of Heavineſs, that if but a little Fly ſhould ſtle againſt the vaſt Frame of the Cœleſtial Spheres, would move them out of their Places.

A ſtrong Fancy, that could be at leiſure, might ake excellent Sport with this Aſtronomical Fi- ion.

So that this firſt Evaſion of our Adverſaries will not elter them from the force of that Argument, which taken from the incredible ſwiftneſs of the Hea- ns.

2. Whereas they tell us in the ſecond place, that a gger Body, as a Millſtone, will naturally deſcend vifter than a leſs, as a Pibble. I anſwer: This is ot becauſe ſtch a great Body is in it ſelf more eaſily

movable, but becauſe the bigger any thing is which i
out of its own Place, the ſtronger will be its natura
deſire of returning thither, and ſo conſequently, th
quicker its Motion. But now thoſe Bodies that mov
circularly, are always in their proper Situations, an
ſo the ſame Reaſon is not appliable unto them. An
then, whereas 'tis ſaid, that Magnitude does al
ways add to the ſwiftneſs of a violent Motion (a
Wind will move a great Ship ſooner than a little Stone:
We anſwer: This is not becauſe a Ship is more eaſil
movable in it ſelf than a little Stone: For I ſuppoſ
the Objector will not think he can throw the one a
far as the other; but becauſe theſe little Bodies are no
ſo liable to that kind of violence from whence thei
Motion does proceed.

As for thoſe Inſtances which are cited to illuſtrat
the poſſibility of this ſwiftneſs in the Heavens, we an
ſwer: The paſſage of a Sound is but very ſlow i
compariſon to the motion of the Heavens. And the
beſides, the ſwiftneſs of the Species of Sound or Sigh
which are Accidents, are not fit to infer the like Ce
lerity in a Material Subſtance: And ſo likewiſe for th
Light, which * *Ariſtotle* himſelf, and with him the ge
nerality of Philoſophers, do for this very Reaſon prov
not to be a Body, becauſe it moves with ſuch ſwif
neſs, of which (it ſeems) they thought a Body to b
incapable. Nay, the † Objector himſelf in anothe
place, ſpeaking of Light in reference to a Subſtanc
does ſay: *Lumen eſt accidens, ſic ſpecies rei viſæ, & al
eſt ratio ſubſtantiarum, alia accidentium.*

* *De Anima. l. 2. c. 7.*

† *Roſſ. l. 2. ſect. 1. c. 4.*

To that of a Bullet, we anſwer: He might as we
have illuſtrated the Swiftneſs of a Bullet, which wi
paſs 4 or 5 Miles in 2 Minutes, by the motion of
Hand in a Watch, which paſſes 2 or 3 Inches in
Hours; there being a greater diſproportion betwi
the motion of the Heavens, and the ſwiftneſs of a Bu
let, than there is 'twixt the ſwiftneſs of a Bullet, an
the Motion of a Hand in a Watch.

Anoth

Another Argument to this purpoſe may be taken *Arg.* 2.
om the chief End of the Diurnal and Annual Moti-
s, which is to diſtinguiſh betwixt Night and Day,
inter and Summer; and ſo conſequently, to ſerve
r the Commodities and Seaſons of the habitable
orld. Wherefore it may ſeem more agreeable to the
iſdom of Providence, for to make the Earth as well
e Efficient, as the final Cauſe of this Motion; eſpe-
lly ſince Nature in her other Operations does ne-
r uſe any tedious difficult Means to perform that
hich may as well be accompliſhed by ſhorter and
ier Ways. But now, the Appearances would be
e ſame, in reſpect of us, if only this little Point of
rth were made the Subject of theſe Motions, as if
e vaſt Frame of the World, with all thoſe Stars of
ch Number and Bigneſs were moved about it. 'Tis
common Maxim, Μήδεν εἰχῆ τὸν φύσιν ἐργάζεσθαι. Na- *Galen.*
re does nothing in vain, but in all her Courſes does
ke the moſt compendious Way. 'Tis not therefore
ſay) likely, that the whole Fabrick of the Heavens,
hich do ſo much exceed our Earth in Magnitude and
rfection, ſhould be put to undergo ſo great and con-
nt a Work in the Service of our Earth, which might
ore eaſily ſave all that Labour by the Circumvolution
its own Body; eſpecially, ſince the Heavens do not
this Motion attain any farther Perfection for them-
ves, but are made thus ſerviceable to this little Ball
Earth. So that in this Caſe it may ſeem to argue
much Improvidence in Nature to employ them in
s Motion, as it would in a * Mother, who in warm- * *Lansberg.*
g her Child, would rather turn the Fire about that,
n that about the Fire: Or in a † Cook, who would † *Keplar.*
t roaſt his Meat by turning it about to the Fire; but
her, by turning the Fire about it: ∴ Or in a Man, ∴ *Galil.*
o aſcending ſome high Tower, to ſave the Labour
ſtirring his Head, ſhould rather deſire that all the
gions might ſucceſſively be turned before his Eye,
t ſo he might eaſily take a view of them.

We allow every Watchmaker ſo much Wiſdom not to put any Motion in his Inſtrument, which ſuperfluous, or may be ſupplied an eaſier way: A ſhall we not think that Nature has as much Provider as every ordinary Mechanick? O can we imagi that She ſhould appoint thoſe numerous and vaſt B dies, the Stars, to compaſs us with ſuch a ſwift a reſtleſs Motion, ſo full of Confuſion and Uncerta ties, when as all this might as well be done by Revolution of this little Ball of Earth?

Arg. 3. Amongſt the ſeveral parts of the World, there Six Planets which are generally granted to move. for the Sun and the Earth, and the fixed Stars, i yet in queſtion, which of them are naturally endow with the ſame Condition. Now common Reaſon dictate unto us, that Motion is moſt agreeable to t which in Kind and Properties is moſt near to th Bodies that undoubtedly are moved. But now th is one eminent Qualification, wherein the Earth d agree with the Planets; whereas the Sun, toget with the fixed Stars, do in the ſame reſpect differ fr them: And that is Light, which all the Planets, a ſo too the Earth, are fain to borrow e where, whilſt the Sun and the Stars have it of th own From whence it may be probably conclud that the Earth is rather the Subject of this Moti than the other. To this it may be added, that Sun and Stars ſeem to be of a more excellent Nat than the other parts of the World; and therefore ſho in reaſon be endowed with the beſt Qualificatio But now Motion is not ſo noble a Condition as R That is but a kind of wearifome and ſervile thin whereas, this is uſually aſcribed to God himſelf: whom 'tis ſaid:

* *Boet. de Conſol. Phil. l.* 3. *Arg.* 4.

* *Immotus ſtabiliſque manens dans cuncta moveri.*

† *De Cælo, l.* 2. *c.* 10.

† *Ariſtotle* tells us, 'tis very agreeable to Reaſon t the Time appointed for the Revolution of each O ſhould be proportionable to its Bigneſs. But now

an only be by making the Earth a Planet, and the ubject of the Annual and Diurnal Motions. Where- ore 'tis probable, that this does rather move than the leavens.

According to the common *Hypotheſis*, the *Primum Mobile* will move round in a Day. *Saturn* in Thirty ears. *Jupiter* in Twelve. *Mars* in Two The *Sun*, *enus*, and *Mercury*, which have ſeveral Orbs, yet will gree in their Revolutions, being each of them bout a Year in finiſhing their Courſes: Whereas by aking the Earth a Planet, there will be a juſt Propor- on betwixt the Bigneſs of the Orbs and the time of eir Motions: For then, next to the Sun or Centre, ere will be the Sphere of *Mercury*; which as it is but arrow in its Diameter, ſo likewiſe is it quick in its Mo- on, running its Courſe in 88 Days. *Venus*, that is ext unto it, in 224 Days. The Earth in 365 Days, r a Year. *Mars* in 687 Days. *Jupiter*, in 4332 Days: *aturn*, in 10759 Days. Thus likewiſe is it with thoſe *Medicean* Stars that encompaſs *Jupiter*. That which is weſt amongſt them, finiſhes his Courſe in two and wenty Hours; the next in three Days and a half; the hird, in ſeven Days; and the fartheſt in ſeventeen Days. Now as it is (according to *Ariſtotle's* Confeſſi- n) more likely that Nature ſhould obſerve ſuch a due roportion betwixt the Heavenly Orbs; ſo is it more robable, that the Earth ſhould move, rather than the leavens.

This may likewiſe be confirmed from the Appearance f Comets: Concerning which there are three things ommonly granted, or if they were not, might be aſily proved: Namely, *Arg.* 5.

1. That there are divers Comets in the Air, betwixt he Moon and our Earth.

2. That many of theſe Comets do ſeem to riſe and et as the Stars.

3. That this appearing Motion is not properly their wn, but communicated unto them from ſomewhat lſe.

But now, this Motion of theirs cannot be cauſed b the Heavens; and therefore it muſt neceſſarily proce from the Revolution of our Earth.

That the Moon's Orb cannot carry along with it t greater part of the Air, wherein theſe Comets are pl ced, might eaſily be proved from the common Groun For the concave Superficies of that Sphere is uſual ſuppoſed to be exactly terſe and ſmooth; ſo that t meer touch of it cannot turn about the whole Eleme of Fire, with a Motion that is not natural unto it. N could this Elementary Fire which they imagine to of a more rarified and ſubtle Nature, communicate t ſame Motion to the thicker Air, and that to the Wat (as ſome affirm:) For by what Means could that ſmoo Orb take hold of the adjoining Air? To this *Sarſ* anſwers, that there are great Gibboſities, and mountai ous Inequalities, in the Concavity of the loweſt Sphe and by theſe is it enabled to carry along with it t Fire and Air. But * *Fromondus* tells him, *Fictitia iſta ad fugam reperta ſunt.* And yet his own Conjecture ſcarce ſo good, when he affirms, that this Motion the Æthereal Air, as alſo of that Elementary Air ha by us, is cauſed by that Ruggedneſs which there is the Bodies of the Planets; of which Opinion we m with as good Reaſon ſay as he ſays to *Sarſius*, *Fict iſta & ad fugam reperta*: Theſe Things are meer Fic ons invented for Shifts, and without any probal ground.

* *Antar. cap.* 16.

But now this Appearance of the Comets may eaſ be reſolved, if we ſuppoſe the Earth to move. F then, though they did ſtill remain in their wont Places; yet this, by its diurnal Revolution ſucceſſive withdrawing it ſelf from them, they will appear riſe and ſet. And therefore, according to this comm natural Experiment, it is more probable that the Ea ſhould move, than the Heavens.

Another Argument urged by ſome to prove th this Globe of Earth is eaſily moveable, is taken fro

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he Opinion of thoſe who affirm that the Acceſs of ny Weight unto a new Place, as ſuppoſe an Army, oes make the Earth poiſe it ſelf afreſh, and change the Centre of Gravity that it had before: But this is not enerally granted; and therefore not to be inſiſted on s a common ground. *Vid. Vaſq. l. 1. diff. 2. cap. 8. 16.*

To this purpoſe likewiſe is that inference of *Lansberius*, who from *Archimedes* his ſaying, that he could nove the Earth, if he knew where to ſtand and faſten is Inſtrument; concludes, that the Earth is eaſily moeable; whereas 'twas the Intent of *Archimedes* in that peech, to ſhew the infinite Power of Engines: There eing no Weight ſo great, but that an Inſtrument might e invented to move it.

Before we finiſh this Chapter, 'tis requiſite that we nquire what kind of Faculty that is from which theſe Motions that *Copernicus* aſcribes unto the Earth, does proceed: Whether or no it be ſome Animal Power, that loes aſſiſt (as *Ariſtotle*) or inform (as *Keplar* thinks,) or lſe ſome other natural motive Quality which is intrinical unto it.

We may obſerve, That when the proper genuine Cauſe of any Motion is not obvious, Men are very prone to attribute unto that which they diſcern to be he moſt frequent Original of it in other things, Life. Thus the *Stoicks* affirm, the Soul of the Water to be the Cauſe of the ebbing and flowing of the Sea. Thus o- hers think the Wind to proceed from the Life of the Air, whereby it is able to move it ſelf ſeveral Ways, as ther living Creatures. And upon the ſame grounds do he *Platonicks*, *Stoicks*, and ſome of the *Peripateticks*, affirm the Heavens to be animated. From hence likewiſe it is, that o many do maintain *Ariſtotle* his Opinion concerning *Intelligences*: Which ſome of his Followers, the Schoolmen, lo confirm out of Scripture. From that Place in *Mat.* 24. 29. where 'tis ſaid, *The Powers of the Heavens ſhall be ſhaken.* In which words, by *Powers* (ſay they) are meant the Angels, by whoſe Power it is, that the Heavens are moved. *Sen. Nat. Queſt. l. 5. cap. 5, 6.*

And ſo likewiſe in that, *Job* 9. 13. where the Vulg has it, *Sub quo curvantur, qui portant orbem*; that is, t Intelligences. Which Text might ſerve altogether well, to prove the Fable of *Atlas* and *Hercules*. Th *Cajetan* concludes from that Place in the *Pſalm* 136. where 'tis ſaid, *God by Wiſdom made the Heavens*; or a cording to the Vulgar, *Qui fecit Cœlos intellectu*, That t Heavens are moved by an intelligent Soul.

If we conſider the Original of this Opinion, we ſh find it to proceed from that Miſtake of *Ariſtotle*, w thought the Heavens to be Eternal; and therefore require ſuch a moving Cauſe, as being of an Immat rial Subſtance, might be exempted from all that We rineſs and Inconſtancy which other things are liable unt

But now this Ground of his is evidently falſe, ſin 'tis certain, That the Heavens had a beginning, a ſhall have an end. However, the employing of Ang in theſe Motions of the World, is both ſuperfluous, a very improbable.

1. Becauſe a natural Power, intrinſical to thoſe B dies, will ſerve the turn as well. And as for other C perations, which are to be conſtant and regular, Natu does commonly make uſe of ſome inward Principle.

2. The Intelligences being immaterial, cannot in mediately work upon a Body; nor does any one t us what Inſtruments they ſhould make uſe of in t Buſineſs. They have not any Hands to take hold the Heavens, or turn them about. And that Opin on of *Aquinas*, *Durand*, *Soncinas*, with other Schoo men, ſeems to be without all Reaſon; who make t Faculty whereby the Angels move the Orbs, to the very ſame with their Underſtandings and Will So that if an Angel do but meerly ſuſpend the Act willing their Motion, they muſt neceſſarily ſtand ſtil And on the contrary, his only willing them to mov ſhall be enough to carry them about in their ſever Courſes: Since it were then a needleſs thing for Pr vidence to have appointed Angels unto this Buſine

which might have been done as well by the only Will of God. And beſides, how are the Orbs capable of perceiving this Will in the Intelligences? Or if they were, yet what Motive Faculty have they of themſelves, which can enable them to obey it?

Now as it would be with the Heavens, ſo likewiſe is it with the Earth, which may be turned about in its Diurnal Revolution, without the help of Intelligences, by ſome motive Power of its own, that may be Intrinſical unto it.

If it be yet enquired, what cauſe there is of its Annual Motion: I anſwer; 'Tis eaſily conceivable, how the ſame Principle may ſerve for both theſe, ſince they tend the ſame way from Weſt to Eaſt.

However, that Opinion of *Keplar* is not very improbable, That all the Primary Planets are moved round by the Sun, which once in Twenty five or Twenty ſix Days, does obſerve a Revolution about its own Axis, and ſo carry along the Planets that encompaſs it; which Planets are therefore ſlower or ſwifter, according to their diſtances from him. If you aſk by what means the Sun can produce ſuch a Motion? He anſwers; By ſending forth a kind of Magnetick Virtue in ſtrait Lines, from each Part of its Body; of which there is always a conſtant Succeſſion: So that as ſoon as one Beam of this Vigour has paſſed a Planet, there is another preſently takes hold of it, like the Teeth of a Wheel.

But how can any Virtue hold out to ſuch a diſtance?

He anſwers: Firſt, as Light and Heat, together with thoſe other ſecret Influences which work upon Mineals in the Bowels of the Earth; ſo likewiſe may the Sun ſend forth a Magnetick, Motive Virtue, whoſe Power may be continued to the fartheſt Planets. Secondly, if the Moon, according to common Philoſophy, may move the Sea, why then may not the Sun move this Globe of Earth?

In ſuch *Queries* as theſe, we can conclude only from Con-

Conjectures: That Speech of the Wise Man, *Eccles.* 3. 11 being more especially verified of *Astronomical* Questions concerning the Frame of the whole *Universe*, *That no Man can find out the Works of God, from the beginning to the end.* Though we may discern divers things in the World, which may argue the infinite Wisdom and Power of the Author, yet there will be always some Particulars left for our Dispute and Enquiry, and we shall never be able with all our Industry, to attain a perfect Comprehension of the Creatures, or to find them wholly out, *from the beginning to the end.*

Valles. Sacr. Philos. c. 64. The Providence of God having thus contrived it that so Man might look for another Life after this when all his Longing and Thirst shall be fully satisfied. For since no natural Appetite is in vain, it must necessarily follow, that there is a possibility of attaining so much Knowledge as shall be commensurate unto these Desires; which because it is not to be had in this World, it will behove us then to expect and provide for another.

PROP. X.

That this Hypothesis is exactly agreeable to common Appearances.

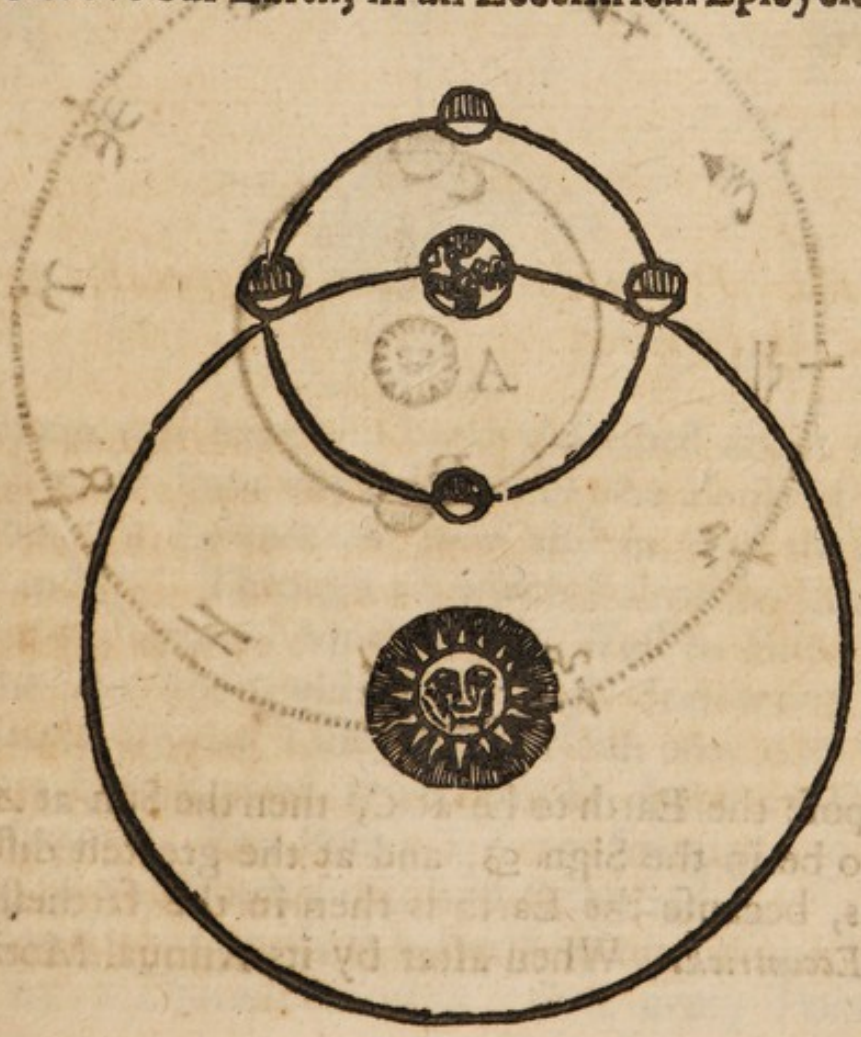
IT hath been already proved, that the Earth is capable of such a Situation and Motion as this Opinion supposes it to have. It remains, that in the last Place we shew how agreeable this would be unto those ordinary Seasons of Days, Months, Years, and all other Appearances in the Heavens.

1. As for the difference betwixt Days and Nights 'tis evident, That this may be as well caused by the Revolution of the Earth, as the Motion of the Sun; since the Heavenly Bodies must needs seem after the same manner to rise and set, whether or no they themselves

by their own Motion, do pass by our *Horizon* and *Vertical* Point; or whether our *Horizon* and *Vertical* Point, by the Revolution of our Earth, do pass by them. According to that of * *Aristotle*, οὐδὲν διαφέρει κινεῖν τὴν ὄψιν ἢ τὸ ὁρώμενον, there will not appear any difference, whether or no the Eye be moved from the Object, or the Object from the Eye. And therefore I cannot chuse but wonder that a Man of any Reason or Sense, should make choice of no better an Argument to conclude his Book withal, than that which we read at the latter end of *Al. Rosse*, where he infers, That the Earth does not move, because then the Shadow in a Sun-Dial would not be altered.

* *De Cœlo, lib.2.cap.8.*

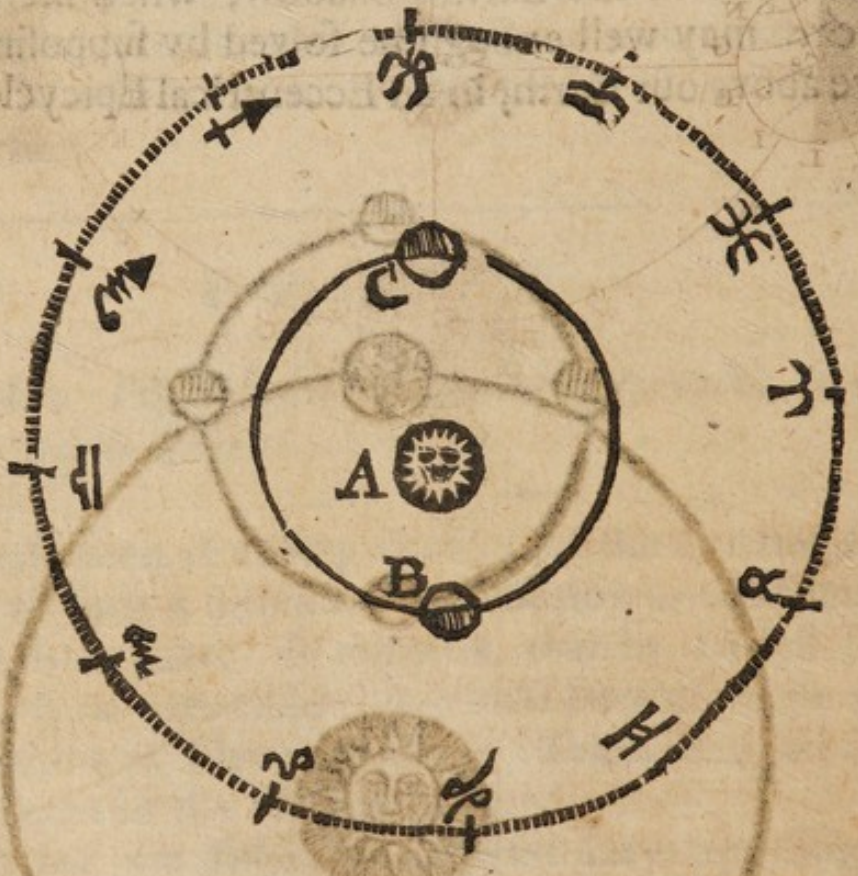
2. As for the difference of Months, we say, That the diverse Illumination of the Moon, the different bigness of her Body, her remaining for a longer or shorter time in the Earth's Shadow, when she is Eclipsed, *&c.* may well enough be solved by supposing her to move above our Earth, in an Eccentrical Epicycle. Thus,



In

In which kind of *Hypotheſis*, there will be a doubl difference of Motion; the one cauſed by the differen Situations of the Moon's Body, in its own Eccentrick the other by the different Situations of the Moon's Orb in the Earth's Eccentrick: Which is ſo exactly anſwera ble to the Motions and Appearances of this Planet, tha from hence *Lansbergius* draws an Argument for this *Sy ſtem* of the Heavens, which in the ſtrength of his Conf dence he calls, *Demonſtrationem* ὅτι συμφωνικὴν, *cui nulla ra tione poteſt contradici.*

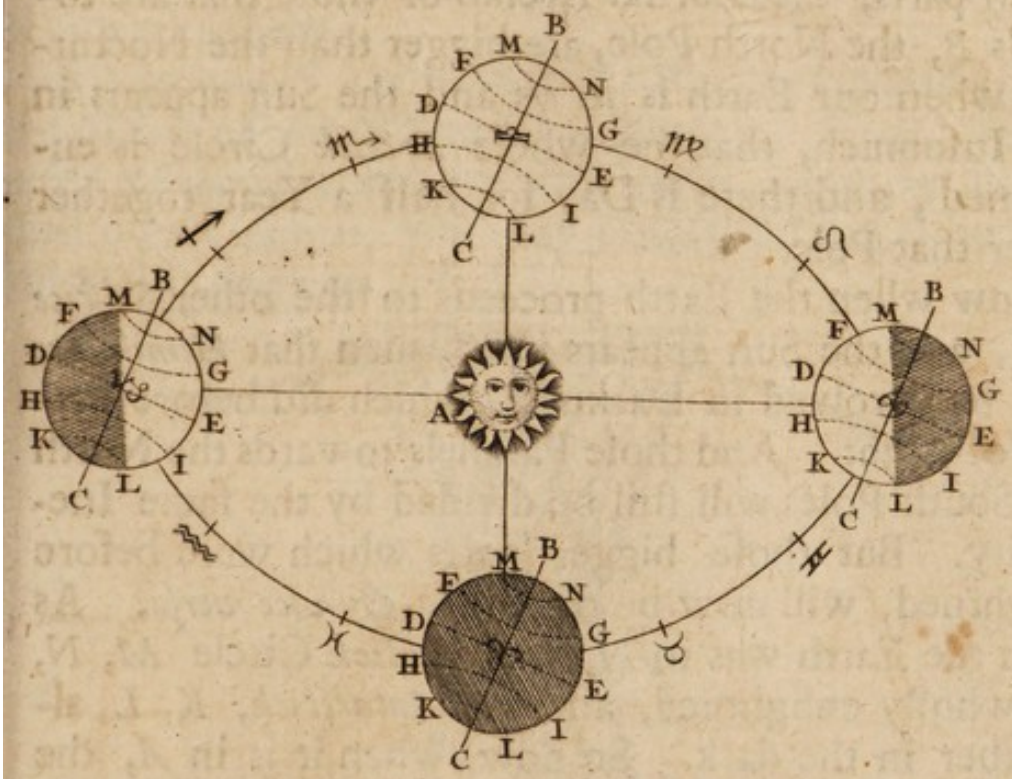
4. As for the difference betwixt Winter and Sum mer; betwixt the number and length of Days, whic appertain to each of thoſe Seaſons; the ſeeming Mo tion of the Sun from one Sign to another in the Z *diack*: All this may eaſily be ſolved, by ſuppoſing th Earth to move in an Eccentrical Orb about the Su Thus,



Suppoſe the Earth to be at *C*, then the Sun at *A* w ſeem to be in the Sign ♋, and at the greateſt diſtan from us, becauſe the Earth is then in the fartheſt pa of its *Eccentrick*. When after by its Annual Motion ha

hath paſſed ſucceſſively by the Signs ♒ ♓ ♈ ♉ ♊, at length it comes to the other *Solſtice* at *B*, where the Sun will appear in ♋ and ſeem biggeſt, as being in its *Perige*, becauſe our Earth is then in the neareſt part of its *Eccentrick*.

As for all other Appearances of the Sun which concern the Annual Motion, you may ſee by the following Figure, that they are exactly agreeable to this *Hypotheſis*.



Where you have the Earth deſcribed about the Sun at *A*, in the Four chief Points of the *Zodiack*; namely, the two *Equinoctials* at ♈ and ♎, and the *Solſtices* at ♋ and ♑. Through all which Points the Earth does paſs in his Annual Motion from Weſt to Eaſt.

The *Axis* upon which our Earth does move, is repreſented by the Line *B C*, which *Axis* does always decline from that of the *Ecliptick*, about 23 Degrees, 30 Minutes. The Points *B C* are imagined to be the Poles, *B* the North-Pole, and *C* the South.

Now if we ſuppoſe this Earth to turn about its own *Axis* by a Diurnal Motion, then every Point of it will

will deſcribe a parallel Circle, which will be either bigger or leſſer, according to its diſtance from the Poles. The chief of them are the *Equinoctial D, E.* The two *Tropicks, F, G*; and *H, I*, the two *Polar* Circles. *M, N*, the *Arctick*, and *K, L*, the *Antarctick*; of which the *Equinoctial* only is a great Circle, and therefore will always be equally divided by the Line of Illumination *M, L*, whereas the other Parallels are thereby diſtributed into unequal parts. Amongſt which parts, the Diurnal Arches of thoſe that are towards *B*, the North Pole, are bigger than the Nocturnal, when our Earth is in ♎ and the Sun appears in ♋: Inſomuch, that the whole *Arctick* Circle is enlightned, and there is Day for half a Year together under that Pole.

Now when the Earth proceeds to the other *Solſtice* at ♑, and the Sun appears in ♎, then that *Hemiſphere* muſt be involved in Darkneſs, which did before partake of Light. And thoſe Parallels towards the North and South Poles will ſtill be divided by the ſame Inequality. But thoſe bigger parts which were before enlightned, will now be darkned, *& vice verſa.* As when the Earth was in *N*, the *Arctick* Circle *M, N*, was wholly enlightned, and the *Antarctick, K, L*, altogether in the dark. So now, when it is in *A*, the *Antarctick K, L*, will be wholly in the Light, and the other *M, N*, altogether obſcured. Whereas the Sun before was vertical to the Inhabitants at the *Tropick F, G*; ſo now is he in the ſame Situation to thoſe that live under the other *Tropicks, H, I.* And whereas before the Pole did incline 23 Degrees 30 Minutes towards the Sun, ſo now does it decline as much from him. The whole difference will amount to 47 Degrees, which is the diſtance of one *Tropick* from the other.

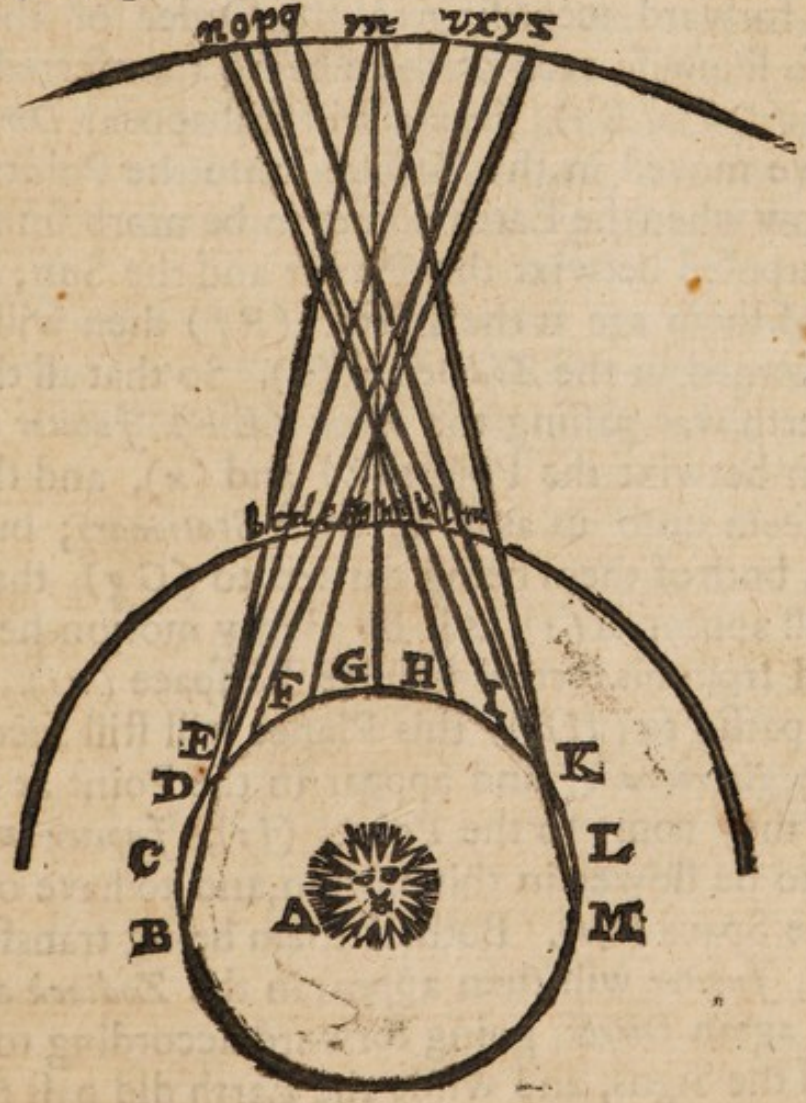
But now in the two other Figures, when the Earth is in either of the *Equinoctials* ♈ ♎, the Circle of Illumination will paſs thro' both the Poles, and therefore muſt

muſt divide all the Parallels into equal Parts. From whence it will follow, that the Day and Night muſt then be equal in all places of the World.

As the Earth is here repreſented in ♎, it turns only the enlightned part towards us: As it is in ♈ we ſee its Nocturnal *Hemiſphere.*

So that according to this *Hypotheſis*, we may eaſily and exactly reconcile every Appearance concerning the difference betwixt Days and Nights, Winter and Summer, together with all thoſe other Varieties which depend upon them.

If you would know how the Planets (according to the *Syſtem* of the Heavens) will appear *Direct*, *Stationary*, *Retrograde*; and yet ſtill move regularly about their own Centers, you may plainly diſcern it by this following *Diagram.*



Where

Where ſuppoſe the Sun to be at *A*, the Circle (*B G, M,*) to be the Orb of the Earth's Motion, and tha above it noted with the ſame Letters, to be the Spher of *Jupiter*; and the uppermoſt of all, to be a part o the *Zodiack* in the Starry Heaven.

Now if you conceive the Letters *A B C D E F* *H I K L M*, and *b c d e f g h i k l m*, to divide th Earth's Orb and that of *Jupiter*, into ſeveral parts proportionable to the ſlowneſs or ſwiftneſs of their dif ferent Motions (*Jupiter* finiſhing his Courſe in 1 Years, and the Earth in one) then ſuppoſing the Eart to be at the Point (*B*) and *Jupiter* likewiſe in his Or to be ſituated at (*b*), he will appear unto us to be in th *Zodiack* at the Point (*r*). But afterwards both of then moving forwards to the Letter (C c.) *Jupiter* wi ſeem to be in the *Zodiack* at (*v*), as having paſſed di rectly forward according to the Order of the Signs And ſo likewiſe each of them being transferred to th places (*D d*) (*E e*) *Jupiter* will ſtill appear *Direct*, an to have moved in the *Zodiack* unto the Points (*y z*, But now when the Earth comes to be more immediate ly interpoſed betwixt this Planet and the Sun; as whe both of them are at the Letter (*F f*) then will *Jupite* be diſcerned in the *Zodiack* at (*x*). So that all the whil the Earth was paſſing the Arch (*E F*) *Jupiter* did ſti remain betwixt the Points (*z*) and (*x*), and therefor muſt ſeem unto us as if he were *Stationary*; but after wards both of them being carried to (*G g*), then *Jup ter* will appear at (*s*), as if by a haſty motion he had re turned from his former Courſe the ſpace (*x s*). Both o them paſſig to (*H h*), this Planet will ſtill ſeem to b ſwiftly *Retrograde*, and appear in the Point at (*p*), bu when they come to the Points (*I i*), *Jupiter* will the ſeem to be ſlower in this motion, and to have only pa ſed the Space (*p n*). Both of them being transferred t (*K k*), *Jupiter* will then appear in the *Zodiack* at (*o*) being again *Direct*, going forward according to the o der of the Signs, and while the Earth did paſs the Arc

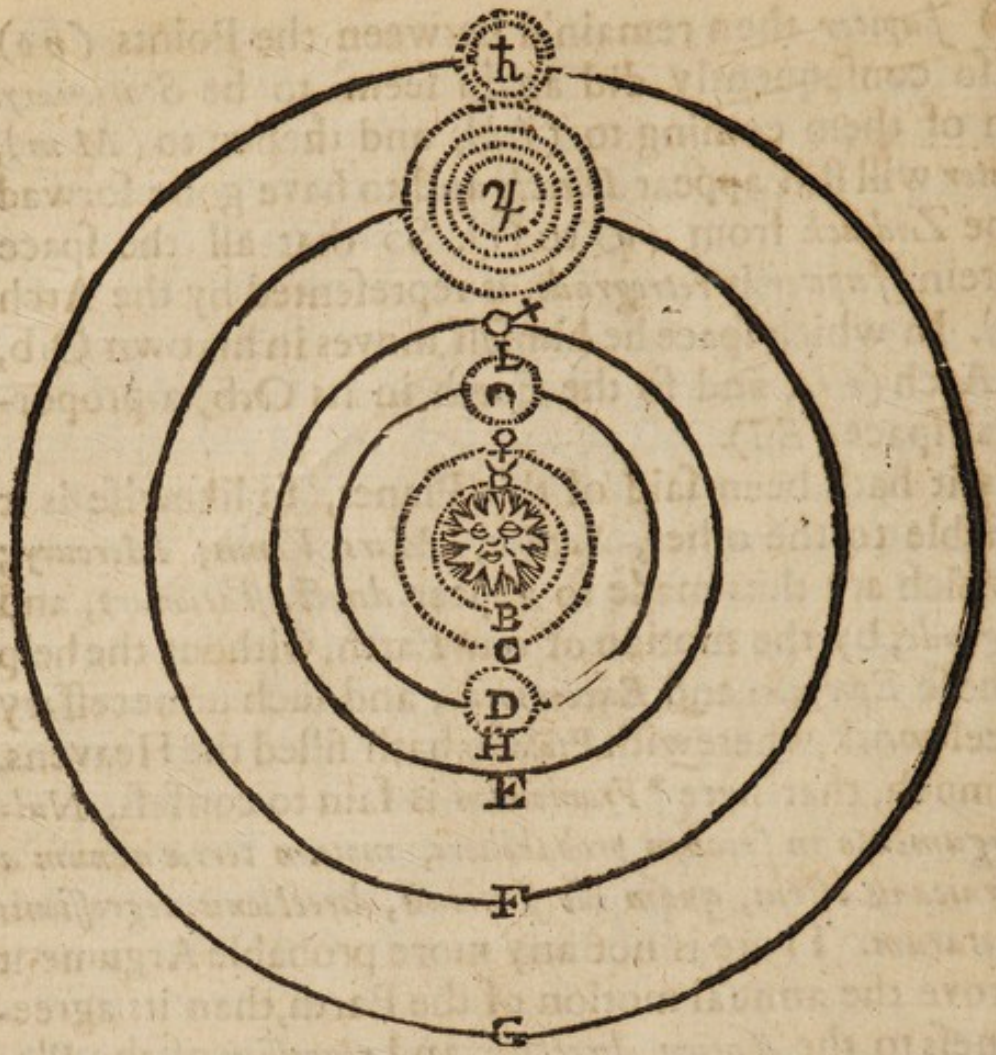
(*I*

K) *Jupiter* then remain'd between the Points (*n o*), nd ſo conſequently did again ſeem to be *Stationary*. oth of them coming to (*L l*), and thence to (*M m*), *upiter* will ſtill appear *Direct*, and to have gone forwad n the *Zodiack* from (*q*) to (*t*). So that all the ſpace herein *Jupiter* is *retrograde*, is repreſented by the Arch z). In which ſpace he himſelf moves in his own Orb, he Arch (*e i*), and ſo the Earth in its Orb, a proporonal ſpace (*E I*).

As it hath been ſaid of this Planet, ſo likewiſe is it ppliable to the other, *Saturn*, *Mars*, *Venus*, *Mercury*; ll which are thus made to appear *direct*, *ſtationary*, and *trograde*, by the motion of our Earth, without the help f thoſe *Epicycles* and *Excentricks*, and ſuch unneceſſary Vheel-work, wherewith *Ptolomy* hath filled the Heavens. nſomuch, that here **Fromondus* is fain to confeſs, *Nul- Argumento in ſpeciem probabiliori, motum terræ annum a opernicanis aſtrui, quam illo ſtationis, directionis, regreſſionis lanetarum.* There is not any more probable Argument o prove the annual motion of the Earth, than its agreebleneſs to the *ſtation*, *direction*, and *regreſſion* of the Planets.

* *Antariſt. c.* 18. *Veſt. tract.* 4. *c.* 3.

Laſtly, That *Copernicus*'s Syſtem of the Heavens is ery anſwerable to the exacteſt Obſervations, may be anifeſt from this following Deſcription of it.



Suppoſe the Sun to be ſituated at *A*: Now becauſe *Mercury* is found by experience to be always very near the Sun, ſo that he does for the moſt part lye hid under his Rays; as alſo becauſe this Planet hath a more lively vigorous Light than any of the other; therefore we may infer, that his Orb is placed next unto the Sun as that at *B*.

As for *Venus*, 'tis obſerv'd, That ſhe does always keep at a ſet diſtance from the Sun, never going from him above 40 Degrees, or thereabouts; that her Body appears thro' the Perſpective to be forty times bigger at one time than at another; that when ſhe ſeems biggeſt and neareſt unto us, we then diſcern her as being perfectly round. Therefore doth this Planet alſo move in a Circle that encompaſſes the Sun. Which Circle does not contain the Earth within it; becauſe then *Venus* would ſometimes be in *oppoſition* to the Sun; whereas

'tis

tis generally granted, that ſhe never yet came ſo far as to be in a *Sextile*.

Nor is this Circle below the Sun (as *Ptolomy* ſuppoeth) becauſe then this Planet, in † both its Conjunctions, would appear horned, which ſhe does not.

† *Matutina Veſpertina.*

Nor is it above the Sun, becauſe then ſhe would always appear in the Full, and never horned.

From whence it will follow, that this Orb muſt neceſſarily be betwixt the Earth and the Sun, as that at *C*.

As for *Mars*, 'tis obſerv'd, that he does appear ſixty times bigger when he is near us, than at his greateſt diſtance; that he is ſometimes in oppoſition to the Sun. From whence we may conclude that his Orb does contain our Earth within it. 'Tis obſerved alſo, that he does conſtantly appear in the Full, and never Horned: From whence likewiſe it is manifeſt, that the Sun is comprehended within its Orb, as it is in that which is repreſented by the Circle *E*.

And becauſe the like Appearances are obſerv'd in *Jupiter* and *Saturn* (tho' in leſs Degrees) therefore we may with good Reaſon conceive them to be in the Heavens, after ſome ſuch manner as they are here ſet down in the Figure, by the Circles *F. G*.

As for the Moon, becauſe ſhe is ſometimes in *oppoſition* to the Sun, therefore muſt her Orb comprehend in it the Earth; becauſe ſhe appears dark in her Conjunction, and ſometimes eclipſes the Sun; therefore that muſt neceſſarily be without her Orb, as it is in that *Epicycle* at *H*. In the Center of which, the Earth muſt neceſſarily be ſituated, according to all thoſe Appearances mention'd before. So that the Orb of its annual motion will be repreſented by the Circle *D*.

All which Appearances cannot ſo well be reconciled by *Ptolomy*, *Tycho*, *Origanus*, or by any other *Hypotheſis*, as by this of *Copernicus*. But the application of theſe to the ſeveral Planets, together with ſundry other Particulars, concerning the *Theorical* part of *Aſtronomy*, you may ſee more fully ſet down by thoſe who have purpoſely

poſely handled this Subject, *Copernicus*, *Rhetichus*, *Galilæus*; but more eſpecially *Keplar*: Unto whom I do acknowlede my ſelf in debted for ſundry Particulars in this Diſcourſe.

I have done with that which was the chief Purpoſe of the pre ſent Treatiſe; namely, the removal of thoſe Common Prejudi ces that Men uſually entertain againſt this Opinion. It remain that by way of Concluſion, I endeavour to ſtir up others unt theſe kind of Studies, which by moſt Men are ſo much neglected

'Tis the moſt rational way, in the proſecution of ſeveral Ob jects, to proportion our Love and Endeavour after every thing according to the excellency and deſirableneſs of it. But nov amongſt all Earthly Contentments, there is nothing either bette in it ſelf, or more convenient for us, than this kind of Learning and that, whether you conſider it according to its *General* Nature as a *Science*; or according to its more *Special* Nature, as *ſuch Science.*

1. Conſider it as a *Science*. Certain it is, that amongſt the variet of Objects, thoſe are more eligible which conduce unto the We fare of that which is our beſt part, our Souls. 'Tis not ſo muc the pleaſing of our Senſes, or the increaſing of our Fortunes, tha does deſerve our Induſtry, as the Information of our Judgment the Improvement of our Knowledge. Whatever the World ma think, yet it is not a vaſt Eſtate, a Noble Birth, an Eminent Plac that can add any thing to our true real Worth; but it muſt b the degrees of that which makes us *Men*, that muſt make us *bett Men*, the Endowments of our Soul, the Enlargement of our Rea ſon. Were it not for the Contemplation of Philoſophy, the He then * *Seneca* would not ſo much as thank the Gods for his Being

* *Præf. ad l. 1. Nat. Queſt.*

Niſi ad hæc admitterer non fuit opere pretium naſci. Detrahe hoc in ſtimabile bonum non eſt vita tanti, ut ſudem, ut æſtuem. Take bu away this Benefit, and he would not think Life worth the ſwea ing for. So much Happineſs could he diſcern in the Studies Nature. And therefore as a *Science* in general, it may very we deſerve our Love and Induſtry.

2. Conſider it as ſuch a particular *Science*, *Aſtronomy:* the Wor ſignifies the Law of the Stars; and the *Hebrews* (who do not o dinarily admit of Compoſition) call it in two Words, חקות שמים

Job 38.33. *Jer.* 33.25.

Cælorum Statuta, or the *Ordinances of Heaven*; becauſe they a governed in their Courſes by a certain Rule, as the *Pſalmiſt* ſpeal in the 148th *Pſal.* v. 6. *God has given them a Law which ſhall no be broken.*

Now this of all other Natural *Sciences* may beſt of all challeng our Induſtry; and that, whether you conſider it,

1. Abſolutely, as it is in it ſelf: Or,
2. As it ſtands in reference to us.

1. As it is in it ſelf. The Excellency of any *Science* may b judged of (ſaith the Philoſopher) firſt, by the Excellency of th Object. Secondly, by the Certainty of its Demonſtrations.

1. Fo

1. For the *Object*. It is no leſs than the whole World (ſince our arth alſo is one of the Planets) more eſpecially thoſe vaſt and orious Bodies of the Heavens. So that in this reſpect it far exeeds all thoſe barren, empty Speculations about *Materia prima*, d *Univerſale*, and ſuch like Cobwebs of Learning; in the ſtudy which ſo many do miſplace their younger Years. And for the me Reaſon likewiſe is it to be preferr'd before all thoſe other *iences*, whoſe Subjects are not either of ſo wide an Extent, or excellent a Nature.

2. For the *Demonſtrations* of *Aſtronomy*, they are as infallible as ruth it ſelf; and for this Reaſon alſo does it excel all other nowledge, which does more depend upon Conjectures and Uncertainty. They are only thoſe who want Skill in the Principles this *Science*, that miſtruſt the Concluſions of it. Since therere in theſe reſpects, it is one of the moſt Excellent *Sciences* in lature, it may beſt deſerve the Induſtry of Man, who is one of he beſt Works of Nature Other Creatures were made with heir Heads and Eyes turned downwards: Would you know why Man was not created ſo too? why it was, that he might be an *Aronomer*.

Os homini ſublime dedit, Celumq; tueri
Juſſit, & erectos ad Sydera tollere vultus.
God gave to Man an Upright Face, that he
Might view the Stars, and learn *Aſtronomy*.

2. Conſider it in reference to us; and ſo it is,
1. Moſt Uſeful.
2. Moſt Pleaſant.

1. Moſt Uſeful, and that in ſundry reſpects. It proves a God nd a Providence, and incites our Hearts to a greater Admiration and Fear of his Omnipotency. *We may underſtand by the Heaens, how much mightier he is that made them; for by the Greatneſs nd Beauty of the Creatures, proportionably the Maker of them is ſeen,* ith the Book of *Wiſdom*, 13. 4, 5. It was hence that *Ariſtotle* id fetch his Chief Argument to prove a *Primus Motor*. 'Twas he conſideration of theſe Things that firſt led Men to the Knowdge and Worſhip of God (ſaith * *Tully*). *Hæc nos primum ad eorum cultum, tum ad modeſtiam, magnitudinemq; animi erudivit.* And therefore when God by the Prophet would convince the eople of his Deity, he bids them *lift up their Eyes on high, and behold who hath created thoſe things; that bringeth out their Hoſt by number, that calleth them all by their Names*, &c. Iſa. 40. 26. Which ccaſion'd that Saying of *Lactantius*; *Tanta rerum magnitudo, tanta diſpoſitio, tanta in ſervandis ordinibus, temporibuſq; conſtantia; non potuit aut olim ſine provido artifice oriri, aut conſtare tot ſæculis ſine incola potente, aut perpetuum gubernari ſine perito & ſciente rectore, quod ratio ipſa declarat.* Such a great Order and Conſtancy amongſt thoſe vaſt Bodies, could not at firſt be made but by a Wiſe Providence, nor ſince preſerved without a Powerful Inhabitant, nor ſo perpetually governed without a skilful Guide. True

* *Tuſcul.* 1. *Item. Plut. deplacit. Phil. l.* 1. *c.* 6.

Inſtit. l. 2. *c.* 5.

True indeed, an ordinary View and common Apprehenſion theſe Celeſtial Bodies, muſt needs manifeſt the Excellency a Omnipotency of their Maker; but yet a more accurate and di gent Enquiry into their Natures, will raiſe our Underſtandi unto a nearer Knowledge, and a greater Admiration of the D ty: As it is in thoſe inferior things, where the meer outſide o Man, the Comelineſs and Majeſty of his Countenance, may ſome Argument from whence to infer the Excellency of his Cr tor. But yet the ſubtle Anatomiſt, who ſearches more deeply to this wonderful Structure, may ſee a clear Evidence for t in the Conſideration of the inward Fabrick, the Muſcles, Nerv Membranes, together with all thoſe ſecret Contrivances in t Frame of this little World. Thus alſo is it in the great *Unive* where the common Apprehenſion of Things is not at all conſi rable, in compariſon to thoſe other Diſcoveries, which may found out by a more exact Enquiry.

As this Knowledge may conduce to the proving of a God, a making Men Religious; ſo likewiſe may it ſerve to confirm u to us the Truth of the Holy Scriptures: Since the Sacred Sto in the order of its Narrations, does ſo exactly agree with t Converſions of Heaven, and *Logiſtical Aſtronomy*.

Pſal.8,3.6. It may alſo ſtir us up to behave our ſelves anſwerably unto t Noble and Divine Nature of our Souls. *When I conſider the H ven, the Works of thy Fingers, the Moon and the Stars which thou h ordained, what is Man, that thou art ſo mindful of him?* as to cre ſuch vaſt Glorious Bodies for his Service.

* *Sen. Nat. Quæſt. l.* 1. *Nonne ô terrena animalia conſideratis, quibus præſidere videamini? Nam ſi inter mares videres unum aliquam, jus ſibi ac poteſtatem præ cæteris vindicentem, quanto movereris chachinno,* &c. *Boetius de Conſol. l.* 2.

Again, when I conſider with my ſelf the ſtrange Immen and Bigneſs of this great *Univerſe*, in compariſon to which, t Earth of ours is but as an undiſcernible Point: When I conſi that I carry a Soul about me, of far greater Worth than all t and Deſires that are of a wider Extent, and more unbounded pacity than this whole Frame of Nature; then, methinks, muſt needs argue a Degenerateneſs and Poverty of Spirit, to b my Faculties about ſo ignoble, narrow a Subject as any of th Earthly things. What a Folly is it in Men to have ſuch h Conceits of themſelves, for ſome ſmall Poſſeſſions which they h in the World above others; to keep ſo great a Buſtle about poor a Matter? * *Hoc eſt punctum quod inter tot gentes ferro & i dividitur.* 'Tis but a little Point which with ſo much ado is ſtributed unto ſo many Nations by Fire and Sword. What gr Matter is it to be Monarch of a ſmall part of a Point? Might the Ants as well divide a little Mole-hill into divers Provinc and keep as great a ſtir in diſpoſing of their Government? *Punct eſt illud in quo navigatis, in quo bellatis, in quo regna deſponitis.* this place wherein we War, and Travel, and diſpoſe of Kingdo is but a Point far leſs than any of thoſe ſmall Stars, that at t diſtance are ſcarce diſcernible. Which when the Soul does ſe ouſly meditate upon, it will begin to deſpiſe the narrowneſs

: preſent Habitation, and think of providing for it ſelf a Man-
n in thoſe wider Spaces above ; ſuch as may be more agreeable
the Nobleneſs and Divinity of its Nature.

Why ſhould any one Dream of propagating his Name, or
reading his Report through the World ? When although he
d more Glory than Ambition can hope for, yet as long as all
is Habitable Earth is but an inconſiderable Point, what great
atter can there be in that Fame which is included within ſuch
ait contracted Limits ?

Boetius Ibid.

Quicunq; ſolam mente præcipiti petit
Summumq; credit gloriam,
Late patentes ætheris cernat plagas,
Arctumq; terrarum ſitum.
Brevem replere non valentis ambitum,
Pudebit aucti nominis.

" He that to Honour only ſeeks to mount,
" And that his chiefeſt End doth count ;
" Let him behold the largeneſs of the Skies,
" And on the ſtrait Earth caſt his Eyes ;
" He will deſpiſe the Glory of his Name,
" Which cannot fill ſo ſmall a Frame.

Why ſhould any one be taken up in the Admiration of theſe
ver Outſides , theſe Earthly Glories ? *Reſpicite Cæli ſpatium,* *Idem lib. 3.*
nitudinem, celeritatem, & aliquando definite vilia mirari. He
t rightly underſtands the Nature of the Heavens, will ſcarce
eem any other thing worth his *Notice*, much leſs his *Wonder*.

Now when we lay all this together, That he who hath moſt in
: World, hath almoſt nothing of it : That the Earth it ſelf, in
mpariſon to the *Univerſe* is but an inconſiderable Point ; and
: that this whole *Univerſe* does not bear ſo great a proportion
the Soul of Man, as the Earth does unto that. I ſay, when a
n in ſome retired Thoughts ſhall lay all this together, it muſt
eds ſtir up his Spirits to a contempt of theſe Earthly Things,
l make him place his Love and Endeavour upon thoſe Comforts
t may be more anſwerable to the Excellency of his Nature.

Without this Science, what Traffick could we have with Fo-
gn Nations ? What would become of that mutual Commerce,
ereby the World is now made but as one Commonwealth.

Voſque mediis in aquis Stellæ, pelagoque timendo.
Decretum monſtraſtis iter, totique dediſtis,
Legibus inventis hominum, commercia mundo.

'Tis you Bright Stars, that in the fearful Sea,
Do guide the Pilot through his purpos'd Way.
'Tis your Direction that doth Commerce give,
With all thoſe Men that thro' the World do live.

. As this Science is thus profitable in theſe and many other
pects ; ſo likewiſe is it equally pleaſant. The Eye (ſaith
Philoſopher) is the Senſe of Pleaſure, and there are no De-

lights

lights ſo pure and immaterial as thoſe which enter throug that Organ. Now to the Underſtanding, which is the Eye o the Soul, there cannot be any fairer Proſpect, than to view th whole Frame of Nature, the Fabrick of this great *Univerſe*, t diſcern that Order and Comelineſs which there is in the *Magni*
Wiſ.7.18, 19. *tude*, *Situation*, *Motion* of the ſeveral Parts that belong unto it to ſee the true Cauſe of that conſtant Variety and Alteratio which there is in the different Seaſons of the Year. All whic muſt needs enter into a Man's Thoughts with a great deal o Sweetneſs and Complacency. And therefore it was that *Julii Cæſar* in the Broils and Tumult of the Camp, made choice o this Delight:

Lucanl.10.
——*Media inter prælia ſemper,*
Stellarum, Cœlique plagis, ſuperiſque vacavit.
He always leiſure found amidſt his Wars,
To mark the Coaſts of Heav'n, and learn the Stars.

And for this reaſon likewiſe did *Seneca*, amidſt the continu Noiſe and Buſtle of the Court, betake himſelf to this Recreatio

O quam juvabat, quo nihil majus, parens
Natura genuit, operis immenſi artifex,
Cœlum intueri Solis, & currus ſacros
Mundique motus, Solis alternas vices,
Orbemque Phœbes, aſtra quem cingunt vaga
Lateque fulgens Ætheris magni decus.
O what a Pleaſure was it to ſurvey
Nature's chief Work, the Heavens; where we may
View the alternate Courſes of the Sun,
The Sacred Chariots, how the World does run:
The Moon's bright Orb, when She's attended by
Thoſe ſcatter'd Stars, whoſe Light adorns the Sky.

And certainly thoſe eminent Men who have this way beſtow a great Part of their Employment, ſuch as were *Ptolomy*, *Julii Cæſar*, *Alphonſus* King of *Spain*, the Noble *Tycho*, &c. have n only by this Means pitched upon that which for the preſe was a more ſolid kind of Pleaſure and Contentment; but al a ſurer way to propagate their Memories unto future Age Thoſe great coſtly Pyramids which were built to perpetuate t Memory of their Founders, ſhall ſooner periſh and moulder aw into their Primitive Duſt, than the Names of ſuch Worthi ſhall be forgotten. The Monuments of Learning are mo durable than the Monuments of Wealth or Power.

All which Encouragements may be abundantly enough to ſ any conſidering Man, to beſtow ſome part of his Time in t Study and Inquiſition of theſe Truths.

Fœlices animæ, quibus hæc cognoſcere primum,
Inque domos ſuperas ſcandere cura fuit.

Mercury

Mercury:

OR THE

SECRET and SWIFT

Messenger.

SHEWING,

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To the Right Honourable

GEORGE,

Lord *Berkley*, Baron of *Berkley*, *Mobray*, *Segrave*, and *Bruce*, and Knight of the Noble Order of the *Bath*.

My Lord,

I *Do here once more preſent your Lordſhip with the Fruit of my* leiſure *Studies, as a Teſtimony of my Readineſs to ſerve you in thoſe ſacred Matters, to which I devote my more ſe-*rious *Hours. I ſhould not have preſumed to this Dedication, had I not been encouraged by that generouſneſs and ſweetneſs of Diſpoſition, which does ſo eminently adorn your Lordſhip's Place and Abilities.*

If your Lordſhip pleaſe to excuſe this Boldneſs, and to vouchafe this Pamphlet a ſhelter under your favourable Patronage, you ſhall thereby encourage me in thoſe higher Studies, which may be more agreeable to that Relation wherein I ſtand, as being

Your Lordſhip's Servant and Chaplain,

J. W.

To the READER.

THat which firſt occaſion'd this Diſcourſe, was the reading of a little Pamphlet, ſtiled, *Nuntius Inanimatus*, commonly aſcribed to a late Reverend Biſhop; wherein he affirms, That there are certain Ways to diſcourſe with a Friend, though he were in a cloſe Dungeon, in a beſieged City, or a Hundred Miles off.

Which Promiſes, at the firſt Peruſal, did rather raiſe my Wonder than Belief, having before that time obſerved nothing that might give any Satisfaction in theſe Particulars. And I ſhould have eſteemed them altogether Fabulous, had it not been for the Credit of their reputed Author.

After this, I did collect all ſuch Notes to this Purpoſe, as I met with in the Courſe of my other Studies.

From whence when I had received full Satisfaction, I did for mine own farther Delight compoſe them into this Method.

I have already attained mine own Ends, both in the Delight of Compoſing this, and the Occaſion of Publiſhing it: And therefore need not either fear the Cenſure of others, or beg their Favour. I could never yet diſcern, that any Reader hath ſhewed the more Charity for the Author's beſpeaking it. Farewell.

J. W.

TO

To MERCURY *the Elder*:

On the moſt Learned *Mercury* the Younger.

REST Maja's *Son, ſometimes Interpreter*
Of gods, and to us Men their Meſſenger:
Take not ſuch Pains as thou haſt done of old,
To teach Men Hieroglyphicks, *and to unfold*
Egyptian *hidden Characters, and how*
Men writ in dark Obſcurity: For now
Trithemius *and* Selenus *both are grown*
Such Cryptographers, *as they ſcarce will own*
Thee for their Maſter; and Decipherers know
Such ſecret Ways to write, thou ne'er didſt ſhow.
Theſe are but Artiſts which thou didſt inſpire;
But now thou of a Mercury *art Sire*
Of thine own Name, a Poſt with whom the Wind,
Should it contend, would be left far behind.
Whoſe Meſſage, as thy Metal, ſtrikes the Gold
Quite through a Wedge of Silver uncontrol'd;
And in a moment's ſpace doth paſs as far
As from the Artick *to th'* Antartick *Star.*
So proving what is ſaid of Influence,
May now be ſaid of his Intelligence,
They neither of them having ſuch a Quality
As a relation to Locality:
No Places diſtance hindring their Commerce,
Who freely traffick through the Univerſe;
And in a minute can a Voyage make
Over the Ocean's univerſal Lake.
This Son of thine, could any Words or Praiſe,
His Learning, Worth, or Reputation raiſe,

We ſhould be Suitors to him to beſtow
Encomiums *on* Himſelf, *which* We *do owe*
Unto his Worth, and uſe that Eloquence,
Which as his own, muſt claim Preheminence:
For thee, 'tis Glory enough thou haſt a Son
Of Art, that hath thy ſelf in Art outdone.

Sir *Francis Kinaſton*, Knt.

To the Unknown Author.

OF *Old, who to the common Good apply'd*
Or Mind or Means, for it were Deifi'd:
But chiefly ſuch who new Inventions found;
Bacchus *for Wine.* Ceres *that till'd the Ground.*
I know no reaſon Time ſhould breed ſuch odds,
(W' have warrant for't) Men now may be ſtil'd gods.
By hiding who thou art, ſeek not to miſs
The Glory due to ſuch a Work as this;
But ſet thy Name, that thou may'ſt have the Praiſe,
Leſt to the Unknown God *we Altars raiſe.*

Anthony Aucher, *Eſq;*

To my Friend the Author.

TO *praiſe thy Work, were to anticipate*
Thy Reader's Judgment, and to injure Fate;
Injuſtice to thy ſelf; for real Worth
Needs not Arts Flattery to ſet it forth.
Some chuſe ſelected Wits *to write as* Friends,
Whoſe Verſes, when the Work fails, make amends.
So as the Buyer has his Pennyworth,
Though what the Author write prove ſpumy Froth.

Thou

Thou, of a Humour croſs to that, haſt choſe
A Friend or two, whoſe Verſe hops like rough Proſe;
From whoſe inexpert Vein thou canſt not look
For Lines that may enhance the Price o'th' Book.
Let it commend it ſelf, all we intend
Is but to ſhew the World thou art our Friend.

Richard Hatton, *Eſq;*

To the Reader.

READer, this Author has not long ago
Found out another World to this below:
Though that alone might merit great Renown,
Yet in this Book he goes beyond the Moon:
Beyond the Moon *indeed, for here you ſee*
That he from thence hath fetch'd down Mercury;
One that doth tell us Things both ſtrange *and* new,
And yet believe't they're not more ſtrange than true.
I'm loth to tell thee what rare Things they be,
Read thou the Book, and then thou'lt tell them me.

Tob. Worlrich, *J. C. Doct.*

To his Honoured Friend J. W. *on his Learned Tract,* The Secret and Swift Meſſenger.

INimitable Sir, we here diſcern
Maxims the Stagirite *himſelf might learn.*
Were Plato *now alive he'd yield to you,*
Confeſſing ſomething might be Known anew.
Freſh Hereſies (New-nothings) ſtill appear
As Almanacks, *the Births of every Year.*

This Dutchman *writes a* Comment ; *that* Tranſlates ;
A third Tranſcribes ; *Your Pen alone* Creates
New neceſſary Sciences : This Art
Lay undiſcover'd as the World's Fifth Part.
But Secreſy's *now publiſh'd ; You reveal*
By Demonſtration how we may conceal.
Our Legates *are but Men, and often may*
Great State-Affairs unwillingly betray ;
Caught by ſome ſifting Spies, or tell-tale Wine,
Which dig up Secrets in the deepeſt Mine.
Sometimes, like Fire pent in, they outward break,
And 'cauſe they ſhould be ſilent, therefore ſpeak.
Nor are King's Writings ſafe : To guard their Fame,
Like Scævola *they wiſh their Hand i'th' Flame.*
Ink turns to Blood ; they oft participate
By Wax and Quill ſad Icarus *his Fate.*
Hence Noblemens bad Writing proves a Plot ;
Their Letters are but Lines, their Names a Knot.
But now they ſhall no more Seal *their own* Fall ;
No Letters prove Killing, *or* Capital.
Things paſs unknown, and each Ambaſſador's
Strict as the Breaſt of Sacred Confeſſors :
Such as the Inquiſition cannot ſee ;
Such as are forc'd neither by Rack, nor Fee.
Swift Secrecy deſcends to Human Powers ;
That which was Pluto's *Helmet, now is Ours.*
We ſhall not henceforth be in pay for Air,
Tranſported Words being dear as precious Ware ;
Our Thoughts will now arrive before they're ſtale ;
They ſhall no more wait on the Carriers Ale
*And Hoſteſs, two Land-*Remoraes, *which bind*
All to a Tortoiſe *pace, though Words be Wind.*
This Book's a better Ark ; we brook no ſtay,
Maugre the deepeſt Flood, or ſouleſt Way.
Commerce of Goods and Souls we owe to Two,
(Whoſe Faxes ſhall now be Twins) Noah *and You.*
Each Bird is turn'd a Parrot, *and we ſee*
Æſop's Beaſts made more eloquent by thee.

Wooers

boers again may wing their fetter'd Love,
Noah's trusty Messenger the Dove.
rches which us'd only to help our Sight,
Like Heavenly Fires) do give our Reason Light.
raths Harbingers, Arrows, and Bullets prove
ke Cupid's *Darts, Ambassadors of Love.*
ren your Diviner Hieroglyphicks *tell,*
ow we may Landskips read, and Pictures spell.
u teach how Clouds inform, how Smoaks advise;
us Saints with Incense talk to Deities.
us by dumb Creatures we instructed are,
the Wise Men were tutor'd by a Star.
Since we, true Serpents like, do little wrong
ith any other Member but the Tongue;
u tell us how we may by Gestures talk;
ow Feet are made to speak, as well as walk;
ow Eyes discourse, how mystick Nods contrive;
aking our Knowledge too, Intuitive.
Bell no noise but Rhetorick *affords;*
ur Musick Notes are Speeches, Sounds are Words.
ithout a Trope there's Language in a Flow'r,
nceits are smelt without a Metaphor.
rk Subtleties we now shall soon define,
ch Organ's *turn'd the Sense of* Discipline.
is to your Care we owe that we may send
sines unknown to any but our Friend.
at which is English *Friendship to my Brother,*
ay be thought Greek *or Nonsense to another.*
now may Homer's Iliads *confine,*
t in a Nut-shell, but a Point, or Line.
hich Art though't seem to exceed Faith, yet who
ies it will find both Truth and Reason too.
s not like Jugglers Tricks, absurd, when shown;
t more and more admir'd, the more 'tis known.
Writing's an Act of Emanation,
And Thoughts speed quick and far as Day doth run.

Richard West. C. C. Ox.

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MERCURY,

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ecret and Swift Meſſenger.

CHAP. I.

he Dependance of this Knowledge in Nature. The Authors that have treated of it. Its Relation to the Art of Grammar.

EVery rational Creature, being of an imperfect and dependent Happineſs, is therefore naturally endowed with an Ability to communicate its own Thoughts and Intentis; that ſo by mutual Services it might the better promote it ſelf in the Proſecution of its own Well-being.

And becauſe there is ſo vaſt a Difference betwixt Spirit and a Body, therefore hath the Wiſdom of Providence contrived a diſtinct Way and Means, whereby they are each of them enabled to Diſcourſe, according to the Variety of their ſeveral Natures.

The Angels or Spiritual Subſtances, *Per inſinuationem ſpecierum*, (as the Schoolmen ſpeak.) By inſinuating of the Species, or an unveiling of their own Natures in the Knowledge of ſuch Particulars they would diſcover to another. And ſince they are of an *Homogeneous* and *immaterial* Eſſence, therefore

Aquinas part 1. *Quæſt.* 107. *Zanch. de Operibus Dei, part* 1. *l.* 3. *c.* 19.

fore do they hear, and know, and speak, not v
ſeveral parts, but with their whole Subſtance.
1 Cor. 13. 1. tho' the Apoſtle mentions the *Tongue of Angels*, that is only *Per conceſſionem, & ex hypotheſi.*

But now, *Men* that have *Organical Bodies*, can communicate their Thoughts ſo eaſie and immed a way. And therefore have need of ſome Cor real Inſtruments, both for the *Receiving* and *Con ing* of Knowledge. Unto both which Functio Nature hath deſigned ſeveral Parts. Amongſt reſt, the Ear is chiefly the Senſe of Diſcipline *Learning*, and the Tongue the Inſtrument of *Te ing*. The Communion betwixt both theſe, is Speech or Language, which was but one at firſt, hath ſince been confounded into ſeveral kinds. A Experience now ſhews, that a Man is equally poſed for the Learning of all, according as Edu tion ſhall direct him. Which would not be, if ſome fondly conceive) any one of them were N tural unto us. For *Intus exiſtens prohibet alienum.*

Valeſius Sacr. Phil. cap. 3.

*Cœl. Rhod. Ant. lect. l.*2*.*9*.c.* 14.

Or ſuppoſe that a Man could be brought up to Speaking of another Tongue, yet this would hinder, but that he ſhould ſtill retain his Knowlec of that which was Natural. For if thoſe which gotten by Art do not hinder one another, mu leſs would they be any impediment to that which from Nature. And according to this it will follo that moſt men ſhould be of a double Langua which is evidently falſe. Whence likewiſe you m gueſs at the Abſurdity of their Enquiries, who ha ſought to find out the Primitive Tongue, by brin ing up Infants in ſuch ſilent ſolitary Places, wh they might not hear the Speech of others.

Languages are ſo far Natural unto us, as other A and Sciences. A Man is born without any of the but yet capable of all.

Now, becauſe *Words* are only for thoſe that preſent both in *Time* and *Place*; therefore to th

th

re hath been added, the Invention of *Letters* and iting, which are ſuch a Repreſentation of our rds (tho' more permanent) as our Words are of Thoughts. By theſe we may diſcourſe with m that are remote from us, not only by the Dince of many Miles, but alſo of many Ages. *Huuſu ſcimus maxime conſtare humanitatem vitæ, memon, ac hominum immortalitatem*, ſaith *Pliny*. *Quid magnificentius? Quid æque mirandum? in quod ne rtis quidem avida rapacitas jus ullum habeat*, ſaith *odiginus*. This being the chiefeſt Means both the promoting of Human Society, and the peruating our Names unto following Times.

Nat. Hiſt. l.14. c.11. Antiq.lect. l. 4. c. 3.

How ſtrange a thing this Art of Writing did ſeem ts firſt Invention, we may gueſs by the late diſrered *Americans*, who were amazed to ſee Men nverſe with Books, and could ſcarce make themves believe that a Paper ſhould ſpeak; eſpecially, en after all their Attention and liſtning to any iting (as their Cuſtom was) they could never ceive any Words or Sound to proceed from

There is a pretty Relation to this Purpoſe, conning an *Indian* Slave; who being ſent by his Ma- with a Basket of Figs and a Letter, did by the y eat up a great Part of his Carriage, convey- the Remainder unto the Perſon to whom he was ected; who when he had read the Letter, and finding the Quantity of Figs anſwerable to at was ſpoken of, he accuſes the Slave of eating m, telling him what the Letter ſaid againſt him. the *Indian* (notwithſtanding this Proof) did conntly abjure the Fact, curſing the Paper, as being lſe and lying Witneſs. After this, being ſent an with the like Carriage, and a Letter expreſſing juſt Number of Figs that were to be delivered, did again, according to his former Practice, der a great Part of them by the Way; but before he

Hermannus Hugo de Orig. Scribendi Præf.

he meddled with any, (to prevent all following A cusations) he first took the Letter, and hid that der a great Stone, assuring himself, that if it not see him eat the Figs, it could never tell of hi but being now more strongly accused than befc he confesses the Fault, admiring the Divinity of Paper, and for the future does promise his best Fi lity in every Employment.

Such strange Conceits did those wilder Nati entertain, concerning this excellent Invention. A doubtless it must needs argue a vast Ability both Wit and Memory in that Man who did first conf all those different Sounds of Voice, (which seem be almost of infinite Variety) within the Bounds those few Letters in the Alphabet.

Cic. l. 3. de Nat. Deor. Polyd. Vir. de Inventor. l 1. c. 6. Vossius de Grammatica, l. 1. c. 9. Natal. Comes Mytho. l. 5. c. 5.

The first Inventor of this was thought to be *Egyptian Mercury*, who is therefore stiled the *Mess ger* of the Gods. To which purpose the Poets ha furnished him with Wings for *Swiftness* and dispat in his Errands. And because the Planet of t Name was thought to observe a more various a obscure Revolution than any of the rest, theref likewise did they attribute unto him such *Secret* a subtle Motions, as might make him a trusty and vate Messenger, and so the fitter for that Pref ment to which for this Invention they had advan him.

There is yet another way of Discoursing, Signs and Gestures; and though it be not so co mon in *Practice* as either of the other, yet in *ture* perhaps it is before them both, since Infants able this way to express themselves, before they h the Benefit of Speech.

But now, because none of these ways in ordi ry Use, are either so *Secret* or *Swift* as some Exig cies would require; therefore many of the Anci have busied themselves in a further Enquiry, h both these Deficiencies may be remedied; as c

ceiv

ving that such a Discovery would be of excellent
e, especially for some Occasions that are incident
Statesmen and *Soldiers.*

That the Ignorance of *Secret* and *Swift* Convey-
ces, hath often proved Fatal, not only to the Ru-
of particular Persons, but also of whole Armies
d Kingdoms, may easily appear to any one that
ut little versed in Story. And therefore the re-
essing of these may be a Subject worth our
quiry.

Amongst the Ancients that have most laboured in
ese Particulars, † *Æneas*, *Cleomenes*, and *Democri-*
, (as they are cited by * *Polybius*) were for their
ventions of this kind, more remarkably eminent.
d that ∴ Author himself hath given us such an
act Relation of the Knowledge of Antiquity in
ese things, that 'tis a wonder these following A-
s should either take no more notice, or make no
re use of it. Besides these, there is also *Julius*
ricanus, and *Philo Mechanicus*, two Ancient Gre-
ns, who have likewise treated of this Subject.

The Military Significations in use amongst the
mans, are handled by † *Vegetius* and * *Fronti-*
.

Their Notes of Secresy, and Abbreviation in
iting, are largely set down by * *Valerius Probus*,
d *Pet. Diaconus.* There is likewise a Volume of
se set forth by *Janus Gruterus*, which for their
t Invention are commonly ascribed unto *Cicero* and
Seneca.

In latter times these particulars have been more
y handled by the Abbot [a] *Trithemius*, [b] *Theodorus*
liander, [c] *Baptista Porta. Cardan.* Subtil. *l.* 17. *de*
. C. 12. 6. [d] *Isaac Casaubon*, [f] *Johannes Walchius*,
Gustavus Selenus, [h] *Gerardus Vossius*, [i] *Hermannus*
go, and divers others in particular Languages.

† *Poliorcetica.*
* *Hist. l.* 10.
∴ *Polybius, ib. juxta finem.*
† *De re milit. l.* 3. *c.* 5.
* *De Strat.*
* *L. de notis antiquus.*
* *The Father.*
[a] *L. de Polygraph. item de Stenograph.*
[b] *Tract. de ratione*

nun. linguarum. [c] *Lib. de Zyphris.* [d] *Notis in Æneæ Polyorcetica.* [f] *Fab. de Cryptog.* [h] *de Gram. L.* 1. *c.* 40. [i] *L. de Or. Scrib. de Augm. Scientiar l.* 6. *c.* 1.

Amongst

Amongſt the reſt, our *Engliſh Ariſtotle*, the Lea
ed *Verulam*, in that Work truly ſtiled the *Advan*
ment of *Learning*, hath briefly contracted the wh
Subſtance of what may be ſaid in this Subje
Where he refers it to the Art of *Grammar*, notin
as a deficient Part. And in reference to this i
handled by moſt of thoſe Authors who have trea
of it.

That Art, in its true Latitude comprehendin
Treaty, concerning all the Ways of Diſcourſe, wh
ther by Speech, or by Writing, or by Geſture,
gether with the ſeveral Circumſtances pertaining
them. And ſo this Subject belongs to the *Mint*
Knowledge; Expreſſions being currant for Co
ceits, as Money is for Valuations.

Now as it will concern a Man that deals in Tr
fick, to underſtand the ſeveral kinds of Money, a
Ibid. that it may be framed of other Materials beſides S
ver and Gold: So likewiſe does it behove them w
profeſs the Knowledge of Nature or Reaſon, righ
to apprehend the ſeveral Ways whereby they m
be expreſſed.

So that beſides the Uſefulneſs of this Subject
ſome ſpecial Occaſions, it doth alſo belong unto
of the Liberal Arts.

From which Conſiderations we may infer, t
theſe particulars are not ſo trivial, as perhaps oth
ways they would ſeem; and that there is ſuffici
motive to excite any Induſtrious Spirit unto a furt
Search after them.

In this following Diſcourſe I ſhall enquire,

1. Concerning the *Secreſy* of Means, whereby
communicate our Thoughts.

2. Concerning their *Swiftneſs*, or quick paſſin
any great Diſtance.

3. How they may be both joined together in
Conveyance of any Meſſage.

In the Proſecution of which, I ſhall alſo ment

(

beſides the true Diſcoveries) moſt of thoſe other ways, whether *Magical*, or *Fabulous*, that are received upon common Tradition.

CHAP. II.

The Conditions requiſite to Secreſy: *The uſe of it in the* Matter *of Speech, either*

By { *Fables of the Heathen.* / *Parables of Scripture.*

TO the Exactneſs of Secreſy in any way of Diſcourſe, there are theſe two Qualifications requiſite.

1. That it be difficult to be unfolded, if it ſhould be doubted of, or examined.

2. That it be (if poſſible) altogether devoid of ſuſpicion; for ſo far as it is liable to this, it may be ſaid to come ſhort in the very Nature of Secreſy; piece what is once ſuſpected, is expoſed to the Danger of Examination, and in a ready way to be diſcover'd; but if not, yet a man is more likely to be diſappointed in his Intentions, when his Proceedings are miſtruſted.

Both theſe Conditions together are to be found but in few of the following Inſtances; only they are here ſpecified, to ſhew what a Man ſhould aim at, in the Inventions of this Nature.

The Art of ſecret Information in the General, as it includes all ſignificatory Signs, may be ſtiled *Cryptomeneſes*, or private Intimations.

The particular Ways of Diſcourſing, were before intimated to be threefold.

1. By Speaking.

2. By Writing.
3. By Signs or Gestures.

According to which Variety, there are also different Ways of Secresy.

1. *Cryptologia.*
2. *Cryptographia.*
3. *Semæologia.*

Cryptologia, or the Secresy of Speaking, may consist either,

1. In the Matter.
2. In the Words.

1. In the *Matter* : When the thing we would utter is so concealed under the Expression of some other Matter, that it is not of obvious Conceit. To which purpose are the *Metaphors*, *Allegories*, and divers other Tropes of Oratory ; which, so far as they concern the *Ornament* of Speech, do properly belong to *Rhetorick* ; but as they may be applied for the *Secresy* of Speech, so are they reducible unto this Part of *Grammar.*

To this likewise appertains all that *ænigmatical* Learning, unto which not only the Learned Heathen, but their Gods also were so much devoted, as appears by the strange and frequent Ambiguities of the *Oracles* and *Sybils.* And those were counted the most profound Philosophers amongst them, who were best able for the Invention of such affected Obscurities.

Fables. Of this kind also were all those mysterious *Fables* under which the Ancients did veil the Secrets of their *Religion* and *Philosophy*, counting it a Prophane Thing to prostitute the hidden Matters of either, unto Vulgar Apprehension. *Quia sciunt inimicam esse naturæ, apertam nudamque expositionem sui ; quæ, sicut vulgaribus hominum sensibus, intellectum sui, vario rerum tegmine operimentoque subtraxit, ita à prudentibus arcana sua voluit per fabulosa tractari* , saith *Macrobius.* The Gods and Nature would not themselves have hidden

In Somn. Scip. Lib. 1. Cap. 2.

o many things from us, if they had intended them
or common Understandings, or that others should
reat of them after an easy and perspicuous Way:
ence was it that the Learned Men of former times
ere so generally inclined to involve all their Learn-
ng, in obscure and mysterious Expressions. Thus
d the *Egyptian* Priests, the *Pythagoreans*, *Platonicks*,
nd almost all other Sects and Professions.

And to this general Custom of those Ages (we
ay guess) the Holy Ghost does allude, in the fre-
uent *Parables* both of the Old and New Testament. *Parables.*
arabola est sermo similitudinarius, qui aliud dicit, aliud *Commen. in*
gnificat, saith *Aquinas*. It is such a Speech of Si- *Isai.* 14.
ilitude, as says one thing and means another. The
isciples do directly oppose it to plain speaking, *Be-* John 16.
ld now speakest thou plainly, and no Parables. 29.

And elsewhere 'tis intimated, that our Saviour
d use that Manner of Teaching for the *Secresy* of
: That those proud and perverse Auditors, who
ould not apply themselves to the Obedience of his
octrine, might not so much as understand it. *To* Mat. 13.
hom it is not given to know the mysteries of the King- 10, 11.
m of God, to them all things are done in Parables, that Mark 4.
ing they may see and not perceive, and hearing they 11, 12.
ay hear and not understand.

The Art of these was so to imply a secret Argu- *Glos. Phil.*
ent, that the Adversary might unawares be *l.* 2. *par.* 1.
ought over to an Acknowledgement and Confes- *Tract.* 2.
n of the thing we would have. Thus did *Nathan* *Sect.* 5.
expectedly discover to *David*, the Cruelty and In- 2 Sam. 12.
tice of his Proceedings in the Case of *Uriah*.
hus did another Prophet make *Ahab* condemn him-
f, for suffering the King of *Syria* to escape. And 1 Kings
this means did our Saviour in the Parable of the 20. 39.
neyard, and the unjust Husbandman, force the Mat. 21.
believing *Jews* to a secret Acknowledgment 31.
those Judgments they had themselves deserved.

Of this Nature was that Argument of an ancie
Orator, who when the Enemies had propoſed Peac
upon this Condition, that the City ſhould bani
their Teachers and Philoſophers, he ſteps up a
tells the People a Tale, of certain Wars betwixt t
Wolves and the Sheep, and that the Wolves pron
ſed to make a League, if the Sheep would put aw
their Maſtiff-Dogs. By this means better inſtructi
them of the Danger and Madneſs there would b
in yeilding to ſuch a Condition.

The *Jewiſh* Doctors do generally in their *Talm*
and all their other Writings, accuſtom themſelves
a Parabolical Way of Teaching; and 'tis obſerve
that many of thoſe horrid Fables that are father
upon them, do ariſe from a Miſapprehenſion
them in this particular: Whilſt others interpret th
according to the *Letter*, which they intended on
for the *Moral*. As that which one *Rabby* relates, co
cerning a Lyon in the Foreſt of *Elay*, that at t
diſtance of Four hundred Leagues, did with
Roaring ſhake down the Walls of *Rome*, and make t
Women Abortive. Wherein he did not affirm t
Exiſtence of any ſuch Monſter, but only intima
the Terribleneſs and Power of the Divine Majeſ
But this by the way.

Scickard Examen Commen. Rabbin diſ. 7.

By this Art many Men are able in their ordina
Diſcourſes, ſo ſecretly to convey their Counſe
or Reproofs, that none ſhall underſtand them, b
thoſe whom they concern. And this way of teac
ing hath a great Advantage above any other, by re
ſon it hath much more Power in exciting the Fan
and Affections. Plain Arguments and Moral P
cepts barely propoſed, are more flat in their Op
ration, not ſo lively and perſwaſive, as when th
ſteal into a Man's Aſſent, under the Covert of
Parable.

To be expert in this particular, is not in eve
Man's Power; like Poetry, it requires ſuch a N
tu

ral Faculty as cannot be taught. But so far as it ls under the Rules and Directions of Art, it be- ngs to the Precepts of *Oratory*.

In the General 'tis to be observed, That in these ses a Man must be very careful to make Choice such a Subject, as may bear in it some proper A- logy and Resemblance to the chief Business. And must before-hand in his Thoughts, so aptly con- ve the several Parts of the Similitude, that they y fitly answer unto those particular Passages ich are of greatest Consequence.

CHAP. III.

ncerning that Secresy of Speech, which consists in the Words, Either

- inventing new ones, as in { *Canting.* / *Conjuring.*
- by a changing of the known Language, whether { *Inversion.* / *Transmutation.* / *Diminution.* / *Augmentation.*

The secret Ways of Speaking, which consist in the Matter of Discourse, have been already ndled. Those that are in the Words are Two- d. Either,

. By inventing new Words of our own, which l signifie upon compact.

. Or by such an Alteration of any known Lan- ge, that in Pronunciation it shall seem as obscure, f it were altogether barbarous.

To the first kind we may refer the *Canting* of Beg- s; who though they retain the common Parti-

cles, yet have impoſed new Names upon all ſu Matters as may happen to be of greateſt Conſ quence and Secreſy.

And of this Nature the Charms of Witches, a Language of Magicians ſeem to be. Though theſe it may well be doubted, whether they have a Signification at all. And if they have, whether ny underſtand them, but the Devil himſelf. 'Tis pr bable he did invent ſuch horrid and barbarous Soun that by them he might more eaſily delude the we Imaginations of his credulous Diſciples. *Martin de Arles*, an Archdeacon in *Navar*, ſpeaking of Conjuring-book, that was found in a Pariſh und his Viſitation, repeats out of it theſe Forms of Di courſing with the Devil. *Conjuro te per ælim, per lion, per ſeboan, per adonay, per allelujah, per tanti, p archabulon*, &c. And a little after, *Sitis allegati conſtricti per iſta ſancta nomina Dei, Hir, ælli, habet, ſa mi, filiſgæ, adrotiagundi, tat, chamiteram*, &c. An in another Place, *Coriſcion, Matatron, Caladafon, O cozo, Yoſiel*, &c.

Tract. de ſuperſtitionibus.

In which Forms the common Particles and Wor of uſual Senſe, are plainly ſet down in ordina *Latin*; but many of the other, which ſeem to ha the greateſt Efficacy, are of ſuch ſecret Senſe, as think no Linguiſt can diſcover.

The Inventions of this kind do not fall under a ny particular Rule or Maxim, but may be equall Infinite to the Variety of articulate Sounds.

Porta de furi. lit. l. 1. cap. 5. Selenus de Cryptographia, l. 2. cap. 1.

The ſecond Way of Secreſy in Speech, is by a Alteration of any known Language, which is fa more eaſie, and may prove of as much Uſe for th Privacy of it, as the other. This may be performe Four Ways.

1. By *Inverſion*, when either the *Letters* or *Syl bles* are ſpelled backwards.

Mitto tibi METULAS cancros imitare legendo where the Word *SALUTEM* is expreſſed by a

Inver

nverſion of the Letters. Or as in this other Exmple, *Stiſho eſtad, veca biti*, which by an Inverſin of the Sylables, is *Hoſtis adeſt, cave tibi.*

2. By *Tranſmutation*, or a mutual changing of one Letter for another in Pronunciation; anſwerable to hat Form of Writing, mentioned in the Seventh Chapter. And tho this may ſeem of great Difficuly, yet Uſe and Experience will make it eaſie.

3. By *Contracting* ſome Words, and leaving Part f them out; pronouncing them after ſome ſuch Way as they were wont to be both Written and Printed in ancient Copies. Thus *ā ā* ſtands for *anina*, *Arl's* for *Ariſtoteles.* But this can be but of mall Uſe in the *Engliſh* Tongue, becauſe that does conſiſt moſt of *Monoſylables.*

4. By *Augmenting* Words with the Addition of oher Letters. Of which kind is that ſecret Way of Diſcourſing in ordinary Uſe, by doubling he Vowels that make the Sylables and interpoſing *G.* or any other Conſonant, *K. P. T. R.* &c. or other Sylable s, as *Porta lib.* 1. *cap.* 5. *de furtiv. liter. notis.* Thus if I would ſay, *Our Plot is diſcovered*, it muſt be pronounced thus, *Ougour plogot igis digiſcogovegereged.* Which does not ſeem ſo obſcure in Writing, as it will in Speech and Pronunciation. And it is ſo eaſie to be learnt, that I have known little Children, almoſt as ſoon as they could ſpeak, diſcourſe to one another as faſt this Way, as they could in their plaineſt *Engliſh.*

But all theſe latter kinds of Secreſy in Speech, have this grand Inconvenience in them, that they are not without Suſpicion. Chap. 17. 18.

There are ſome other Ways of Speaking by inarticulate Sounds, which I ſhall mention afterwards.

CHAP. IV.

Concerning the Secret Conveyances of any written Message in Use amongst the Ancients.

Either by { *Land.* / *Water.* / *The open Air.* }

THe Secresy of any written Message may consist either in the { *Conveyance.* / *Writing.* }

1. In the *Conveyance*, when a Letter is so closely concealed in the Carriage of it, as to delude the Search and Suspicion of the Adversary. Of which kind the Ancient Historians do furnish us with divers Relations, reducible in the General unto these three Heads. Those that are

1. By Land.
2. By Water.
3. Through the open Air.

1. *By Land.* 1. The secret Conveyances by Land, may be of numberless variety; but those ancient Inventions of this Nature, which to my Remembrance are most obvious and remarkable, are these.

That of *Harpagus* the *Mede* (mentioned by *Herodotus* and *Justin*) who when he would exhort *Cyrus* to a Conspiracy against the King his Uncle, (and not daring to commit any such Message to the ordinary Way of Conveyance, especially since the King's Jealousy had stopped up all Passages with Spies and Watchmen) he puts his Letters into the Belly of a Hare, which, together with certain Hunters Nets, he delivered unto a trusty Servant, who under this Disguise of a Huntsman, got an unsuspected Passage to *Cyrus*. And *Astyages* himself was

Herod. l. 1. cap. 123. Justin. l. 1.

by

y this Conſpiracy bereaved of that Kingdom which as then the greateſt Monarchy in the World.

To this Purpoſe likewiſe is that of *Demaratus* King f *Sparta*, who being baniſhed from his own Coun- y, and received in the *Perſian* Court, when he here underſtood of *Zerxes* his Deſign and Preparati- n for a War with *Greece*, he uſed theſe means for e Diſcovery of it unto his Countrey-men. Having rit an Epiſtle in a * Tablet of Wood, he covered ver the Letters with Wax, and then commit- d it unto a truſty Servant, to be delivered nto the Magiſtrates of *Lacedæmon*; who, when ey had received it, were for a long time in a per- exed Conſultation what it ſhould mean; they did e nothing written, and yet could not conceive but at it ſhould import ſome weighty Secret; till at ngth the King's Siſter did accidentally diſcover the riting under the Wax: By which means the *Greci- s* were ſo well provided for the following War, as give a Defeat to the greateſt and moſt numerous rmy that is mentioned in Hiſtory.

Juſtin. l. 2. See the like related of *Hamucar. Ib. l.* 21.

* Such as formerly they were wont to write upon, whence the Phraſe *RaſaTabula*, and *litera a litura*.

The Fathers of the Council of *Epheſus*, when *Neſtorius* was condemned, being ſtrictly debarred from l ordinary Ways of Conveyances, were fain to ſend nto *Conſtantinople* by one in the Diſguiſe of a Beggar.

Iſaac. Caſa. Notis in Æneæ Polior. c. 31.

Some Meſſengers have been ſent away in Coffins being dead: Some others in the Diſguiſe of Brute reatures, as thoſe whom *Joſephus* mentions in the ege of *Jotapata*, who crept out of the City by ight like Dogs.

De Bello Judaic. l. 3. *c.* 8.

Others have conveyed Letters to their impriſoned riends, by putting them into the Food they were receive, which is related of *Polycrita*. *Laurentius edices* involving his Epiſtles in a Piece of Bread, d ſend them by a certain Nobleman in the Form of Beggar. There is another Relation of one, who lled up his Letters in a Wax-candle, bidding the eſſenger tell the Party that was to receive it, that the

Herm. Hugo de Orig. Scrib. c. 15. *Solemn. de Cryptographia, l.* 8. *c.* 7.

the Candle would give him Light for his Buſineſ
There is yet a ſtranger Conveyance ſpoken of i
Poliorcet. c. 31. *Æneas*, by Writing on Leaves, and afterwards wit
theſe Leaves covering over ſome ſore or putrid U
cer, where the Enemy would never ſuſpect any ſe
cret Meſſage.

Others have carried Epiſtles inſcribed upon thei
own Fleſh, which is reckoned amongſt thoſe ſecre
Conveyances mentioned by *Ovid.*

De Arte Amand. *Caveat hoc cuſtos, pro charta, conſcia tergum*
Præbeat, inque ſuo corpore verba ferat.

But amongſt all the ancient Practices in this kind
there is none for the Strangeneſs, to be compare
Herod. l. 5. c. 35. unto that of *Hyſtiæus*, mentioned by *Herodotus*, an
Noctes Attici. l. 17. c. 10. out of him in *Aulus Gellius*; who whilſt he reſide
with *Darius* in *Perſia*, being deſirous to ſend unto *A*
riſtagoras in *Greece*, about revolting from the *Perſia*
Government, (concerning which they had befor
conferred together) but not knowing well how
that Diſtance to convey ſo dangerous a Buſine
with ſufficient Secreſy, he at length contrived it a
ter this Manner: He choſe one of his Houſhold-Se
vants that was troubled with ſore Eyes, pretendin
that for his Recovery his Hair muſt be ſhaved, an
his Head ſcarified; in the Performance
which *Hyſtiæus* took occaſion to Imprint his ſecre
Intentions on his Servant's Head; and keeping hi
cloſe at Home till his Hair was grown, he then to
him, That for his perfect Recovery, he muſt trav
into *Greece* unto *Ariſtagoras*, who by ſhaving his Ha
the ſecond Time, would certainly reſtore him. B
which Relation you may ſee what ſtrange Shifts th
Ancients were put unto, for want of Skill in th
Subject that is here diſcourſed of.

Joſeph. de Bello Juda. l. 6. c. 15. 'Tis reported of ſome Fugitive *Jews* at the Sieg
of *Jeruſalem*, who more ſecurely to carry away the
Gold, did firſt melt it into Bullets, and then ſwallo
it down, venting it afterwards amongſt their othe

Excr

Excrements. Now if a Man had but his Faculty, who could write *Homer*'s *Iliads* in ſo ſmall a Volume as might be contained in a Nut-ſhell; it were an eaſie Matter for him, by this Trick of the *Jews*, ſecurely to convey a whole Pacquet of Letters. *Solin. Polyhiſt. c. 6.*

2. When all the Land-Paſſages have been ſtopped up, then have the Ancients uſed other ſecret Conveyances by Water; writing their Intentions on thin Plates of Lead, and faſtning them to the Arms or Thighs of ſome expert Swimmer. * *Frontinus* relates, that when *Lucullus* would inform a Beſieged City of his coming to ſuccour them, he put his Letters into two Bladders, betwixt which a common Soldier in the Diſguiſe of a Sea-monſter, was appointed to ſwim into the City. There have been likewiſe more exquiſite Inventions to paſs under the Water, either by a Man's Self, or in a Boat, wherein he might alſo carry Proviſion, only having a long Trunk or Pipe, with a Tunnel at the Top of it, to let down freſh Air. But for the Prevention of all ſuch Conveyances, the Ancients were wont in their ſtricteſt Sieges, to croſs the Rivers with ſtrong * Nets, to faſten Stakes in ſeveral Parts of the Channel with ſharp Irons, as the Blades of Swords, ſticking upon them. 2. By Water. * *De Stratag. l. 3. c. 13.* * *Plin. l. 10. c. 37.*

3. Hence was it that there have been other means attempted through the open Air, either by uſing Birds, as Pigeons and Swallows inſtead of Meſſengers, of which I ſhall treat more particularly in the ſixteenth Chapter. Or elſe by faſtning a Writing to an Arrow, or the Weight that is caſt from a Sling. 3. Thro' the open Air.

Somewhat of this Nature, was that Intimation agreed upon betwixt *David* and *Jonathan*, though that Invention does ſomewhat ſavour of the Ancient ſimplicity and Rudeneſs. It was a more exact Intention mentioned by *Herodotus* concerning *Artabanus* and *Timoxenus*, who when they could not come together, were wont to inform one another of any Thing 1 Sam. 20. *Urania ſive l. 8. c. 128.*

Thing that concerned their Affairs, by faſtning a Letter unto an Arrow, and directing it unto ſome appointed Place, where it might be received.

Polyænus, l. 2. See *Plutarch* in *Cimon.*

Thus alſo *Cleonymus* King of *Lacedæmon*, in the Siege of the City *Trezene*, enjoyned the Soldiers to ſhoot ſeveral Arrows into the Town, with Notes faſtned unto them having this Inſcription, Ἥκω ἵν' πολιν ἐλευθερώσω. *I come that I may reſtore this Place to its Liberty.* Upon which the credulous and diſcontented Inhabitants were very willing to let him enter.

When *Cicero* was ſo ſtreightly Beſieged by the *Gauls*, that the Soldiers were almoſt ready to yield; *Cæſar* being deſirous to encourage him with the News of ſome other Forces that were to come unto his Aid, did ſhoot an Arrow into the City, with theſe Words faſtned unto it, *Cæſar Ciceroni fiduciam optat, expecta auxiliam.* By which means the Soldiers were perſuaded to hold out ſo long, till theſe new Succours did arrive and break up the Siege.

The ſame thing might alſo be done more ſecurely, by rolling up a Note within the Head of an Arrow, and then Shooting of it to a Confederates Tent, or to any other appointed Place.

Poliorcet. l. 4. c. Dialog. 2. mentioned alſo by *Heliodor. Hiſt. Æthio. l. 9.*

To this purpoſe is that which *Lypſius* relates out of *Appian*, concerning an ancient Cuſtom for the Beſieged to write their Minds briefly in a little Piece of Lead, which they could with a Sling caſt a great Diſtance, and exactly hit any ſuch particular Place as ſhould be agreed upon, where the Confederate might receive it, and by the ſame means return an Anſwer.

Of this Nature likewiſe are thoſe kind of Bullets, lately invented in theſe *German* Wars, in which they can ſhoot, not only Letters, Corn, and the like, but (which is the ſtrangeſt) Powder alſo into a beſieged City.

But

But amongst all other possible Conveyances thro' the Air, Imagination it self cannot conceive any one more useful, than the Invention of a flying Chariot, which I have mentioned elsewhere. Since by this means a Man may have as free a Passage as a Bird, which is not hindered, either by the highest Walls, or the deepest Rivers and Trenches, or the most watchful Centinels. But of this perhaps I may have occasion to treat more largely in some other Discourse.

World in the Moon, chap. 14.

CHAP. V.

Of that Secresy which consists in the Materials *of Writing, whether the Paper or Ink.*

THE several Inventions of the Ancients, for the private *Conveyance* of any written Message, were the Subject of the last Chapter.

The Secresy of *Writing* may consist,

Either in { The Materials, Or, The Form.

1. The *Materials* of Writing, are, the Paper and Ink, (or that which is instead of them) both which may be so privately ordered, that the inscribed Sense shall not be discoverable, without certain Helps and Directions.

Selenus de Cryptogra. l. 8. c. 1. 4.

1. The chief Contrivance of Secresy by the Paper in Use amongst the Ancients, was, the *Lacedemonian Scytale*; the Manner of which was thus: There were provided two round Staves, of an equal Length and Size, the Magistrates always retaining one of them at Home, and the other being carry'd abroad by the General, at his going forth to War. When there was any secret Business to be writ by it, their manner was, to wrap a narrow Thong of Parchment about one of these Staves,

1. The Paper.

by

by a Serpentine Revolution, ſo that the Edges o it might meet cloſe together; upon both which Edges they inſcribed their Epiſtle; whereas, the Parchment being taken off, there appear'd nothing but Pieces of Letters on the Sides of it, which could not be joined together into the right Senſe, without the true *Scytale.* Thus is it briefly and fully deſcribed by *Auſonius.*

Auſonius ad Paulinum.

Vel Lacedemoniam Scytalen imitare libelli,
Segmina Pergamei, tereti, circumdata ligno,
Perpetuo inſcribens verſu, deinde ſolutus,
Non reſpondentes ſparſo dabit ordine formas.

In Vita Lyſandri. You may read in *Plutarch*, how by this means *Pharnabaz* did deceive *Lyſander.*

'Tis true, indeed, that this Way was not of ſuch inextricable Secreſy, but that a little Examination might have eaſily diſcover'd it, (as *Scaliger* truly obſerves); however, in thoſe Ages, which were leſs verſed in theſe Kinds of Experiments, it ſeemed much more ſecret than now it does unto us; and in theſe Times, there are ſuch other means of private Diſcourſing, which even *Scaliger*'s Eyes (as good as they were) could not diſcover. And therefore it was too inconſiderate and magiſterial a Sentence of him, from thence to conclude all this kind of Learning to be vain and uſeleſs, ſerving only for Impoſture, and to perplex the Enquirer.

Exerc. 327.

Voſſius de Arte Gram. l. 1. *c.* 40.

'Tis certain, that ſome Occaſions may require the exacteſt Privacy; and 'tis as certain, that there may be ſome Ways of Secreſy, which it were Madneſs for a Man to think he could unfold. *Furori ſimile eſſe videtur, ſibi aliquem perſuadere, tam circumſpectum hominem eſſe poſſe, ut ſe à furtivo quodam ſcripto, abditaq; machinatione tueri poſſit: Nam aſtans quilibet, vel procul diſtans loquitur, & factum nunciat, ut non ſolum à nemine percipiatur, ſed ne ſic quidem ſignificare quippiam poſſe exiſtimet,* ſaith *Vegetius.* And *Baptiſta Porta,* who had a ſtrange and incredible Ability in diſco-

Veget. de re milit. l. 3.

Proœm. l. 3. *de furtivis notis.*

vering

ering of Secret Writings, yet doth ingeniously onfeſs, *Multa eſſe poſſe furtiva ſcripta, quæ ſe inter-etaturum quenquam polliceri, furorem ac delirium plane iſtimarem.*

So that tho' the Ancient Inventions of this Kind ere too eaſily diſcoverable, yet *Scaliger* had no eaſon to conclude this to be a needleſs Art, or that erefore he could unfold any other way that might invented. But this by the by.

2. The other Material of Writing, is, the Ink, or at Liquor which is uſed inſtead of it; by which eans alſo there are ſundry Ways of Secreſy, com-only mentioned in Natural *Magick.* 2. The Ink.

Porca Magiæ, l. 16. Wecker. de Secret. l. 14. Joach. Fortius Experient. Cardan. Subt. l. 17. Item de varietate, l. 12. c. 61.

Thus, if a Man write with Salt *Armoniack* diſ-lved in Water, the Letters will not appear legible, l the Paper be held by the Fire: This others af-m to be true alſo in the Juice of Onions, Lemons, ith divers the like Acid and Corroding Moiſtures.

And on the contrary, thoſe Letters that are writ-n with diſſolved Allum, will not be diſcernable, l the Paper be dipped in Water.

Ibid.

There are ſome other Juices, that do not appear, l the Paper be held betwixt a Candle and the ye.

That which is written with the Water of putri-d Willow, or the diſtilled Juice of Gloworms, ll not be viſible but in the Dark; as *Porta* affirms m his own Experience.

Bibliander de Ratione com. linguarum. De furtiv. lit. l. 1. c. 15

There is alſo a Secret Way of Writing with two veral Inks, both of them alike in Colour, but the e being of that Nature, that it will eaſily be rub-d or waſhed off, and the other not.

A Man may likewiſe write ſecretly with a raw g, the Letters of which being throughly dried, the whole Paper be blacked over with Ink, that may appear without any Inſcription; and when s Ink is alſo well dried, if you do afterwards ntly ſcrape it over with a Knife, it will fall off

from

from thoſe Places, where before the Words wer written.

Thoſe Letters that were deſcribed with Milk, c Urine, or Fat, or any other glutinous Moiſture will not be legible, unleſs Duſt be firſt ſcatter'd up on them; which, by adhering to thoſe Places, wi diſcover the Writing. This Way is mentioned b *Ovid*:

De Arte Amandi.

Tuta quoq; eſt, fallitq; oculos è lacte recenti
Litera, carbonis pulvere tange, leges.

And 'tis thought that *Attalus* made uſe of this De vice, the better to excite the Courage of his Sol diers. Being before the Battel to ſacrifice to the god for Succeſs, as he pulled out the Entrails of the Beaſt he deſcribed upon them theſe words, *Regis Victoria* which he had before written backward in his han with ſome gummy Juice. The Entrails being turne up and down by the Prieſt, to find out their ſignifi cation, the Letters did by that means gather ſo muc Duſt as to appear legible. By which *Omen* the Sol diers were ſo ſtrangely heighten'd in their Hope and Valour, that they won the Day.

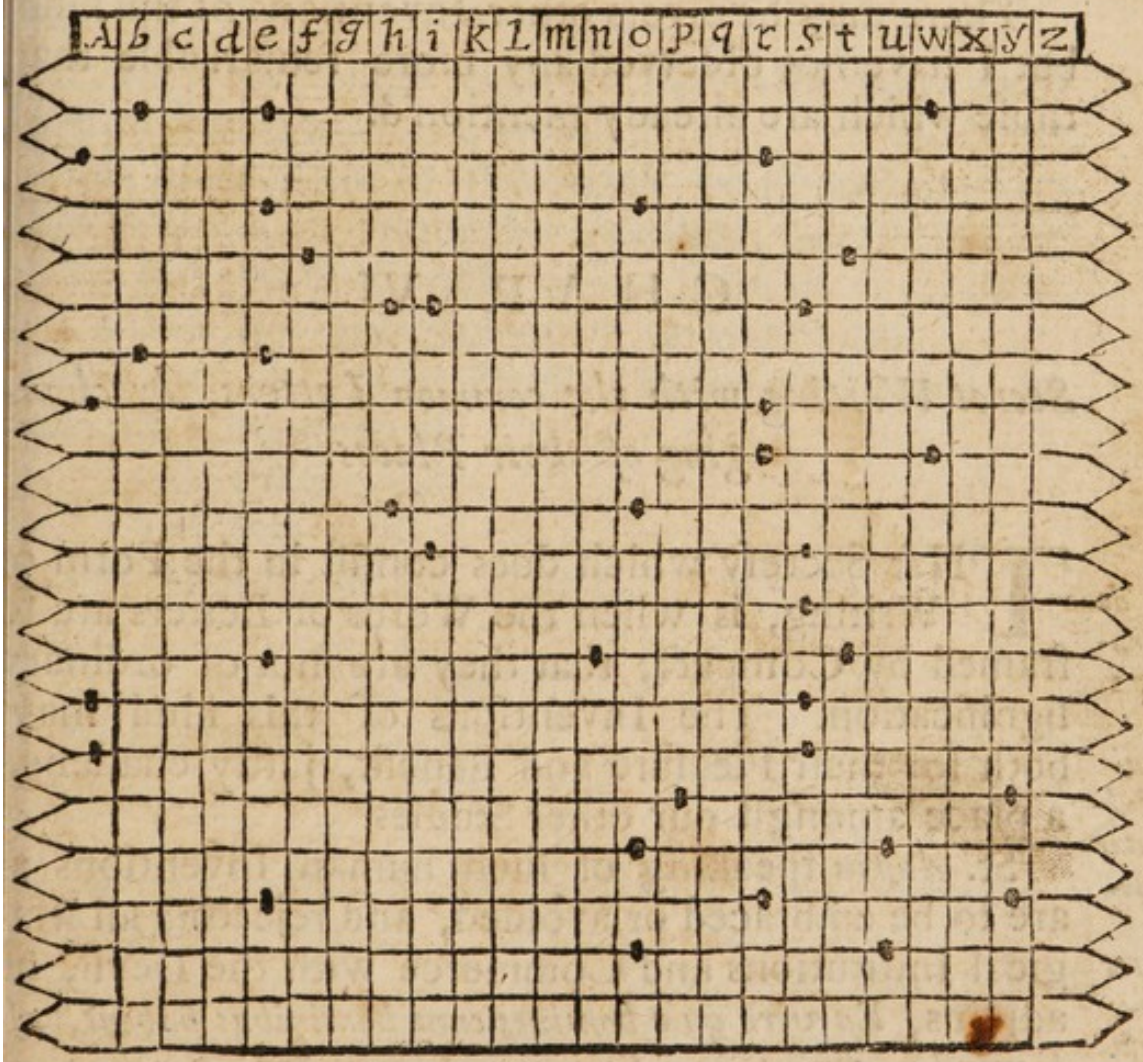
Guſt. Selenus de Cryptographia, l. 8. c. 3.

Unto theſe Experiments of Secreſy in the *Mate rials* of Writing, ſome add thoſe other ways of ex preſſing any private Intimation, by drawing a Strin through the holes of a little Tablet or Board; thei holes ſhould be of the ſame number with the Le ters, unto which by Compact they ſhould be ſeve rally applied. The order of the Threads paſſin through them, may ſerve to expreſs any Words, an ſo conſequently any Senſe we would diſcover.

To this purpoſe likewiſe is that other way of ſecre Information, by divers Knots tied upon a String, ac cording to certain Diſtances, by which a Man ma as diſtinctly, and yet as *Secretly*, expreſs his Mean ing, as by any other way of Diſcourſe. For wh would miſtruſt any private News or Treachery t lye hid in a Thread, wherein there was nothing t

be discerned, but sundry confused Knots, or other the like Marks ?

The Manner of performing it is thus: Let there be a square piece of Plate, or Tablet of Wood like a Trencher, with the Twenty four Letters described on the top of it, at equal distances, and after any order that may be agreed upon before-hand; on both the opposite sides let there be divers little Teeth, on which the String may be hitched or fasten'd for its several Returns, as in the following Figure.



Where the String is supposed to be fasten'd by a Loop on the first Tooth, towards the Letter A, and afterwards to be drawn successively over all the rest. The Marks upon it do express the secret Meaning: *Beware of this Bearer, who is sent as a Spy over you.*

When it is taken off, and ſent to a Confederate, he may eaſily underſtand its intention, by applying it to his own Tablet, which muſt be anſwerable unto this. The Inſtrument may be made much longer than is here expreſſed: But if the Matter to be revealed ſhould happen to be more than the Tablet would bear, then may it be ſupplied either by another String, or elſe by beginning again with that part of the ſame String wherein the laſt Letter was terminated.

There may be divers other Inventions of this kind, but I have not obſerved any more remarkable than thoſe which are already mention'd.

CHAP. VI.

Secret Writing with the common Letters, by changing of their Places.

Selenus de Cryptographia, l. 2. c. 5. *Ars occultandi inter artes Subtilitate præſtantes annumeranda eſt. Cardan. Subtil.* l. 17. *De Doctrin. Chriſtiana*, l. 2. c. 26.

THat Secreſy which does conſiſt in the Form of Writing, is when the Words or Letters are ſo framed by Compact, that they are not of ordinary ſignification. The Inventions of this kind may both for their Pleaſure and Benefit, juſtly challenge a place amongſt our other Studies.

St. *Auſtin* ſpeaking of ſuch human Inventions as are to be embraced or avoided, and rejecting all Magical Inſtitutions and Commerce with the Devil, he adjoins, *Ea verò quæ homines cum hominibus habent, aſſumenda, & maxime literarum figuræ*, &c. *Ex eo genere ſunt etiam notæ, quas qui didicerunt, proprie notarii appellantur. Utilia ſunt iſta, nec diſcuntur illicite, nec ſuperſtitioſe implicant, nec luxu enervant, ſi tantum occupent, ut majoribus rebus, quibus inſervire debent, non ſint impedimento.*

This way of Secret Writing may be contrived, either,

1. By the common Letters.
2. Or by some invented Notes and Characters instead of them.

Both these being distinguishable into those kinds that contain either,

1. Equal.
2. Or more.
3. Or fewer Signs than are naturally required to the true framing of the Word.

The particulars of these may be altered to such great Variety as cannot be reckoned, and therefore I shall specify those only which seem most remarkable, either for their Antiquity or Usefulness.

The Way of Secret Writing by equal Letters, is, either by Changing of

1. Their Places, or
2. Their Powers.

1. By altering of the Places;

Either of the { Lines. / Letters. / Both.

1. A Man may obscure the Sense, by perplexing the Order of the *Lines*. If they be written, not only from the Left Hand to the Right, but also from the Right Hand to the Left, as in the *Eastern* Languages; or from the Top to the Bottom, and so backward again, as is commonly related to be usual amongst the Inhabitants of *Taprobana* in the *South*, with those in *China* and *Japan*: According to this following Example. 1. By transposing the Lines. *Diodor. Sic. Biblioth. l. 2. Herman. Hugo de Orig. Scrib. c. 8.*

e r f d l e e l l t
i e t o o ſ w i i h
l ſ u u h h s n t e
p h o t o a v c s p
p a h t t l t r h e
u n t h e l s e t s
ſ d i e l n g a o t
y ſ w ſ b o n ſ d i
d p e i a t o e c l
e e g e e b m a n e

In the Reading of which, if you begin at th firſt Letter towards the Right Hand, and ſo down wards, and then upwards again, you may find theſ Words expreſſed:

The Peſtilence doth ſtill increaſe amongſt us; we ſha not be able to hold out the Siege, without freſh and ſpeed Supply.

2. By tranſpoſing the Letters.

2. A Man may obſcure the Senſe of his Writing by tranſpoſing each *Letter*, according to ſome un uſual Order. As, ſuppoſe the firſt Letter ſhould b at the latter End of the Line, the ſecond at the Be ginning, or the like.

3. By tranſpoſing both the Lines and Letters.

3. The Meaning of any written Meſſage ma be concealed, by altering the Order both of th *Letters* and the *Lines* together. As if a Man ſhoul write each Letter in two ſeveral Lines, thus:

T e o l i r a e l m s f m ſ e s p l v o w e u t e
h ſ u d e ſ r a l o t a i h d, u p y s r e m s y i

The Souldiers are almoſt famiſhed; Supply us, or w muſt yield.

* Or as many more as the length of the Epiſtle ſhall require.

This way may be yet further obſcured, by placin them in * four Lines, and after any diſcontinua Order. As, ſuppoſe that the firſt Letter be in th

Begi

Beginning of the firſt Line, the ſecond in the Beginning of the fourth Line, the third in the End of the firſt, the fourth in the End of the fourth, the fifth in the Beginning of the ſecond Line, the ſixth in the Beginning of the third, the ſeventh in the End of the ſecond, the eighth in the End of the third; and ſo of the reſt: As in this Example.

W m r p i t a h h s c t e i n p k e
h a t h f o n o i h k f t o e n i l
a n o e r r o c g t t t h m n v r l
e a u o m h t e i n l e n e t t e f

Which in its Reſolution is this:

We ſhall make an Irruption upon the Enemy from the North, *at Ten of the Clock this Night.*

This way will yet ſeem more obſcure, if each Line be ſever'd into ſuch Words as may ſeem barbarous. *Walchius, Fab. 9.*

All theſe Kinds may be varied unto divers other more intricate Tranſpoſitions, according as a Man's Fancy or Occaſion ſhall lead him.

CHAP. VII.

Concerning Secret Writing with equal Letters, by changing their Powers. *The Uſe of this amongſt the* Jews *and* Romans. *The Key-Character.*

AS a written Meſſage may be concealed by changing the Places of the Letters, ſo likewiſe by changing of their *Powers*, putting one of them for another, as ſuppoſe L for A, and A for L, or the like: Anſwerable to that Kind of Cabaliſm in the *Jewiſh* Learning, which the Rabies call צירוף, or *Schickard in Becbinath. Haperuſ. Diſp. l. 4 Glaſſius Philolog. l. 2. part tract 2.*

or *Combinatio*; when the Letters of the Alphabet are severally transposed, and taken one for another after any known Order. Of which there be as many Kinds, as there may be several Combinations of the Letters: But amongst the rest, they observe two of more frequent Use. The first is stiled from the four first Correspondent Letters אלבם *Albam*; in which they are thus opposite to one another.

א ב ג ד ה ו ו ח ט י כ
ל מ נ ס ע פ צ ק ר ש ת

The other is from the same Reason called אתבש *Athbash*, wherein the Letters are thus mutually opposed:

א ב ג ד ה ו ו ח ט י כ
ת ש ר ק צ פ ע ס נ מ ל

Both these Kinds of Secret Writing, the *Jewish* Doctors think to be frequently used by the Sacred Penmen of Holy Writ; amongst whom, the Prophet *Isaiah* and *Jeremiah* are observed to be of more especial Note for their Skill in Cabalisms.

By the first of these Combinations, called *Albam*, that Place of *Isaiah* 7. 6. is usually interpreted; where there is a Person mentioned, under the unknown Name of טבאל *Tabeal*, whom the Prophet affirms to aspire unto the Crown of *Judah*; meaning, by a secret Transmutation of the Letters, רמלה *Remaliah* the King of *Israel*, whom he was loth more expresly to nominate: And therefore he veils it by this kind of Secresy, instead of ר writing the Letter above it ט; for מ, the Correspondent Letter ב; and so ל for א, and א for ל. Which being joined together, do make טבאל, instead of רמלא.

By

By the second of these Combinations, called *Athbaſh*, is that Place, *Jerem.* 51. 1. translated; where by the Original לב קמי *Cor insurgentium contra me*, is meant כשדים the *Chaldæans*; and therefore both the *Targum*, and the *Septuagint* do unanimously translate it so; as if in their Version of it, they had chiefly respect unto this kind of Cabalism. So likewise in 41 Verse of the same Chapter, by the designed Name of ששך, is meant בבל.

Item c. 25. *v.* 26. *fide Hieron. com. in eundem locum.*

This way of Secret Writing hath been also in use amongst the Ancient *Romans*: Thus *Suetonius* relates of *Julius Cæsar*, when he would convey any private Business, he did usually write it, *per quartam Elementorum Literam*; that is, D for A, E for B, and so of the rest, after this Order.

Sueton. in vita ejus. A. Gellius Noct. Attic. l. 17. *c.* 9.

d e f g h i k l m n o p q r ſ t u w x y z a b c
a b c d e f g h i k l m n o p q r s t u w x y z

Hasten unto me.
Ldwxhq yqxr ph.

And the same Author reports of *Octavius Augustus*, that in the writing of his Secrets, he did *secundum Elementum proprii loco substituere*, set down the second Letter for the first, as B for A, C for B, and for A a Double x x.

But now, because such an Epistle might be easily unfolded, being altogether written by the same way; therefore this kind of Secresy hath, by later Invention, been further obscured, by writing each several Word, or Line, or Letter, by a diverse Alphabet.

For the Performance of this, two Friends must before-hand, by Compact, agree upon some certain Form of Words, that may be instead of a Key, serving both to close, and to unlock the Writing; which

which Words would be leſs diſcoverable, if they b barbarous, and of no Signification.

But for the eaſier apprehending of this, I ſhal explain it in an Example.

Suppoſe the Key agreed upon, were only thi one Word *Prudentia.*

Having firſt framed ſeveral Alphabets, accordin to each of its Letters, thus:

A	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	w	x	y	z
P	q	r	ſ	t	v	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o
R	s	t	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q
U	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t
C	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	w	x	y	z	a	b	c
E	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	w	x	y	z	a	b	c	d
N	o	p	q	r	s	t	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m
I	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s
I	k	l	m	n	o	p	q	r	s	t	u	w	x	y	z	a	b	c	d	e	f	g	h
A	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	w	x	y	z

I may write each Line, or Word, or Letter, ac cording as the Order of theſe Alphabets ſhall di rect. As in theſe,

1. In the Lines.

Ixt hdkasytgh bkiycn
xfi nrel fx matlmrck;
npkkfs pn, im oczs qdff
uhyrox xr xlh hqmpmh.

2. In the Words.

Ixt kfmcuawik gpodhs
iru aeny bs oiwnotem;
bdyytg vs, dg lzwp qdff
uhyrox ys gur ygcfcy.

3. I

3. In the Letters.

Izz wshemitin in pzgcwy
vfm zean xf kaxxznebr
skgkoc hm, xr izzb awet
rtm iox gh cht whmqwy.

Which Examples being unfolded, do each of hem expres this inward Meaning:

The Souldiers mutiny
for want of Victuals;
Supply us, or they will
Revolt to the Enemy.

These Ways may be yet further obscured, if the irst Alphabet, (according to which the rest are described) be contrived after any mixed Order. As, uppose instead of the ordinary A b c, *&c.* there e written these Letters, after this manner.

R z k m p s e b l a u f t c y g w h x o q i n d.

And then will they be liable to all those other Differences of Secresy, that are usually invented by he *Wheel Character*, which you may see largely described by *Porta.*

There may be divers other Ways to this purpose, ut by these you may sufficiently discern the Nature of the rest.

CHAP. V.

Of Secret Writing by more Letters than are requisite to the intended meaning.

THE different kinds of Secresy by *equal Letters* have been already handled. The next particular

cular to be discussed, is concerning the Ways of h ding any private Sense under *more Letters* than are r quired to the Words of it.

Of which kind there may be divers particular some of them in Use amongst the Ancients.

1. A Writing may be so contrived, that only on Letter in a Verse shall be significant. As it was i *Sybilla Erythræa.* those remarkable *Acrosticks* made by a *Sybil* concern ing our Saviour; where the Letters at the Beginnin of each Verse, being put together, made up thes Words, Ἰησοῦς Χριστὸς Θεοῦ υἱὸς σωτὴρ. *Jesus Christ the So of God, a Saviour.*

Beda l. de Sybillis. The Translation of these you may see in St. *Au gustin de Civit. Dei, lib.* 18. *cap.* 23. And the Origi nal are mentioned by *Ludovicus Vives,* in his Note upon that Place.

According unto this doth *Plautus* contrive th Names of his Comedies in the first Letters of thei Arguments. But this Way is so ordinary in Practice that it needs not any further Explication.

2. The inward Sense hath likewise been conveye by some single Letters of several Words in the sam Verse. As in that common Distich.

Vale. *Mitto tibi caput Veneris, ventremque Dianæ*
Latronisque caput, posteriora canE.

3. Sometimes one Letter in each Word was onl significant. By which Way of Secret Expression, th Holy Ghost (say the *Rabbies*) hath purposely invol ved many sacred Mysteries in Scripture. Whe these significant Letters were at the Beginning o each Word, the *Cabalists* in their Learning, calle such an implicit Writing ראשי תיבות *Capita Dictionum* When they were at the latter End, then was it sti led סופי תיבות *Fines dictionum.* Both being reckon ed as Species of that *Cabalism* which they calle נוטריקון *Notaricon,* imposed by some later *Rabbie* from the *Latin* Word *Notarius.*

Of the first Sort, is that Collection from those eminent Words, *Gen.* 49. 10. יָבֹא שִׁילֹהוּ *Shilo shall come, and in him,* &c. where the Capital Letters make up the Word ישו *Jesu.* The Capital Letters.

So Psal. 72. 17. יִנּוֹן שְׁמוֹ וְיִתְבָּרְכוּ *His name shall continue, and in him shall be blessed,* &c. which Place does expresly treat concerning the *Messias* his Name, and therefore seems unto the *Jews*, to be of strong Consequence for the Proof of Christianity. For so much is that Nation befooled in their absurd Dotage upon these trivial literal Collections, that a Reason of this Nature is of greater force unto them, than the most evident solid Demonstration that may be urged. *Ludovicus Carret*, a famous *Jew*, Physician to the *French* King, being himself converted, and writing an Epistle to this Purpose, unto those of his own Nation, he does chiefly insist upon the Arguments of this kind, as being in his Opinion of greatest Efficacy to prove the Truth of Christian Religion. *Lib. Visorum Divinorum.*

Of the other Sort is that Passage, *Gen.* 1. 1. בְּרֵאשִׁית בָּרָא אֱלֹהִים where the final Letters make up the Word אמת or *Truth.* Which kind of *Cabalism* is six times repeated in the History of the Creation. As *Moses* by such an artificial Contrivance of the Letters at the Beginning of his Writings, did purposely commend unto our Belief his following Books. Unto this *David* is thought to allude, *Psal.* 119. 160. *The beginning of thy word is* אמת *Truth.* Of this Nature likewise is that Observation from *Exod.* 3. 13. לִי מַה שְּׁמוֹ מָה *When they shall say unto me, what is his name,* &c. Where the final Letters answer יהוה *Jehovah.* The final Letters.

It were an easie matter for a Man that had Leisure and Patience for such Enquiries, to find out sundry Arguments of this kind for any Purpose.

4. There is another way of hiding any secret Sense under an ordinary Epistle, by having a * Plate with certain Holes in it, through which (being *Cardan de subtil. l. 17. Porta de furt. l. 2. c. 18.

Such as Printers use when they are to insert diverse red Letters amongst the black.

ing laid upon the Paper) a Man may write thos Letters or Words, that serve to express the inward Sense; the other Spaces being afterwards filled up with such other Words, as in their Conjunction to these former, shall contain some common unsuspected Business.

5. There is also another intricate Way to this Purpose, much insisted on by *Trithemius*, *Porta*, and *Sylenus*. When each usual Word or Form of an Epistle, is varied to as many Differences as there are Letters, unto which they must all of them be severally assigned. But these two latter Inventions (though they be of great Secresy, yet) because they require so much Labour and Trouble in the Writer, I shall therefore pass them over without any further Enlargement.

CHAP. IX.

Of concealing any written Sense under Barbarous Words, and such as shall not seem to be of any Signification. How all the Letters may be expressed by any Five, Three, or Two of them. Of Writing with a double Alphabet. How from these two last Ways together, there may be contrived the best kind of Secret Writing.

ALL the Ways of Secresy by *more Letters*, already specified, do make the Writing appear under some other Sense, than what is intended, and so consequently are more free from Suspicion. There are likewise some other Inventions to express any inward Sense by barbarous Words, wherein only the first, and middle, and last Letters shall be significant. As in this Example.

Fildy

Fildy, fagodur wyndeeldrare discogure rantibrad.
Which in its resolution is no more than this:
Fly for we are discovered.

To this Purpose likewise is that other Way of expressing the whole Alphabet by any five, or three, or two of the Letters repeated. And though such a Writing, to ordinary Appearance, will seem of no Signification at all, and so may seem of less Use; yet because a right Apprehension of these Ways may conduce to the Explication of some other particulars that follow, it will not be amiss therefore to set them down more distinctly.

All the Letters may be expressed by any five of them doubled. Suppose A B C D E.

A B C D E F G H I K L M N
aa ab ac ad ae ba bb bc bd be ca cb cc

O P Q R S T V W X Y Z. &
cd ce da db dc dd de ea eb ec ed ee

According to which, these Words, *I am betrayed*, may be thus described.

Bd aacb abaedddbaaecaead.

Three Letters being transposed through three Places, do give sufficient Difference, whereby to express the whole Alphabet.

A B C D E F G H I
aaa aab aac baa bba bbb bbc caa cca

K L M N O P Q R S
ccb ccc aba abb abc aca acb acc bca

T V W X Y Z &.
bcb bcc bab cba cbb cbc bac

Hasten unto me.

Caa aaa bca bcb bba abb bcc abb bcb abc ab bba.

The whole Alphabet expreſſed by any 2 Letters in five Places.

Two Letters of the Alphabet being tranſpoſed through five Places, will yield thirty two Differences, and ſo will more than ſerve for the Four and twenty Letters; unto which they may be thus applied.

A.	*B.*	*C.*	*D.*	*E.*	*F.*	*G.*
aaaaa.	*aaaab.*	*aaaba.*	*aaabb.*	*aabaa.*	*aabab.*	*aabba.*

H.	*I*	*K.*	*L.*	*M.*	*N.*	*O.*
aabbb.	*abaaa.*	*abaab.*	*ababa.*	*abaab.*	*abbaa.*	*abbab.*

P.	*Q.*	*R.*	*S.*	*T.*	*V.*	*W.*
abbba.	*abbbb.*	*baaaa.*	*baaab.*	*baaba.*	*baabb.*	*babaa.*

X.	*Y.*	*Z.*
babab.	*babba.*	*babbb.*

aababababababba aaaaababaaaaaaababba.

f l y a w a y.

Writing by a double Alphabet.

There is yet another Way of Secreſy by more Letters than are naturally required to the inward Senſe; if we write with a double Alphabet, wherein each Letter ſhall in the Faſhion of it, bear ſome ſuch ſmall Diſtinction from the other of the ſame kind, as is uſual in common mixed Writing. *For Example.*

The firſt Alphabet.

Aa. Bb. Cc. Dd. Ee. Ff. Gg. Hh
Ii. Kk. Ll. Mm. Nn. Oo. Pp. Qq.
Rr. Ss. Tt. Vuv. Ww. Xx. Yy. Zz.

the second Alphabet.

Aa. Bb. Cc. Dd. Ee. ff. Gg. Hh
Ii. Kk. Ll. Mm. Nn. Oo. Pp. Qq.
Rr. Ss. Tt. Vuv. Ww. Xx. Yy. Zz.

1. Write an Epiſtle of an ordinary Matter, or (if be needful) contrary to what you intend. Let the Body it conſiſt chiefly of the firſt Alphabet, only inſert-g (as you have occaſion) ſuch Letters of the ſe-ond, as may expreſs that inward meaning which you ould reveal to a Confederate.

For Example, from thoſe that are Beſieged.

Wee prosper stillin our af-
faires. and shall (without
having any further helpe
endure the siege.

In

In which Clause, the Letters of the second Alph bet are only significant, expressing this inward Sen

Weeperish with hunger helpe us.

But because the Differences betwixt these two A phabets may seem more easily discoverable, sin they are both generally of the same kind, the L ters of the second being all of them more round a full than the other; therefore for their better Secr sy in this particular, it were safer to mix them bo by Compact, that they might not in themselves distinguishable.

The best way of secret writing. *Bacon. Augment. scient. l. 6. c. 8.*

Now if this kind of Writing be mixed with t latter Way of Secresy, by two Letters transpos through five Places, we may then write *omnia* *omnia*, which (as a learned Man speaks) is the hig est Degree of this Cyphering.

For supposing each Letter of the first Alphabet be instead of the Letter A, and those of the other for we may easily inscribe any secret Sense in any ord nary Letter, only by a quintuple Proportion of t Writing infolding to the Writing infolded. As f Example.

All things do happen ac
cording to our desires, the
particulars you shall vnder
stand when wee meete at
the appointed time and place
of which you must not faile
by any means The succes of
our affairs dos much depend
vpon the meeting that wee
have agreed vpon.

The involved meaning of which Clause is this:
Fly, for we are discovered, I am forced to write this.
If you suppose each Letter of the first Alphabet to
e instead of A, and those of the second for B, then
vill the former Clause be equivalent to this following
Description.

Aabab ababa babba aabab abbab baaaa babaa
F l y f o r w

aabaa aabaa aaaaa baaaa aabaa aaabb abaaa
e e a r e d i

baaab aaaba abbab baabb aabaa baaaa aabaa
ſ c o v e r e

aaabb abaaa aaaaa ababb aabab abbab baaaa
d, I a m f o r

aaaba aabaa aaabb baaba abbab babaa baaaa
c e d t o w r

abaaa baaba aabaa baaba aabbb abaaa baaab.
i t e t h i s.

This Way of Secreſy may be ſerviceable for ſu Occaſions as theſe. Suppoſe a Man were tak Captive, he may by this means diſcover to his Frien the Secrets of the Enemies Camp, under the outwa Form of a Letter perſuading them to yield. O ſuppoſe ſuch a Man were forced by his own Han writing to betray his Cauſe and Party, though t Words of it in common Appearance may expr what the Enemy does deſire; yet the involved mea ing, (which ſhall be legible only to his Confederate may contain any thing elſe which he has a Mind diſcover to them: As in the former Example.

But now if there be a threefold Alphabet, (as eaſie to contrive) then the inward Writing will be unto the outward but a triple Proportion, whi will be much more convenient for enlarging of t private Intimations.

And this Way of Writing is juſtly to be preferr before any of the other, as containing in it more minently, all thoſe Conditions that are deſirable ſuch kind of Inventions. As, 1. 'T

1. 'Tis not very laborious either to write or read.
2. 'Tis very difficult to be decyphered by the Enemy.
3. 'Tis void of Suspicion.

But by the way, 'tis to be generally observed, that the mixture of divers kinds of secret Writing together (as suppose this with the Key-character) will make the inward Sense to be much more intricate and perplexed.

CHAP. X.

Of Writing any Secret Sense by fewer Letters than are required to the Words of it. The Use of this amongst the Jews *and* Romans.

AS the Sense may be obscured by writing it with more Letters than are required to the Words of it, so likewise by fewer. Abbreviations have been anciently used in all the Learned Languages, especially in common Forms, and Phrases of frequent Use. Sometimes by contracting Words, when some Parts of them did stand for the whole. So in the *Hebrew*, וכו׳ for וכולו *et totum illud*, which is all one with our *et cetera*, &c. כלו׳ for כלומר *Secundum dicere*, equivalent to our *viz.* or *v. g. verbi gratia.* So likewise in the *Greek*, Χ̄ς for Χριστὸς, and ἀ̄ν̄π̄ for ἀνθρωπὸς. And in the *Latin*, *Dns* for *Dominus*; *aa* for *Anima*, and the like. But these were rather for the speed of Writing, than the Secresy. *Buxtorf. de Abbreviat. in initio.*

Sometimes Words were expressed only by their first Letters. Thus did the *Jews* write all their Memorials, and common Forms, which are largely handled by *Buxtorf.* Hence was it, that their Captain *Judas* had his Name of *Maccaby*; for being to fight a- *Ibid.*

gainſt *Antiochus*, he gave that ſaying for his Wat word, *Exod.* 15. מי כמכה באלהים יהוה. *Who is like u thee (O Lord) amongſt the Gods?* inſcribing in Enſigns the Capital Letters of it, מכבי *Maccabi*. Whe upon after the Victory, the Soldiers ſtiled their Ca tain by that Name.

'Tis obſerved by the *Rabbies*, that many gra Myſteries are this Way implied in the Words of Sc pture. Thus, where it is ſaid, *Pſal.* 3. רבים *Many r up againſt me*, 'tis interpreted from the ſeveral Lette *Reſh* the *Romans*, *Beth* the *Babylonians*, *Jod* the *Jo ans* or *Grecians*, *Mem* the *Medes*. Anſwerable ur which, that Place in *Gen.* 49. 10. (ſpeaking of *S lo*, unto whom יקהת the *gathering* of the People ſh be) is by another *Rabby* applied to the *Jews*, *Chri ans*, *Heathens*, and *Turks*.

Upon theſe Grounds likewiſe, is that Argume to prove the Trinity, from the firſt Verſe of *Gene* בראאלהים The Word אלהים *Elohim*, being of the P ral Number, is thought to be that Divine Na which denoteth the Perſons of the Deity; whi Perſons are more particularly intimated in the L ters of the Verb ברא, that anſwers unto it: ב *B* being put for בן the Son, ר *Reſh* for רוח the Holy Gho א *Aleph* for אב the Father. And if you will belie the *Jews*, the Holy Spirit hath purpoſely involved the Words of Scripture, every Secret that belongs any Art or Science, under ſuch Cabaliſms as the And if a Man were but expert in unfolding of the it were eaſie for him to get as much Knowledge *Adam* had in his Innocency, or Human Nature is pable of.

Theſe kind of myſterious Interpretations from p ticular Letters, do ſeem to be ſomewhat favoured, God's Addition of the Letter ה unto the Name of *bram* and *Sara*, upon the renewing of his Covena with them; which in all likelihood was not witho ſome ſecret Myſtery. That being the chief Let

Gen. 17. 5. 15.

the *Tetragammaton*, might perhaps intimate that ongst their other Posterity, with the Promise of ich he had then Blessed them, they should be the Parents of the *Messias*, who was *Jeho-h*.

This likewise others have confirmed from the Ex-ple of Christ, who calls himself *Alpha* and *Ome-* Rev. 1. 8.

Vide Tertul. l. de præscr. c. 50.

But though such Conjectures may be allowable in me particulars, yet to make all Scriptures capable the like Secrets, does give such a Latitude to en's roving and corrupt Fancies, as must needs casion many wild and strange Absurdities. And erefore *Irenæus* does fitly observe, that from such idle llections as these, many Heresies of the *Valentini-s* and *Gnosticks* had their first Beginnings.

Iren. l. 1. c. 13.

As this Way of short Writing by the first Letters, as of ancient Use amongst the *Jews*, so likewise a-ongst the *Romans*, which appears from many of eir Contractions yet remaining, as *S. P. D. Salu-n plurimam dicit. S. Pq. R. Senatus populusque Ro-anus. C. R. Civis Romanus. U. C. Urbs condita.* And e like.

These single Letters were called *Syglæ*, *per ncopen*, from the obsolete Word *Sigillæ*, whence *gillatim.* They were usually inscribed in their oins, Statues, Arms, Monuments, and Publick ecords. You may see them largely treated of by *lerius Probus*, where he affirms the Study of them be very necessary for one that would understand e *Roman* Affairs. *His enim exprimebant nomina Curi-um, Tribuum, Comitiorum, Sacerdotiorum, Potestatum, lagistratuum, Præfecturarum, Sacrorum ludorum, Re-m Urbanarum, Rerum militarium, Collegiorum, De-riarum, Fastorum, Numerorum, Mensurarum, Ju-s civilis, & similium.*

Lib. de liter. antiquis. As it is set forth by *Jacob Mazocki us.*

They were first used by their Notaries, at Senates nd other Publick Assemblies, and from thence re-

tained in their Statutes and Civil Laws: Whence *Manilius* makes it the Note of a good Lawyer.

——*Qui legum tabulas & condita jura*
Noverit, atque notis levebus pendentia verba.

Isidor. Bibliand. de ratione com. ling. Pet. Grinit. Honest. Disc. l. 6. c. 8.

Thus (saith *Isidor*) (A) inversed V did formerly stand for *Pupilla*, and M inversed W for *Mulier*. By these Letters *D. E. R. I. C. P.* is signified, *De ea re ita censuerunt Patres.*

When the Judges were to inscribe their several Opinions on a little Stone or *Tessera*, to be cast into the Urn; by the Note *A*, they did absolve, by **K* condemn; by *N. L. Non liquet*, they did intimate that they could not tell what to make of the Business, and did therefore suspend their Judgments.

* From the *Greek*, καταδικάζειν.

But because of those many Ambiguities which this contracted Way of Writing was liable unto, and the great Inconveniences that might happen thereupon in the Misinterpretation of Laws; therefore the Emperor *Justinian* did afterward severely forbid any further Use of them, as it were, calling in all those Law-Books that were so written. *Neque enim licentiam aperimus ex tali codice in judicium aliquid recitari.*

Lib. 1. Cod. Tit. 17. leg. 1, 2.

The chief Purpose of these Ancient Abbreviations amongst the *Romans*, was properly for their speed. But it is easie to apprehend how by Compact they may be contrived also for Secresy.

CHAP.

CHAP. XI.

Writing by invented Characters.

e Distinction of these into such as signifie, either { Letters. Words. Notions.

e General Rules of unfolding and obscuring any Letter-characters. How to express any Sense, either by Points, or Lines, or Figures.

Besides the Ways of secret Writing by the common Letters, there may likewise be divers ners by invented Notes.

The Difference of Characters, whereby several nguages are expreſt, is part of the second general urse in the Confusion of Tongues; for as before ere was but one Way of Speaking, so also but one ay of Writing. And as now, not only Nations, t particular Men, may discover their Thoughts by y different articulate Sounds, so likewise by any ritten Signs.

These invented Characters in the General, are dinguishable into such as signifie, either

1. *Letters.*
2. *Words.*
3. *Things, and Notions.*

First, concerning those that signify Letters: To hich kind some Learned Men refer the *Hebrew* haracter that is now in use; affirming, that *Ezra* ſt invented it, thereby the better to conceal the crets of their Law, and that they might not have much as their Manner of Writing common with e *Samaritans* and other Schismaticks. 'Twere

The Letter-character. *Hieronym. præf. ad l. Regum. Joseph Scal. notis ad Euseb.*

'Twere but needless to set down any Particulars of this kind, since it is so easy for any ordinary Man to invent or vary them at Pleasure.

The Rules that are usually prescribed for the unfolding of such Characters, are briefly these.

1. Endeavour to distinguish betwixt the Vowels and Consonants. The Vowels may be known by their Frequency, there being no Word without some of them. If there be any single Character in *English*, it must be one of these three Vowels *a, i, o.*

2. Search after the several Powers of the Letters. For the understanding of this, you must mark which of them are most common, and which more seldom used. (This the Printers in any Language can easily inform you of, who do accordingly provide their Sets of Letters.) Which of them may be doubled, and which not, as *H*, *Q*, *X*, *Y*. And then, for the Number of Vowels or Consonants in the Beginning, Middle, or End of Words, a Man must provide several Tables, whence he may readily guess at any Word, from the Number and Nature of the Letters that make it: As, what Words consist only of Vowels; what have one Vowel, and one Consonant; whether the Vowel be first, as in these Words, *Am, an, as, if, in, is, it, of, on, or, us* or last, as in these Words, *Be, he, me, by, dy, ly, my, ty, do, to, so,* &c. And so for all other Words, according to their several Quantities and Natures.

These Tables must be various, according to the Difference of Languages. There are divers the like Rules to be observed, which are too tedious to recite; you may see them largely handled by *Baptista Porta*, and *Gustavus Selenus*.

The

The common Rules of unfolding being once nown, a Man may the better tell how to delude em; either by leaving out those Letters that are leſs Uſe, as *H*, *K*, *Q*, *X*, *Y*; and putting other haracters inſtead of them, that ſhall ſignify the owels: So that the Number of this invented Alhabet will be perfect; and the Vowels, by reaſon their double Character, leſs diſtinguiſhable. Or Man may likewiſe delude the Rules of Diſcovery, y writing continuately, without any Diſtinction etwixt the Words, or with a falſe Diſtinction, or y inſerting *Nulls* and *Non-ſignificants*, &c.

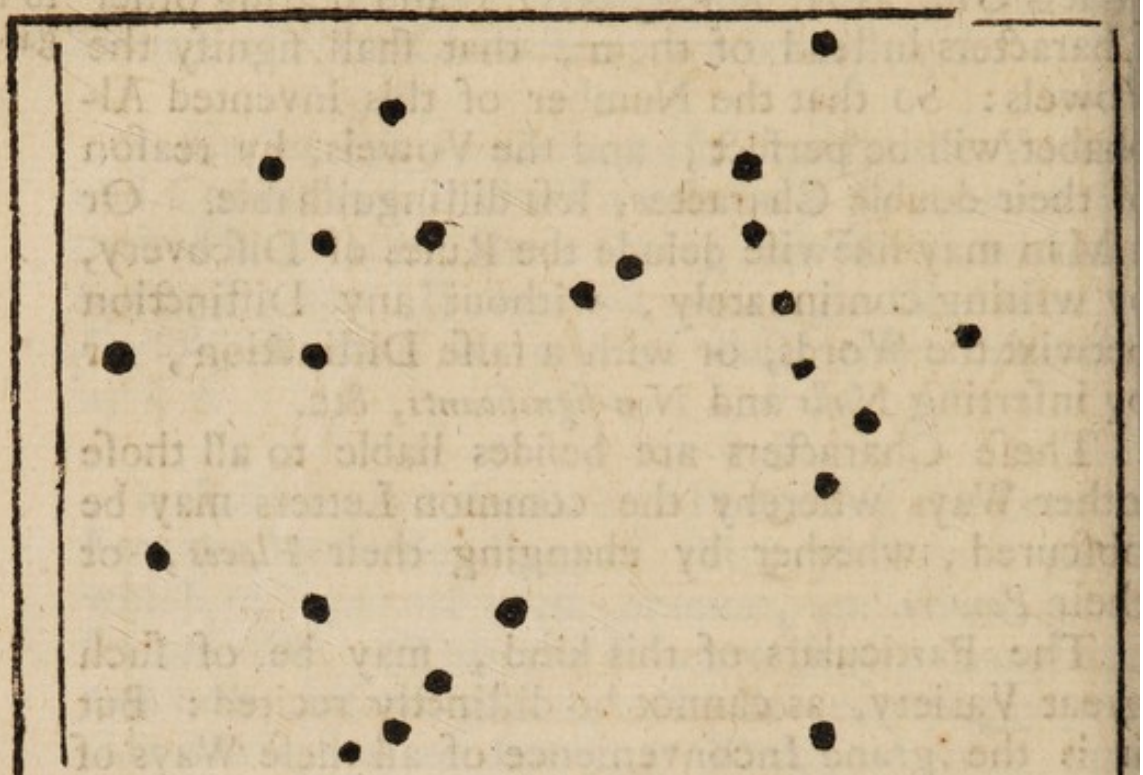
In theſe caſes Orthography is not to be regarded.

Theſe Characters are beſides liable to all thoſe ther Ways whereby the common Letters may be bſcured, whether by changing their *Places*, or heir *Powers*.

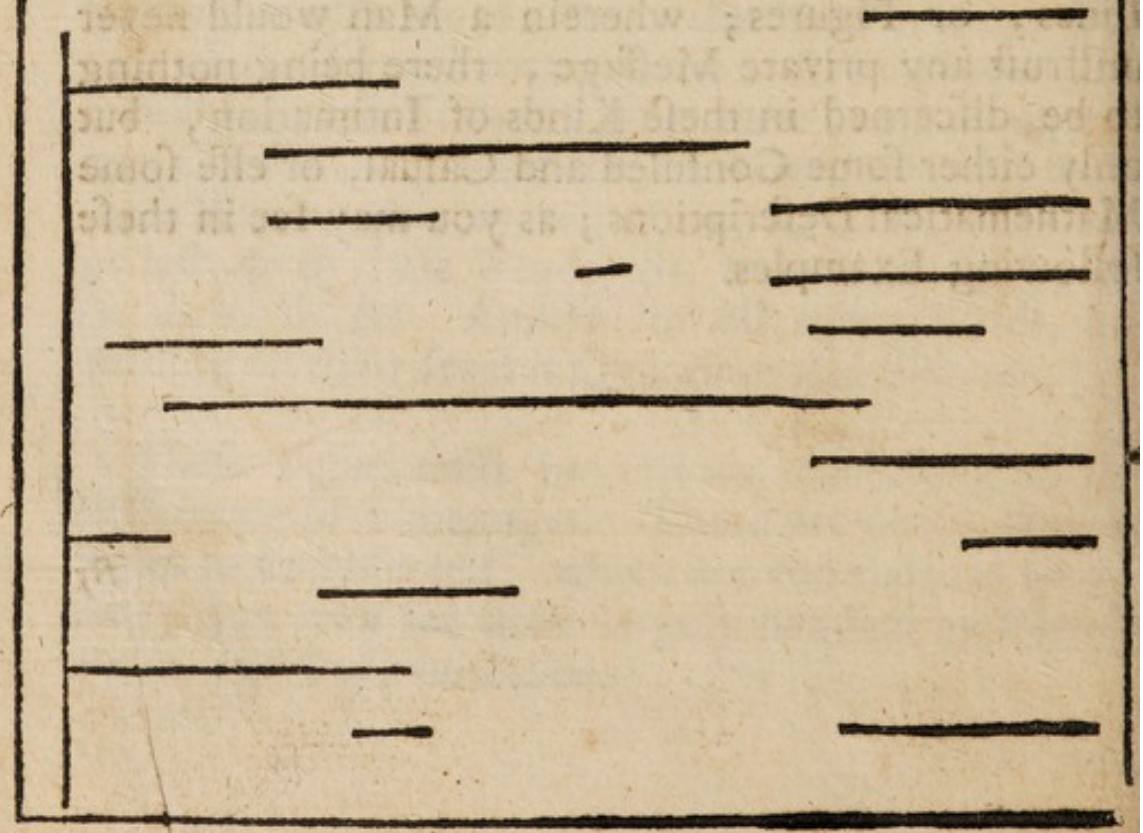
The Particulars of this kind, may be of ſuch reat Variety, as cannot be diſtinctly recited: But is the grand Inconvenience of all theſe Ways of ecreſy by invented Characters, that they are not vithout Suſpicion.

For the remedying of which, there have been ome other Inventions of writing by Points, or ines, or Figures; wherein a Man would never iſtruſt any private Meſſage, there being nothing o be diſcerned in theſe Kinds of Intimation, but nly either ſome Confuſed and Caſual, or elſe ſome Mathematical Deſcriptions; as you may ſee in theſe ollowing Examples.

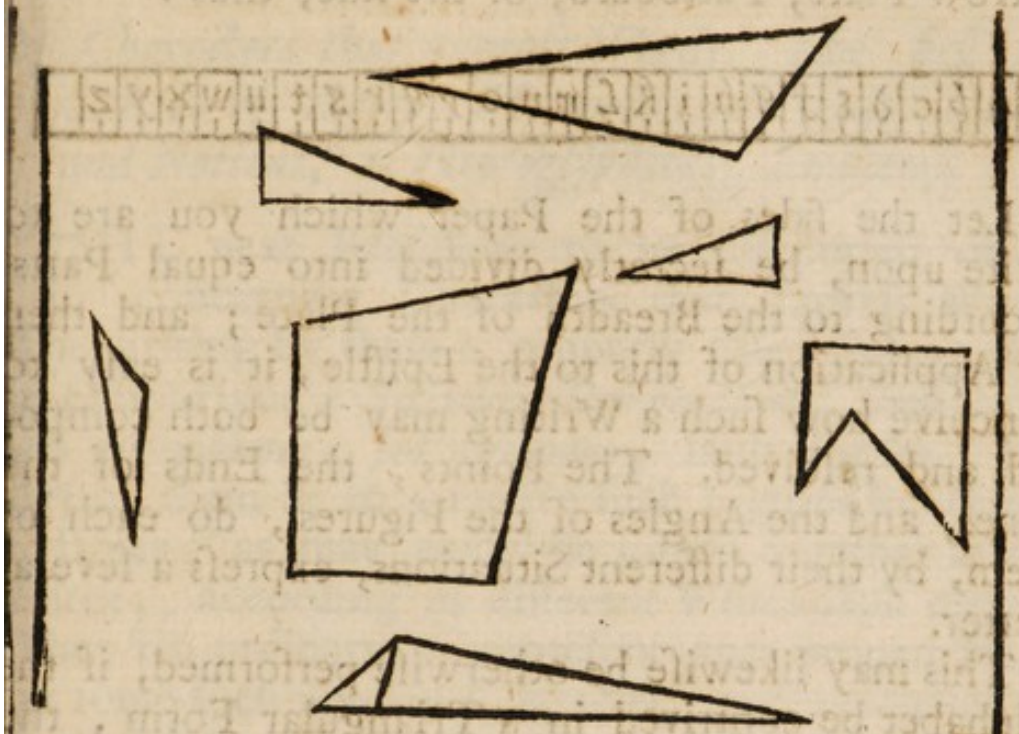
By Points alone.



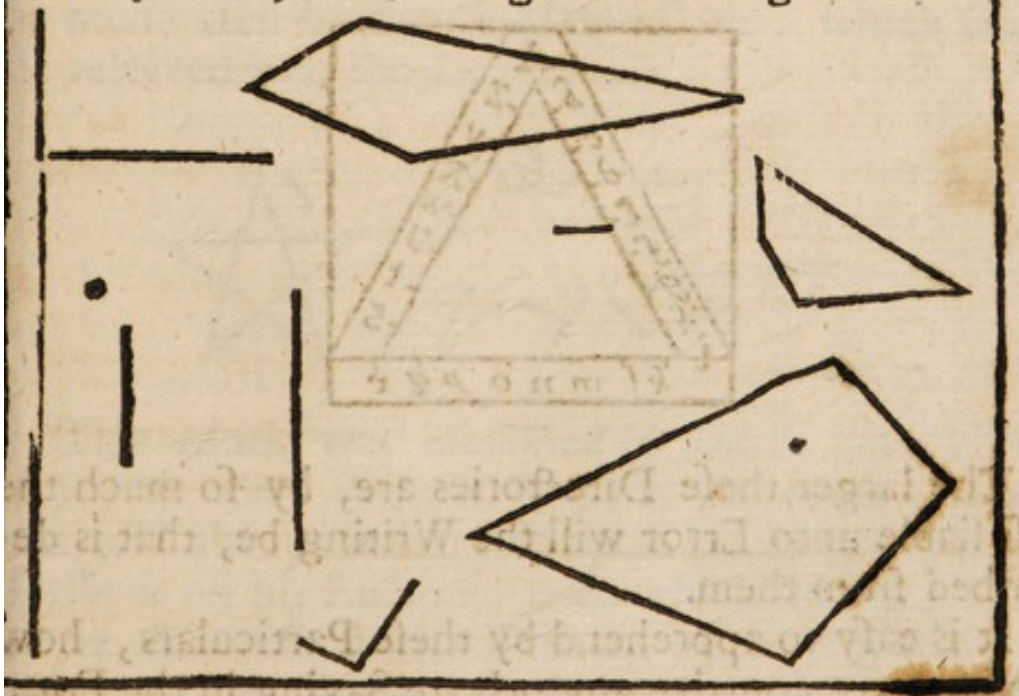
By Lines alone.



By Mathematical Figures.



By Points, Lines, and Figures mixed together.



Each of which Figures do expreſs theſe Words:

There is no Safety but by Flight.

The

The Direction both for the making and unfolding of theſe Deſcriptions, is this: Let the Alphabet be deſcribed at equal Diſtances, upon ſome thin and narrow Plate, Paſtboard, or the like, thus:



Let the ſides of the Paper which you are to write upon, be ſecretly divided into equal Parts, according to the Breadth of the Plate; and then by Application of this to the Epiſtle, it is eaſy to conceive how ſuch a Writing may be both compoſed and reſolved. The Points, the Ends of the Lines, and the Angles of the Figures, do each of them, by their different Situations, expreſs a ſeveral Letter.

This may likewiſe be otherwiſe performed, if the Alphabet be contrived in a Triangular Form, the Middle Part of it being cut out.

And ſo for a Square or round Form.



The larger theſe Directories are, by ſo much the leſs liable unto Error will the Writing be, that is deſcribed from them.

Joh. Walchius, Fab. 9.

It is eaſy to apprehend by theſe Particulars, how a Man may contrive any private Saying in the Form of a Landskip, or other Picture. There may be divers the like Ways, whereby this Invention of Secreſy may be further obſcured; but they are in themſelves ſo obvious, that they need not any larger Explication.

CHAP.

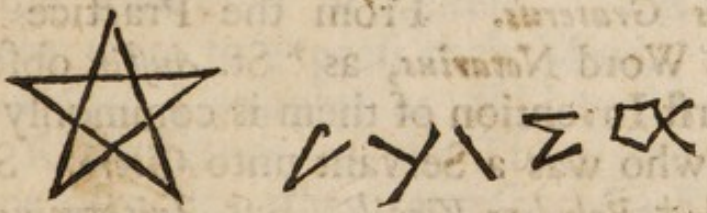
CHAP. XII.

Of Characters that expres's Words. The first Invention of these. Of those that signify Things and Notions, as Hieroglyphicks, Emblems.

THE next Particular to be discourſed of, is, concerning Characters that expreſs Words. The writing by theſe is properly ſtiled *Stenography*, or Short-Hand; *Scripturæ Compendium, cum verba non perſcribimus, ſed ſignamus*, ſaith *Lypſius*. The Art of them is, to contrive ſuch Figures for ſeveral Sylables, as may eaſily be joined together in one Form, according as different Words ſhall require. Thus 'tis ordinary to repreſent any proper Name by ſome ſuch unuſual Character, as may contain in it all the Letters of that Name for which it is intended. Of this Nature was that Angular Figure ſo much uſed by the *Græcians* of old, which might be reſolved into the Letters ὑγίεα.

Cent. 1. ad Belg. Epiſt. 27.

Schikard Happer. Diſp. 5.



This Mark was eſteemed ſo Sacred amongſt the Ancients, that *Antiochus Soter*, a perpetual Conqueror, did always inſtamp it upon his Coin, and inſcribe it on his Enſigns; unto which he did pretend to be admoniſhed in a Dream, by an Apparition of *Alexander* the Great. And there are many Superſtitious Women in theſe Times, who believe this to be ſo lucky a Character, that they always work it upon the Swadling Clothes of their Young Children, thinking thereby to make them more healthful and proſperous in their Lives.. Unto this kind

alſo,

also, some refer the Characters that are used in Ma gick, which are maintained to have, not only a se cret Signification, but likewise a natural Efficacy.

This Short-hand Writing is now so ordinary i Practice (it being usual for any common Mecha nick both to write and invent it) that I shall no need to set down any particular Example of i In Ancient Times it was not so frequently used but then there was a twofold Kind of it.

Private.
Publick.

And therefore *Pancirollus* reckons it amongst these later Inventions, *l. de Repert. tit.* 14. *Casaubon. notis in Æne. Poliorcet. c.* 31. *De notis Tyronis & Senec.*

These private Characters were practised by th *Roman* Magistates, and others of eminent Favou amongst them; who being often importuned t write in the Commendation of those Persons the knew not, were fain to agree upon some Secre Notes, whereby their *Serious* Epistles might be di stinguished from those of *Form.* Whence the Pro verb arose, *De meliori nota commendare.*

The other Characters of publick and commo Use, are many of them explained by *Valerius Pro bus*, in his Book *de Literis Antiquis*; and there is whole Volume, or Dictionary of them, set forth by *Janus Gruterus.* From the Practice of these came the Word *Notarius*, as * St. *Austin* observes.

* *De Doct. Christ. l.* 2. *c.* 26.

The first Invention of them is commonly ascribe to *Tyro*, who was a Servant unto *Cicero.* So * *Euse bius*, and † *Polydore Virgil.* But *Trithemius* affirms That *Cicero* himself writ a Treatise on this Subject which was afterwards augmented by St. *Cyprian* And that he had found in an Old Library, the Co py of a Psalter written in these Characters, inscri bed by some ignorant Man with this Title, *Psalte rium in Lingua Armenica.*

* *In Chron.* † *De invent. rerum l.* 2. *c.* 8. *De Polygr.*

That *Cicero* was not unacquainted with thes Notes, may be evident from that Passage to *Atticus Quod ad te de legatis scripsi, parum intellexit, credo quia* διὰ σημείων *scripseram.*

Lib. 13. *ad Attic. Ep.* 32.

Pe

Pet. Diaconus attributes the first Invention of these to the Old Poet *Ennius*; whose Beginnings in this kind, did afterwards receive successive Addition from the Works of *Tyro*, *Philargirus*, *Aquila*, and *Seneca* the Father; by whom they were increased to the Number of 5000. *Prolog. not. Conrad. Imp. Isidor. Orig. l. 1. c. 21.*

But *Hermannus Hugo*, a late Jesuit, will have this Short-hand Writing to be of far more ancient Use; affirming, that *David* alludes to the Practice of it, in that Phrase, *Psal.* 45. 1. *The Pen of a ready Writer.* And that the Writing upon the Wall, in *Dan.* 5. 25. which so puzzled the *Chaldean* Wizards, was described in such kind of Characters. But whether this were so, or not, is not much material: It is sufficiently pertinent to the present Enquiry, that the Use of these Word-Characters may well enough conduce to the Secresy of any written Message. *De Orig. scribendi, c. 18. juxta finem.*

The third and last sort of Signs, that have been anciently used for the Expression of *Things* and *Notions*, are either *Hieroglyphicks*, or *Emblems*.

1. Concerning *Hieroglyphicks*. The Word signifies *Sacred Sculptures*, which were engraven upon Pillars, Obelisks, Pyramids, and other Monuments, before the Invention of Letters. Thus the *Ægyptians* were wont to express their Minds, by the Pictures of such Creatures as did bear in them some natural Resemblance to the Thing intended. By the Shape of a Bee, they represented a King; intimating, that he should be endowed with Industry, Honey, and a Sting. By a Serpent, with his Tail in his Mouth, the Year, which returns into it self: And (which was a kind of Prophetical Hieroglyphick) by the Sign of a Cross, they did anciently denote *Spem venturæ Salutis*, or *Vitam Eternam*, as *Pet. Crinitus* relates out of *Ruffinus*. * *Philo* reckons up the Knowledge of these amongst those other abstruse *Ægyptian* Arts, wherein *Moses* is said to be so expert. And *Clemens* relates of *Pythagoras*, how he

Of Hieroglyphicks. *Tacit. Annal. l. 11. Pol. Virgil de Invent. l. 3. c. 11. De honesta disciplina l. 7. c. 2. * Lib. de vita Mosis. Lib. 1. Stromat.*

he was content to be circumciſed, that ſo he migh be admitted to the underſtanding of thoſe many an great Myſteries which were this way delivered b the Ancient Prieſts, who did conceal all thei Learning under ſuch kind of Magical Expreſſions as the Poet ſtiles them.

Lucan l. 3.

Nondum flumineas Memphis *contexere byblos*
Noverat, & ſaxis tantum volucreſque feræque,
Sculptaq; ſervabant magicas animalia linguas.

Plutarch ſpeaks of a Temple in *Ægypt* dedicate to *Minerva*, in the Front of which there was place the Image of an *Infant*, an *Old Man*, a *Hawk*, b which they did repreſent God; a *Fiſh*, the Expreſ ſion of Hatred; and a *Sea-horſe*, the common Hie roglyphick of Impudence: The Conſtruction o all being this; *O ye that are born to dye, know tha God hateth Impudence.*

Lib. de Iſid. & Oſiride.

Of this Nature were thoſe Preſents ſent unto *Da rius*, when he was almoſt wearied in his War againſ the *Scythians*; which were, a Bird, a Mouſe, Frog, and certain Arrows; intimating, that unle the *Perſians* could fly as *Birds*, or hide themſelve under Water as *Frogs*, or inhabit the Caverns of th Earth as *Mice*, they ſhould not eſcape the *Scythia Arrows*. Of this kind likewiſe were ſome Militar Signs amongſt the *Romans*. When any thing wa to be carry'd with Silence and Secreſy, they lifte up the Repreſentation of a *Minotaur*; thereb teaching the Captains, that their Counſels and Cor trivances muſt be as inextricable as a Labyrintl which is feigned to be the Habitation of that Mon ſter.

Herodot. Melpom. l. 4. *c.*130. *Cl. Alex. Strom.* 5.

Pierius Hieroglyph. l. 3. *c.* 38.

Emblems from the *Greek* Word ἐμβάλλειν, *interſerere, injicere.*

2. Like unto theſe Hieroglyphicks, are the Ex preſſions by Emblems. They were uſually inſerte as Ornaments upon Veſſels of Gold, and othe Matters of State or Pleaſure. Of this Nature a the Stamps of many Ancient Medals, the Impreſſ of Arms, the Frontiſpieces of Books, *&c.*

Th

The Kinds of them are chiefly twofold.

1. *Natural.* Which are grounded upon some Resemblance in the Property and Essence of the Things themselves. So a Dolphin, which is a swift Creature, being described upon an Anchor, which serves for the Stay and Rest of a Ship, signifies *Festinalente*, Deliberation in Counsel, and Dispatch in Execution: A Young Stork carrying the Old one, Filial Gratitude.

2. *Historical*, Those that refer to some common Relation. So the Picture of *Prometheus* gnawed by a Vulture, signifies the Desert of over-much Curiosity. *Phaeton*, the Folly of Rashness. *Narcissus*, the Punishment of Self-love.

It was formerly esteemed a great Sign of Wit and Invention, handsomely to convey any noted Saying under such kind of Expressions.

CHAP. XIII.

Concerning an Universal Character, that may be legible to all Nations and Languages. The Benefit and Possibility of this.

After the Fall of *Adam*, there were two General Curses inflicted on Mankind: The one upon their *Labours*, the other upon their *Language*.

Against the first of these we do naturally endeavour to provide, by all those common Arts and Professions about which the World is busied; seeking thereby to abate the Sweat of their Brows in the Earning of their Bread.

Against the other, the best Help that we can yet boast of, is the *Latin* Tongue, and the other learned Languages, which by Reason of their Generality, do somewhat restore us from the first Confusion. But

now if there were such an Universal Character to express Things and Notions, as might be legible to all People and Countries, so that Men of several Nations might with the same ease both write and read it, this Invention would be a far greater Advantage in this Particular, and mightily conduce to the spreading and promoting of all Arts and Sciences: Because that great part of our Time which is now required to the Learning of Words, might then be employed in the Study of Things. Nay, the Confusion at *Babel* might this Way have been remedied, if every one could have expressed his own meaning by the same kind of Character. But then perhaps the Art of Letters was not invented.

That such a manner of Writing is already used in some Parts of the World, the Kingdoms of the high *Levant*, may evidently appear from divers credible Relations. *Trigaultius* affirms, that though those of *China* and *Japan*, do as much differ in their Language as the *Hebrew* and the *Dutch*; yet either of them can by this Help of a common Character, as well understand the Books and Letters of the others, as if they were only their own.

Histor. Sinens. l. 1. c. 5.

Bacon Augment. Scient. l. 6. c. 13.

And for some particulars, this general kind of Writing is already attained amongst us also.

Voss. Gr. l. 1. c. 41.

Herm. Hugo de Orig. Scrib. c. 4.

1. Many Nations do agree in the Characters of the common Numbers, describing them either the *Roman* Way by Letters, as I. II. V. X. C. D. M. or else the *Barbarian* Way by Figures, as 1. 2. 3. 10 *&c.* So likewise for that which we call Philosophical Number, which is any such Measure whereby we judge the Differences betwixt several Substances, whether in Weight, or Length, or Capacity; each of these are expresst in several Languages by the same Character. Thus ℈ signifies a Scruple, ʒ a Drachm and so of the rest.

2. The Astronomers of several Countries do express

press both the Heavenly Signs, and Planets, and Aspects by the same kind of Notes: As, ♈, ♉, ♊, ♋, &c. ♄, ♃, ♂, ♀, &c. ☌, ✶, △, □, ☍. Which Characters (as it is thought) were first invented by the Ancient Astrologers for the Secresy of them, the better to conceal their Sacred and Mysterious Profession from vulgar Capacity.

3. The Chymical Treatises that are written in different Languages, do all of them agree in the same Form of Writing their Minerals. Those that are attributed to any of the Planets, are decyphered by the Character of the Planet to which they belong. The rest by other particular Signs, as △ for Salt Ammoniack, ☍ for Arsnick, *&c.*

4. Musical Notes in most Countries are the same: Nor is there any reason why there may not be such a general kind of Writing invented for the Expression of every Thing else as well as these particulars.

In the Contrivance of this there must be as many several Characters as there are primitive Words. To which purpose the *Hebrew* is the best Pattern, because that Language consists of fewest Radicals.

Each of these Primitives must have some particular Marks to distinguish the Cases, Conjugations, or other necessary Variations of those Derivatives that depend upon it.

In the Reading of such a Writing, though Men of several Countries should each of them differ in their Voices, and pronouncing several Words, yet the Sense would be still the same. As it is in the Picture of a Man, a Horse, or Tree; which to all Nations do express the same Conceit, though each of these Creatures be stiled by several Names, according to the Difference of Languages.

Suppose that Astronomical Sign ♉ were to be pronounced, a *Jew* would call it שׁוֹר; a *Grecian*, Ταῦρον; an *Italian*, *Toro*; a *Frenchman*, *Taureau*; a *German*, *Stier*; an *Englishman*, a *Bull*.

So likewise for that Character, which in *Tiro's* Notes signifies the World, a *Jew* would read it תבל; a *Grecian*, Κόσμος; an *Italian*, *il monde*; a *Frenchman*, *le monde*; a *German*, *Belt*. Though several Nations may differ in the *Expression* of things, yet they all agree in the same Conceit of them.

The Learning of this Character will not be more difficult than the Learning of any one Language, because there needs not be more Signs for the Expression of Things, than there is now for the Expression of *Words*. Amongst those in *China* and *Japan*, there is said to be about Seven or Eight Thousand.

The perfecting of such an Invention were the only Way to unite the Seventy two Languages of the first Confusion; and therefore may very well deserve their Endeavours who have both Abilities and Leisure for such kind of Enquiries.

CHAP. XIV.

Concerning the third Way of Secret Discoursing by Signs and Gestures, which may signifie, either

ex { congruo. / placito.

THE third Way of Discoursing was by Signs and Gestures, which (as they are serviceable to this Purpose) may be distinguished into such as are significant, either

1. *Ex congruo.*
2. Or *ex placito.*

1. *Ex congruo*, when there is some natural Resemblance

blance and Affinity betwixt the Action done, and the thing to be expreſt. Of which kind are all thoſe outward Geſtures, whereby not only dumb Creatures, but Men alſo do expreſs their inward Paſſions, whether of Joy, Anger, Fear, *&c.* For,

Sæpe tacens vocem verbaque vultus habet.

And the Wiſe Man notes it of the Scorner, That *he winketh with his eyes, he ſpeaketh with his feet, he teacheth with his fingers.* Prov. 6. 13.

Of this kind likewiſe are many Religious Actions, and Circumſtances of Divine Worſhip, not only amongſt the Ancient Heathen, but ſome that were particularly enjoyned the Prieſts and *Levites* of the old Law; and ſome too that are now in Uſe in theſe Times of the Goſpel. For by ſuch bodily Geſtures and Signs, we may as well ſpeak unto God as unto Men.

To this kind alſo are reducible thoſe Actions of *Form*, that are required as neceſſary Circumſtances in many civil Affairs and publick Solemnities, which are uſually ſuch, as in themſelves are apt to ſignifie the thing for which they are meant.

But now ſometimes the intended meaning of theſe Geſtures is concealed under a ſecret Similitude. As it was in that Act of *Thraſybulus*, who being conſulted with, how to maintain a Tyranny that was newly uſurped: He bid the Meſſenger attend him in the Field; where with his Wand he whipt off thoſe higher Ears of Corn that did over-top the reſt; intimating, that it conſiſted in cutting off the Peers and Nobility, who were likely to be moſt impatient of Subjection. This I may call a *Parabolical* Way of ſpeaking by Geſtures.

2. *Ex placito*, when theſe Signs have their Signification from Uſe and mutual Compact; which kind of Speaking, as it refers to laſcivious Intimations, is largely handled by *Ovid, de Arte amandi.*

Verba supercilliis sine voce loquentia dicam,
Verba leges digitis, &c.

By the Help of this it is common for Men of several Nations, who understand not one another's Languages, to entertain a mutual Commerce and Traffick. And 'tis a strange thing to behold, what Dialogues of Gestures there will pass betwixt such as are born both Deaf and Dumb; who are able by this means alone, to answer and reply unto one another as directly as if they had the Benefit of Speech. 'Tis a great part of the State and Majesty belonging to the *Turkish* Emperor, that he is attended by Mutes, with whom he may discourse concerning any private Business, which he would not have others to understand.

It were a miserable thing for a Rational Soul to be imprisoned in such a Body as had no Way at all to express its Cogitations; which would be so in all that are born Deaf, if that which Nature denied them, were not in this Respect supplied by a second Nature, Custom and Use.

But (by the Way) 'tis very observable which * *Vallesius* relates of *Pet. Pontius* a Friend of his, who by an unheard-of Art taught the Deaf to speak. *Docens primum scribere, res ipsas digito indicando, quæ characteribus illis significarentur; deinde ad motus linguæ, qui characteribus responderent provocando.* First learning them to write the Name of any thing he should point to; and afterwards provoking them to such Motions of the Tongue as might answer the several Words. 'Tis probable that this Invention well followed, might be of singular Use for those that stand in need of such Helps. Tho' certainly that was far beyond it, (if true) which is related of an ancient Doctor, *Gabriel Neale*, that he could understand any Word by the meer Motion of the Lips, without any Utterance.

* *Sacra Philos. c.* 3.

The particular Ways of Discoursing by Gestures, are not to be numbred, as being almost of infinite Variety, according as the several Fancies of Men shall

shall impose Significations upon all such Signs or Actions as are capable of sufficient Difference.

But some there are of more especial Note for their Use and Antiquity. Such is that upon the Joynts and Fingers of the Hand, commonly stiled *Arthrologia*, or *Dactylologia*; largely treated of by the venerable * *Bede*, † *Pierius*, and others. In whom you may see, how the Ancients were wont to express any Number by the several Postures of the Hands and Fingers: The Numbers under a hundred, were denoted by the Left Hand, and those above, by the Right Hand. Hence *Juvenal*, commending *Pylias* for his old Age, says, That he reckoned his Years upon his Right Hand.

Fœlix nimirum qui tot per sæcula vitam
Distulit, atque suos jam dextra computat annos.

There are divers Passages in the Ancient Authors, both Sacred and Prophane, which do evidently allude to this kind of reckoning.

Hence it is easie to conceive, how the Letters as well as the Numbers, may be thus applied to the several Parts of the Hand, so that a Man might with divers Touches, make up any Sense that he hath occasion to discover unto a Confederate.

This may be performed, either as the Numbers are set down in the Authors before-cited; or else by any other Way of Compact that may be agreed upon.

As for Example: Let the Tops of the Fingers signifie the five Vowels; the middle Parts, the five first Consonants; the Bottoms of them, the five next Consonants; the Spaces betwixt the Fingers the four next. One Finger laid on the side of the Hand may signifie T, two Fingers V the Consonant, three W, the little Finger crossed X, the Wrist Y, the middle of the Hand Z.

But because such various Gesticulations as are required to this, will not be without Suspicion, therefore it were a better Way, to impose Significations

* *Lib. de loquelâ per gestum digitorum sive de indigitatione.*
† *Hieroglyphic. l. 37. c. 1.* &c. *Cælius Antiq. lect. l. 23. c. 12. Satyr. 10.*

upon such Actions as are of more common unsuspected Use; as scratching of the Head, rubbing the several Parts of the Face, winking of the Eyes, twisting of the Beard, *&c.* Any of which, or all of them together, may be as well contrived to serve for this Purpose, and with much more Secresy.

In which Art, if our gaming Cheats, and *Popish* Miracle-Impostors, were but well versed, it might much advantage them, in their cozening Trade of Life.

CHAP. XV.

Concerning the Swiftness of Informations, either by Qualities, as the Impression of Imagination, and the Sensitive Species; or by Spiritual Substances, as Angels.

HAving already treated concerning the several Ways of *Secresy* in Discoursing, I shall in the next Place enquire, How a Man may with the greatest Swiftness and Speed, discover his Intentions to one that is far distant from him.

There is nothing (we say) so swift as Thought and yet the Impression of these in another, might be as quick almost as the first Act, if there were but such a great Power in Imagination, as some later Philosophers have attributed to it.

* *Marsil. Ficin. Theolog. Platon. l. 3. c. 1. Pomponatius de Incantat. Paracelsus.*

Next to the Acts of Thought, the Species of Sight do seem to be of the quickest Motion. We see the Light of the *East* will in a Moment fill the Hemisphere, and the Eye does presently discern an Object that is very remote. How we may by this mean communicate our Thoughts at great Distances, shall discourse afterwards.

The Substances that are most considerable for the Swiftness of their Motion, are

Either { *Spiritual.* / *Corporeal.*

Amongst all created Substances, there are not any of so swift a Motion as Angels or Spirits. Because there is not either within their Natures, any such Indisposition and Reluctancy, or without them in the Medium, any such Impediment as may in the least manner retard their Courses. And therefore have the Ancient Philosophers employed these as the Causes of that mad Celerity of the Celestial Orbs; tho' according to their Suppositions, I think it would be a hard Match, if there were a Race to be run betwixt the *Primum Mobile* and an Angel. It being granted that neither of them could move in an Instant, it would be but an even lay which should prove the swifter. Spirits.

From the Fitness of Spirits in this regard to convey any Message, are they in the learned Languages called Messengers. מלאך ἀγγελος *Angelus.*

Now if a Man had but such Familiarity with one of these, as *Socrates* is said to have with his Tutelary *Genius*: If we could send but one of them upon any Errand, there would be no quicker Way than this for the Dispatch of Business at all Distances. *Plutarch. Maximus Tyrius. Dissertat.* 26, 27.

That they have been often thus employed, is affirmed by divers Relations. *Vatinius* being at *Rome*, was informed by an Apparition of that Victory which *Paulus* their General had obtained over King *Perses* in *Macedon*, the very same Day wherein the Battel was fought; which was a long Time before any other Messenger could arrive with the News. *Lactant. Inst. l.* 2. *ep.* 8. *Val. Max. l.* 1. *c.* 8. *Florus, lib.* 2. *c.* 12.

And it is storied of many others, that whilst they have resided in remote Countries, they have known the Death of their Friends, even in the very Hour of their Departure; either by Bleeding, or by Dreams, or some such Way of Intimation. Which, though it

be

be commonly attributed to the Operation of Sympathy; yet it is more probably to be ascribed unto the Spirit or Genius. There being a more especial Acquaintance and Commerce betwixt the Tutelary Angels of particular Friends, they are sometimes by them informed (tho' at great Distances) of such Remarkable Accidents as befall one another.

But this way there is little Hopes to advantage our Enquiry, because it is not so easie to employ a good Angel, nor safe dealing with a bad one.

The Abbot *Trithemius*, in his Books concerning the several Ways of secret and speedy Discoursing, does pretend to handle the Forms of Conjuration, calling each kind of Character by the Name of Spirits, thereby to deter the Vulgar from searching into his Works. But under this Pretence, he is thought also to deliver some Diabolical Magick. Especially in one Place, where he speaks of the three Saturnine Angels, and certain Images, by which, in the Space of twenty four Hours, a Man may be informed of News from any Part of the World. And this was the main Reason, why by *Junius* his Advice *Frederick* the Second, Prince *Palatine*, did cause the Original Manuscript of that Work to be burned. Which Action is so much (though it should seem unjustly) blamed by *Selenus*.

Vossius Gram. l. 1. c. 41.

Polygraph. l. 3. c. 16.

Cryptogr. l. 3. c. 15.

CHAP. XVI.

Concerning the Swiftness of Conveyance by Bodies *whether* Inanimate, *as Arrows, Bullets; or* Animate, *as Men, Beasts, Birds.*

THE *Bodies* that are most eminent for their Swiftness, may be distinguished into such as are

Eithe

Either { *Inanimate.* / *Animate.*

These Inanimate Bodies, as Arrows, Bullets, *&c.* have only a violent Motion; which cannot therefore be continued to so great a Distance, as some Occasions would require: But for so much Space as they do move, they are far swifter than the Natural Motion of any Animated Body. How these have been contrived to the speedy Conveyance of Secret Messages, hath been formerly discoursed, in the Fourth Chapter, which I now forbear to repeat. Inanimate Bodies.

Those Living Bodies that are most observable for their Speed and Celerity in Messages, are either Men, Beasts, Birds: Tho' I doubt not, but that Fishes also may be serviceable for this purpose, especially the Dolphin, which is reported to be of the greatest Swiftness, and most easily circurated, or made tame.

Amongst the Ancient Footmen, there are some upon Record for their incredible Swiftness. *Lædas* reported to be so quick in his Running, *Ut arenis indentibus & cavo pulvere, nulla indicia relinqueret vestigiorum*; that he left no Impression of his Footsteps on the Hollow Sands. And it is related of a Boy amongst the *Romans*, being but Eight Years old, that did run Five and forty Miles in an Afternoon. *Philistius* and *Philonides*, two Footmen unto *Alexander* the Great, are said to have run 1200 *Stadia* in a day. Which Relations will seem less incredible, if we consider the Ancient Exercises and Games of this kind, together with the publick Fame and Rewards to those that were most eminent. Men. *Solinus Polyhist. c. 6.* *Ibid.*

Amongst the Variety of Beasts, there are some more especial Note for their Strength and Swiftness. *Scaliger* mentions a Story, (tho' he distrusts the Truth of it) of a certain Beast called *Ellend*, Swiftness of Beasts. *Exer.* 205.

two

two of which being joined in a little Cart, are ſai to paſs Three hundred Leagues a day upon the Ice.

In former Ages, and in other Countries, th Dromedary, and Camel, and Mule, were of mor common Uſe; but in theſe Times and Places, th Horſe (for the moſt part) ſerves inſtead of then all; by the Help of which, we have our ſwifteſ Means of ordinary Conveyance. The Cuſtom o Riding Poſt, by renewing both Horſe and Man a ſet Stages, is of Ancient Invention. *Herodotus* re lates it to be uſed by *Xerxes* in the *Grecian* War; an that it was by the *Perſians* called Ἀγγαρήιον. Th Particulars that concern theſe kind of Conveyance amongſt the Ancients, are largely handled by *Her mannus Hugo*, *Lib.* 3. *de Origine ſcribendi*, *c.* 14.

Lib. 8. 98.

Pliny tells us of certain Mares in *Luſitania*, whic do conceive meerly by the *Weſt* Wind; that alon (without the Copulation of any Male) ſerving t actuate their Heat, and to generate their Youn Which are likewiſe mentioned by *Virgil*:

Nat. Hiſt. l. 8. *c.* 42.

Georg. 3.

Exceptantq; auras leves, & ſæpe ſine ullis
Conjugiis, vento gravidæ, &c.

Methinks theſe Children of the Wind ſhould, f their Fleetneſs, make excellent Poſt-Horſes, ar much conduce to the ſpeedy Conveyance of ar Meſſage.

The *Paracelſians* talk of Natural Means to extra the Mettle and Spirit out of one Horſe, and infu it into another; of enabling them to carry a Ma ſafely and ſwiftly through Enemies, Precipices, other dangerous Places. And ſuch Horſes (ſa they) were uſed by the Wiſe Men of the *Eaſt* our Saviour's Nativity; for they had not otherwi been able to have kept pace with a Star, or to ha paſſed ſo great a Journey as it was to *Jeruſalem* which is thought to be Five or Six hundred Miles the leaſt, from the Places of their Habitation. this Conceit were feaſible, it would much promo

he Speed of Conveyances; but I think it may juſt-
y be referred amongſt the other Dreams of the
Melancholick Chymicks.

Amongſt all Animate Bodies, there is not any
hat have naturally ſo ſwift a Motion as Birds;
vhich if a Man could well employ in the Diſpatch
f any Errand, there would be but little Fear that
ıch Meſſenger ſhould be either intercepted, or
orrupted. The Swiftneſs of Birds.

That this hath been attempted, and effected by
ıany of the Ancients, is affirmed by divers Relati-
ns. *Pliny* tells us of *Volaterranus*, that he diſcover'd
Conqueſt he had gotten unto the City of *Rome*,
y ſending out Swallows, which ſhould fly thither,
ing anointed over with the Colour of Victory.
nd of another, who ſending one of theſe Birds in-
a beſieged City, (whence ſhe was before taken
om her young ones) and tying a String unto her
ith certain Knots upon it, did thereby ſhew, after
hat Number of Days their Aids would come; at
hich time they ſhould make an Irruption upon the
nemy. *Nat. Hiſt. l.* 10. *c.* 24.

And elſewhere, in the ſame Book, he relates,
ow *Hircius* the Conſul, and *Brutus* who was be-
ged in *Mutina*, did this way maintain mutual In-
ligence, by tying their Letters unto ſuch Pigeons,
were taught beforehand to fly from the Tents to
e City, and from thence to the Tents again. *Cap.* 37.

How *Thauroſthenes* did by this means ſend the
ews of his Victory at *Olympia*, to his Father at
gina, is related by *Ælian*. *Hiſt. Animalium, l.* 6. *c.* 7.

Anacreon has an Ode upon ſuch a Pigeon, which
himſelf had often uſed as a Meſſenger, wherein
Bird is feigned to ſay,

Ἐγὼ δ' Ἀνακρείοντι
Διακονῶ ποσαῦτα
Καὶ νυῦ ὁρᾷς ἐκεῖνε
Ἐπιστολὰς κομίζω.

Unto

Sat. 4. juxta fin.

Unto this Invention also, *Juvenal* is thought t allude; where he says,

——— *Tanquam è diversis partibus orbis,*
Anxia præcipiti veniſſet Epiſtola pennâ.

Saturn. Serm. l. 2. c. 6.

Lypsius relates out of *Varro*, That it was usual fo the *Roman* Magistrates when they went unto th Theatre, or other such publick Meetings, whenc they could not return at pleasure, to carry such Pigeon with them; that if any unexpected Busine should happen, they might thereby give Warnin to their Friends or Families at home.

By which Relations you may see how common ly this Invention was practised amongst the Anci ents. Nor hath it been less used in these later Time especially in those Countries where by reason c continual Wars and Dissentions, there have bee more particular and urgent Necessity for such kin of Conveyances. *Nunc vulgatissima res est, colum bas habere, ad ejusmodi jussa paratas*, saith *Casaubo Harum opere, nostrates hoc bello civili, frequenter adju sunt*, saith *Godesc. Stewechius.*

Not. in Æneæ Poliorcet. c. 31. Comment. in Veget. l. 3. c. 5.

There are divers other Stories to this purpos but by these you may sufficiently discern the com mon Practices of this kind. As it is usual to bring u Birds of Prey, as Hawks, Cormorants, *&c.* to a Obedience of their Keepers; so likewise have som attempted it in these other Birds, teaching them th Art of carrying Messages. There is a smaller so of Pigeon, of a light Body, and swift Fligh which is usually made choice of for such partic lars; and therefore the kind of them is common called by the Name of Carriers.

See *Nunt. Inanimat.* concerning *Amiraldus. Porta de furt. lit. l. 2. c. 21.* concerning Marches. *Herm. Hugo de Orig. scribendi, c. 15. Thuanus Hist. l. 17.*

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CHAP. XVII.

Of Secret and Swift Informations by the Species of Sound.

HAving in the former Chapters treated severally concerning the divers Ways of Secresy and Swiftness in Discourse; it remains that I now enquire, (according to the Method proposed) how both these may be joined together in the Conveyance of any Message. The Resolution of which, so far as it concerns the Particulars already specify'd, were but needless to repeat.

That which does more immediately belong to the present *Quære*, and was the main Occasion of this Discourse, does refer to other Ways of Intimation, besides these in ordinary Use, of Speaking, or Writing, or Gestures. For in the general we must note, That *whatever is capable of a competent Difference, perceptible to any Sense, may be a sufficient Means thereby to express the Cogitations.* It is more convenient, indeed, that these Differences should be of as great Variety as the Letters of the Alphabet; but it is sufficient if they be but twofold, because two alone may, with somewhat more Labour and time, be well enough contrived to express all the rest. Thus any two Letters or Numbers, suppose A. B. being transposed through five Places, will yield thirty two Differences, and so consequently will superabundantly serve for the Four and twenty Letters, as was before more largely explained in the Ninth Chapter.

Now the Sensitive Species, whereby such Informations must be conveyed, are, either the Species of *Sound*, or the Species of *Sight*: The Ear and the Eye being the only Senses that are of quick Perception, when their Objects are remote.

Vege-

De re militar. l. 3. c. 5.

Vegetius distinguisheth all significatory Signs into these Three Sorts.

1. *Vocalia.* By articulate Sounds.
2. *Semivocalia.* By inarticulate Sounds.
3. *Muta.* By the Species of Sight.

The two last of these are chiefly pertinent to the present Enquiry. Concerning which, in the General it may be concluded, that any Sound, whether of Trumpets, Bells, Cannons, Drums, *&c.* or any Object of Sight, whether Flame, Smoak, *&c.* which is capable of a double Difference, may be a sufficient Means whereby to communicate the Thoughts.

The particular Application of these, to some Experiments, I shall treat more distinctly in the Remainder of this Discourse.

Secret and speedy Information by the Species of Sound.

First, Concerning the Secresy and Swiftness of any Message by the Species of Sound. Though their audible Species be much slower than those of Sight, yet are they far swifter than the natural Motion of any corporeal Messenger. The chief Use of them is for such as are within some competent Nearness as perhaps a Mile off. But they may also by frequent Multiplication be continued to a far greater Distance.

Proœm. in lib. Plutar. de defectu oraculorum.

There is a Relation in *Joach. Camerarius*, of some that have heard their Friends speaking to them distinctly, when they have been many Miles asunder. *Habui notos homines, neque leves, & non indoctos, qui affirmabant, se audiisse secum colloquentes diserte, eos quos tum multorum millium passuum abesse certe scirent.* But this he justly refers to Diabolical Magick, and the Illusion of Spirits.

De rerum Inventor. lib. 2.

There are other *natural* Experiments in this kind of more especial Note for their Antiquity. Such was that of King *Xerxes*, related by *Cleomenes*, as is cited by *Sardus*. Cleomenes *in libro de circulis cœlestibus scribit* Xerxem *toto itinere à* Perside *in* Græciam *stationes statuisse, & in iis homines ita prope, ut vocem*

te-

erius alter exaudiret; quo modo quadraginta horarum ſpa-tio, ex Græciâ *in* Perſidem *res nunciari poterat.* But his Invention, beſides the great Trouble and Uncer-tainty of it, is alſo too groſs for Imitation, ſavour-ng ſomewhat of the Rudeneſs of thoſe former and nore barbarous Ages.

Much beyond it was that Experiment of the *Ro-nans*, in the Contrivance of the *Picts* Wall, related by our Learned *Cambden*; this Wall was built by *Se-verus* in the *North* Part of *England*, above a hundred Miles long. The Towers of it were about a Mile diſtant from one another. Betwixt each of theſe Towers there paſſed certain hollow Pipes or Trunks n the Curtains of the Wall, through which the Defen-ants could preſently inform one another of any thing hat was neceſſary, as concerning that Place where-n the Enemy was moſt likely to aſſault them, *&c.*

Britan. de Vallo ſive the *Picts Wall. p.* 654. *Boter. Geog. l.* 2. *&* 4. where he mentions alſo another Wall of 8000 Furlongs in *China.*

Since the Wall is ruined, and this Means of ſwift dvertiſement taken away, there are many Inhabi-nts thereabouts, which hold their Land by a Te-ure in *Cornage* (as the Lawyers ſpeak) being bound y blowing of a Horn to diſcover the Irruption of the nemy.

There is another Experiment to this Purpoſe men-oned by *Walchius*, who thinks it poſſible ſo to con-ive a Trunk or hollow Pipe, that it ſhall preſerve e Voice entirely for certain Hours or Days, ſo that a an may ſend his Words to a Friend inſtead of his Wri-ng. There being always a certain Space of Intermiſſi-n, for the Paſſage of the Voice, betwixt its going into eſe Cavities, and its coming out; he conceives at if both ends were ſeaſonably ſtopped, whilſt e Sound was in the midſt, it would continue there l it had ſome vent. *Huic tubo verba noſtra inſuſur-mus, & cum probe munitur tabellario committamus,* &c. hen the Friend to whom it is ſent, ſhall receive and en it, the Words ſhall come out diſtinctly, and in e ſame Order wherein they were ſpoken. From

Fabul. 9.

ſuch a Contrivance as this, (ſaith the ſame Author) did *Albertus Magnus* make his Image, and Friar *Bacon* his Brazen Head, to utter certain Words. Which Conceit (if it have any Truth) may ſerve ſomewhat to extenuate the groſs Abſurdity of that *Popiſh* Relick, concerning *Joſeph*'s [Hah] or the Noiſe that he made (as other Carpenters uſe) in fetching of a Blow; which is ſaid to be preſerved yet in a Glaſs amongſt other Ancient Relicks.

But againſt theſe Fancies it is conſiderable, that the Species of Sound are multiplied in the Air, by a kind of Continuation and Efflux from their firſt Original, as the Species of Light are from any luminous Body; either of which being once ſeparated from their Cauſes, do preſently vaniſh and die. Now as it would be a mad thing for a Man to endeavour to catch the Sun-beams, or encloſe the Light; upon the ſame Grounds likewiſe muſt it needs be abſurd, for any one to attempt the ſhutting in of articulate Sounds: Since both of them have equally the ſame intrinſical and inſeparable Dependance upon their efficient Cauſes.

True, indeed, the Species of Sound may ſeem to have ſome kind of Self-continuance in the Air, as in Ecchoes; but ſo likewiſe is it in Proportion with thoſe of Sight, as in the quick turning round of a Fire-ſtick, which will make the Appearance of a fiery Circle: And tho' the firſt kind of theſe be more laſting than the other, by reaſon their natural Motion is not ſo quick, yet neither of them are of ſuch Duration as may be ſufficient for the preſent Enquiry.

None of all theſe Inventions already ſpecified, do ſufficiently perform the Buſineſs that is here enquired after; nor are they either ſo generally or ſafely appliable for all Places and Exigencies.

The Diſcovery that is here promiſed, may be further ſerviceable for ſuch Caſes as theſe.

Suppoſe a Friend were perfidiouſly clapped up in ſom

ome close Dungeon, and that we did not know ex-
ctly where, but could only guess at the Place, with-
n the Latitude of half a Mile or somewhat more; a
Man might very distinctly by these other Inventions,
iscourse unto him. Or suppose a City were straitly
Besieged, and there were either within it or without
, such a Confederate, with whom we should neces-
arily confer about some Design; we may by these
Means safely discover to him our Intentions. By
which you may guess that the Messenger which is
ere employed, is of so strang a Nature, as not to
e barred out with Walls, or deterred by Enemies.

To the Performance of this, it is requisite that
here be two Bells of different Notes, or some such
ther audible and loud Sounds, which we may com-
and at Pleasure, as Muskets, Cannons, Horns,
rums, *&c.* By the various Sounding of these (ac-
ording to the former Table) a Man may easily ex-
ress any Letter, and so consequently any Sense.

These Tables I shall again repeat in this Place: *Cap. 9.*
hat of two Letters may be contrived thus:

A.	B.	C.	D.	E.	F.	G.
aaa.	aaaab.	aaaba.	aaabb.	aabaa.	aabab.	aabba.

H.	I.	K.	L.	M.	N.	O.
bbb.	abaaa.	abaab.	ababa.	ababb.	abbaa.	abbab.

P.	Q.	R.	S.	T.	V.	W.
bba.	abbbb.	baaaa.	baaab.	baaba.	baabb.	babaa.

X.	Y.	Z.
bab.	babba.	babbb.

Suppose the Word *Victuals* were this Way to be ex-
ist; let the bigger Sound be represented by A, and
the lesser by B, according to which, the Word may
thus made up by five of these Sounds for each Let-

V. I. C. T. U. A. L.
baabb. abaaa. aaaba. baaba. baabb. aaaaa. ababa.
S.
baaab.

That is, the leſſer Note ſounded once, and the the bigger twice, and then again the leſſer twice as (baabb) will ſignifie the Letter (V.) So the big ger once, and then the leſſer once, and after tha the bigger thrice together, as (abaaa) will repre ſent the Letter (I.) and ſo of the reſt.

If the Sounds be capable of a triple Differenc then each Letter may be expreſſed by a threefol Sound, as may appear by this other Alphabet.

A. B. C. D. E. F. G. H. I. K. L.
aaa. aab. aac. baa. bab. bba. bbb. bbc. caa. cba. cbb.

M. N. O. P. Q. R. S. T. V. W. X.
cbc. cca. ccb. ccc. aba. abb. abc. aca. acb. acc. bca.

Y. Z.
bcb. bcc.

V. I. C. T. U. A. L. S.
acb. caa. aac. aca. acb. aaa. cbb. abc.

If theſe Sounds do contain a quintuple differenc then may every Letter be ſignified by two Soun only, (which will much conduce to the Speed an Diſpatch of ſuch a Meſſage.) As you may ſee i this other Table.

A. B. C. D. E. F. G. H. I. K. L. M. N. O. P
aa. ab. ac. ad. ae. ba. bb. bc. bd. be. ca. cb. cc. cd. ce

Q. R. S. T. V. W. X. Y. Z.
da. db. dc. dd. de. ea. eb. ec. ed.

VIC

V. I. C. T. U. A. L. S.
de. bd. ac. dd. de. aa. ca. dc.

'Tis related by *Porta*, that when the Citizens in he Siege of *Navarre* were reduced to such great Extremities that they were ready to yield, they did discover to their Friends the Greatness and Kind of heir Wants, by discharging divers Cannons and Ordances in the Night-time, according to a certain Order before agreed upon; and by this Means did btain such fitting Supplies as preserved the City. *De furt. lit. l. 1. c. 6.*

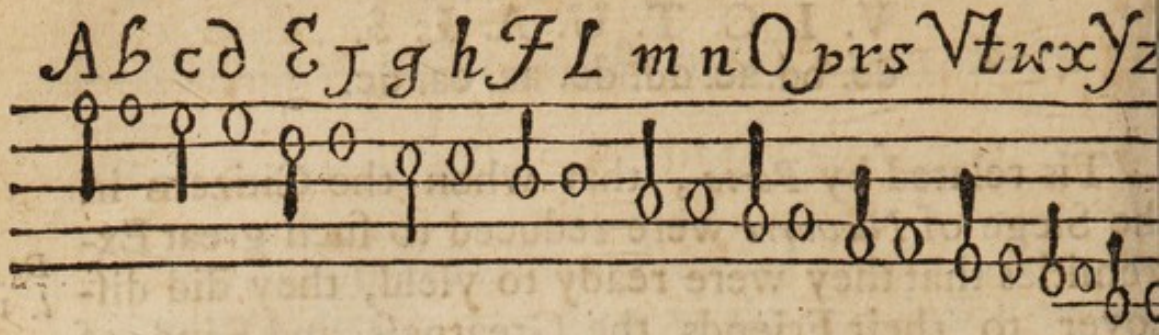
CHAP. XVIII.

oncerning a Language that may consist only of Tunes and Musical Notes, without any articulate Sound.

F the Musical Instrument that is used to this Purpose, be able to express the Ordinary Notes, not ly according to their different *Tones*, but their *nes* also, then may each Letter of the Alphabet be ndred by a single Sound.

Whence it will follow, that a Man may frame a nguage, consisting only of Tunes and such inarulate Sounds, as no Letters can express. Which d of Speech is fancied to be usual amongst the Luy Inhabitants, who (as * *Domingo Gonsales* hath covered) have contrived the Letters of the habet upon the Notes after some such Order as s.

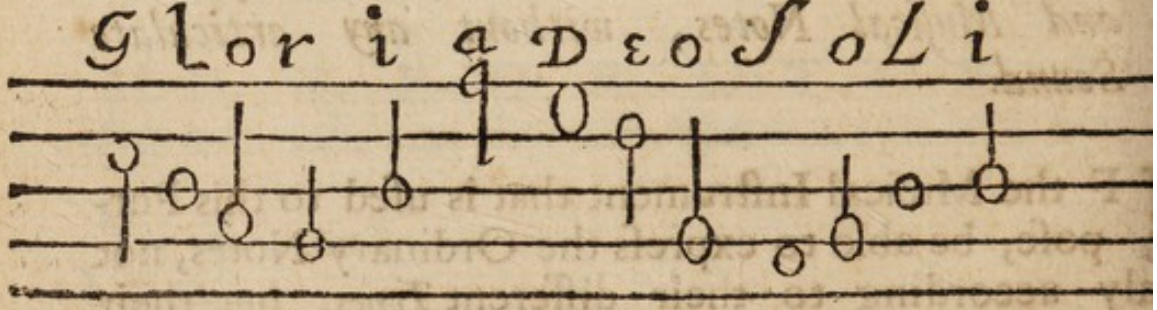
* Or the Man in the Moon, written by the same Author of *Nuntius Inanimat.*



Where the 5 Vowels are represented by the Minnum on each of the five Lines, being most of them placed according to their right Order and Consequence only the Letters K. and Q. are left out, because they may be otherwise expressed.

See *Dom. Gonsal* 94.

According to this Alphabet of Notes, these Words *Gloria Deo soli*, must be thus contrived.



By this you may easily discern how two Musicians may discourse with one another, by playing upon their Instruments of *Musick*, as well as by talking with their Instruments of *Speech*. And (which is a singular Curiosity) how the Words of a Song may be contrived in the Tune of it.

I suppose that these Letters and Notes might be disposed to answer one another, with better Advantage than here they are expressed. And this perhaps would be easie enough for those that are thoroughly versed in the Grounds of Musick, unto whose further Enquiry I do here only propose this Invention.

But now if these inarticulate Sounds be contrived

fo

for the Expression, not of Words and Letters, but of Things and Notions, (as was before explained, concerning the Universal Character) then might there be such a General Language, as should be equally speakable by all People and Nations; and so we might be restored from the second General Curse, which is yet manifested, not only in the Confusion of Writing, but also of Speech.

The Utterance of these Musical Tunes may serve for the Universal *Language*, and the Writing of them for the Universal *Character*. As all Nations do agree in the same Conceit of Things, so likewise in the same Conceit of Harmonies.

This Curiosity (for ought I know) has not yet been mentioned by any Author, but it may be (if well considered) of such excellent Use, as to deserve a more full and particular Enlargement in a Treatise by it self.

CHAP. XIX.

Of those common Relations that concern Secret and Swift Informations by the Species of Sight; which are either Fabulous, *or* Magical.

THE usual Relations that concern Secret and Swift Conveyances by the Species of Sight, may be distinguished into such as are, either

1. *Fabulous.*
2. *Magical.*
3. *Natural and true.*

1. Of those fabulous Relations to this purpose.

First, Of those that are *Fabulous.* In which kind, that of the Loadstone is most remarkable, as it is maintained by * *Famianus Strada*, in his Imitation of *Lucretius*'s Stile, and divers others. The Manner that is usually prescribed for the Performance of it,

* *Lib.* 2. *Prol.* 6.

is thus: Let there be two Needles provided, of an equal Length and Bigneſs, being both of them touched with the ſame Loadſtone: Let the Letters of the Alphabet be placed in the Circles on which they are moved, as the Points of the Compaſs under the Needle of the Mariner's Chart. Let the Friend that is to travel take one of them with him, firſt agreeing upon the Days and Hours wherein they ſhould confer together: At which times, if one of them move the Needle of his Inſtrument to any Letter of the Alphabet, the other Needle, by a Sympathy, will move unto the ſame Letter in the other Inſtrument, though they be never ſo far diſtant: And thus by ſeveral Motions of the Needle to the Letters, they may eaſily make up any Words or Senſe which they have a mind to expreſs.

O utinam hæc ratio ſcribendi prodeat uſu;
Cautior & citior properaret Epiſtola, nullas
Latronum verita inſidias, fluvioſque morantes,
Ipſe ſuis princeps manibus ſibi conficeret rem, &c.

Saith *Strada*. But this Invention is altogether imaginary, having no Foundation in any real Experiment. You may ſee it frequently confuted in thoſe that treat concerning Magnetical Virtues. *Non ſolum exhibilandi ſunt, ſed etiam male mulctandi Philoſophicâ ferulâ, fabularum iſti procuſores, qui ſuis portentis deterrent homines à præclariſſimo cauſarum ſtudio* ſaith *Cabæus* to this purpoſe.

Philoſoph. Magnet. l. 4. c. 10.

The firſt Occaſion of theſe Relations, was, the Proof of that ſtrange immaterial Power of the Loadſtone, whereby it did work through thick and ſolid Bodies, as a Table, or Wall, or the like; as alſo of that directive Virtue, whereby it always tends to the Poles; from whence others have conjectured, that it might be ſerviceable alſo for ſuch a Buſineſs at ſo great a Diſtance.

But againſt this, it is conſiderable,

1. That

1. That every Natural Agent is ſuppoſed to have ſome certain Sphere, which determines its Activity.

2. That Magnetical Operations do not ariſe (as ſome fondly conceive) from a Sympathetical Conformation of Natures, which is the ſame at all diſtances; but from ſuch a Diffuſion of theſe Magnetical Qualities through the *Medium*, that they may be continued from the Agent to the Patient. And ſo theſe Natural Powers will not be of ſo great an Extent, as they are ſuppoſed in this Experiment.

The utmoſt Diſtance, at which we may diſcourſe with another by theſe Magnetical Virtues, is, two or three Foot, or thereabouts; and this we may do, tho' it be through a Wall of that Thickneſs. *Fieri enim poſſe me docuit experientia, ut ope Magnetis, & inſtrumenti ad id aptati, amicus cum amico, in cubiculo proximo, trans craſſum murum (puta bipetalem) colloquatur, animi ſui ſententiam impertiat, & ad quæſita reſpondeat*; ſaith a late Author. But in this Experiment, it is not only the ſecondary Virtue of the Needles that can be thus effectual, (as is ſuppoſed in the former Invention) but there muſt be the Help alſo of the Loadſtone it ſelf.

S. Ward Magnetis Reduct. c. 40. See Cabæus Phil. Magn. l. 4. c. 11.

As for the Reaſon why theſe Magnetical Powers are able to work through Solid Bodies; 'tis conſiderable, that any Quality may be diffuſed through ſuch a Subſtance, as hath no Natural Repugnancy into it. We ſee, the Light does paſs as well through hot Bodies as cold, through ſolid as fluid, *&c.* only Opacity keeps it out, becauſe that Quality alone is contrary to its Nature. So likewiſe is it with Magnetical Virtues, which do equally ſpread themſelves through all kind of Bodies, whether *rare* or *denſe*, *diaphanous* or *opacous*; there being no Quality contrary to this, becauſe it is that General Endowment of the whole Globe, that Univerſal Quality to which all other Particulars are naturally ſubſervient.

The

2. Magical.

The ſecond Sort of Relations to this purpoſe are ſuch as refer to *Diabolical Magick*; of which kind is that Invention thought to be, which is commonly aſcribed to *Pythagoras*; of whom it is reported, that he could write any thing in the Body of the Moon, ſo as it might be legible to another at a great Diſtance. *Agrippa* affirms this to be naturally poſſible, and the way of performing it not unknown to himſelf, with ſome others in his time. And *Fredericus Riſner* ſeems to believe it; for ſpeaking of the ſtrange Experiments to be wrought by ſome Glaſſes, he adds, *Denique certo artificio, depicta imagines, aut ſcriptas literas, nocte ſerena, plenæ lunæ ſi opponi poſſunt, ut radiis lunam irradiantibus, ideoque re flexis, videas & legas, quæ Conſtantinopoli Lutetiam tib nuncientur.*

Occult. Philoſoph. l. 1. c. 6.

Optic. l. 3. prop. 36. Speculorum perſuaſio hoc pervaſit, &c.

There is an Experiment in Opticks, to repreſen any Writing by the Sun-beams, upon a Wall, o Front of a Houſe: For which purpoſe, the Letter muſt be firſt deſcribed with Wax, or ſome othe opacous Colour, upon the Surface of the Glaſs, i an inverted Form; which Glaſs afterwards reflect ing the Light upon any Wall in the Shade, will diſ cover theſe Letters in the right Form and Orde Unto ſome ſuch Invention I did firſt (before I ha well conſider'd theſe particulars) attribute the Per formance of thoſe ſtrange Promiſes in *Nuncius Ina nimatus*; but upon better Thoughts it will b found, that the Species of Reflection in this Expe riment are ſo weak, that unleſs the Glaſs and th Letters be very big, and the Wall ſomewhat near there will be no diſtinct Appearance of the Writing And therefore this way there can be no Thought of contriving any reflected Species, that ſhall b viſible at ſo great a Diſtance as the Moon. Nor i there any other Natural Means conceivable, b which ſo ſtrange an Effect may be performed; whic is the Reaſon that it is ſo frequently attributed t

World in the Moon, *c. 7.*

Diabo

Diabolical Magick, by almost all the Writers that have occasion to treat of it.

But *Agrippa* in another place speaking concerning this Invention, affirms that it was performed thus: *Pythagoras* did first describe with Blood any Letters which he thought fit, in some great Glass, and then opposing the Glass against the Full Moon, the Letters would appear thorough it, as if they were writ in the circumference of her Body. *Quæ collibuisset sanguine perscripsit in speculo, quo, ad pleni luminis lunæ orbem obverso, stanti à tergo, res exaratas in disco lunæ commonstravit.* In which Passage he seems to intimate, that this Writing in the Moon could not be visible at any great distance (as it is related in common Tradition), but that it did appear to such only, betwixt whose Eyes and the Moon this Glass might be interposed. And according to this, the Wonder of the Relation ceases, nor may it truly be referred to Diabolical Magick. *Agrippa de Vanit. Scient. c. 48.*

More properly reducible to this kind, are those inchanted Glasses mentioned in divers Authors: In which some Magicians are said to contain such familiar Spirits, as do inform them of any Business they shall enquire after. I have heard a great Pretender to the knowledge of all secret Arts, confidently affirm, that he himself was able at that time, or any other, to shew me in a Glass what was done in any part of the World; what Ships were sailing in the *Mediterranean*; who were walking in any Street of any City in *Spain*, or the like. And this he did aver with all the labour'd Expressions of a strong Confidence. The Man, for his Condition, was an *Italian* Doctor of Physick; for his Parts, he was known to be of extraordinary Skill in the abstruser Arts, but not altogether free from the Suspicion of this unlawful Magick. *Joach. Camerar. Proœm. in lib. Plut. de defect. Orac.*

CHAP.

CHAP. XX.

Of Informations by significatory Fires and Smoaks. Their Antiquity. The true manner of using them to this purpose. That these were meant in Nuntius inanimatus.

THE Experiments of this kind that are true, and upon Natural Grounds, have been made either by Fire in the Night, or Smoak and such other Signs visible at a distance in the Day-time.

These Informations by significatory Fires, have been of Ancient Use. The first Invention of them is commonly ascribed to *Sinon* in the *Trojan* Wars. *Specularem significationem Trojano Bello Sinon invenit*, (saith *Pliny*.) This was the Sign upon which he agreed to unlock the Wooden Horse.

Nat. Hist. l. 7. c. 56.

Virgil.

——— *Flammas cum regia puppis*
Extulerat. ———

But *Diodorus Siculus* affirms them to be practised by *Medea* in her Conspiracy with *Jason*. And they are frequently mentioned in other Ancient Historians. * *Herodotus* speaks of them in the *Grecian* War against *Xerxes*: And † *Thucydides* testifies of them in the Onsets that were made by the *Peloponnesians* against *Salamis*, and in the Siege of *Corcyra*. *Appian* speaking of *Scipio* at *Numantia*, how he divided his Camp into divers Companies, says, That he assigned each of them to several Tribunes, with this Charge, *Si impeterentur ab hoste, de die*, * *panno rubro in hasta sublato significarent*; *de nocte*, *igne*. If the Enemy did charge any of them, they should signify it to the others, in the Day-time by holding up a Red Cloth, in the Night by Fires. ‡ *Vegetius* affirms it to be usual, when the Army was divided, to inform one another, in the Day by Smoak, in the Night by

Biblioth. l. 4.

* *Polymn. l. 7. c. 182.*
† *Hist. l. 2. Item, l. 3.* So *Curtius* of *Alex. M. l. 5.*
* To this purpose the Flags of Truce or Defiance.
‡ *De re mil. l. 3. c. 5. Lipsius de milit. Rom. lib. 5. Dialog. 9.*

by Fires. These significatory Fires were by the *Grecians* called Φρύκτοι (saith *Suidas*) and sometimes Πυρσεια. The Use of them was chiefly for the Answer of some particular *Quære*, that was before agreed upon; as concerning the coming of Aids or Enemies; if the Enemies were coming, they were wont to shake these Torches, if the Aids, they held them still, (saith the *Scholiast* upon *Thucydides.*)

Æneas Poliorc. c.31.

Schol. in l.2.Thucyd.

But they have by more exact Inventions been enlarged to a greater Latitude of Signification: So that now, any thing which we have Occasion to discover, may be expressed by them.

Wecker de Secretis, l. 14. c. 1. Port. de furt. lit. l. 1. c. 10. Cardan. de Variet. Rerum, l. 12. c. 61.

The Ways by which they may be contrived to this purpose, are divers; I shall specify only the chief of them.

That which in ancient Times was used by the *Grecians*, and is particularly treated of in * *Polybius*, adviseth thus:

*Hist. l. 10. juxta fin.

Let the Letters be divided into Five Tablets or Columns.

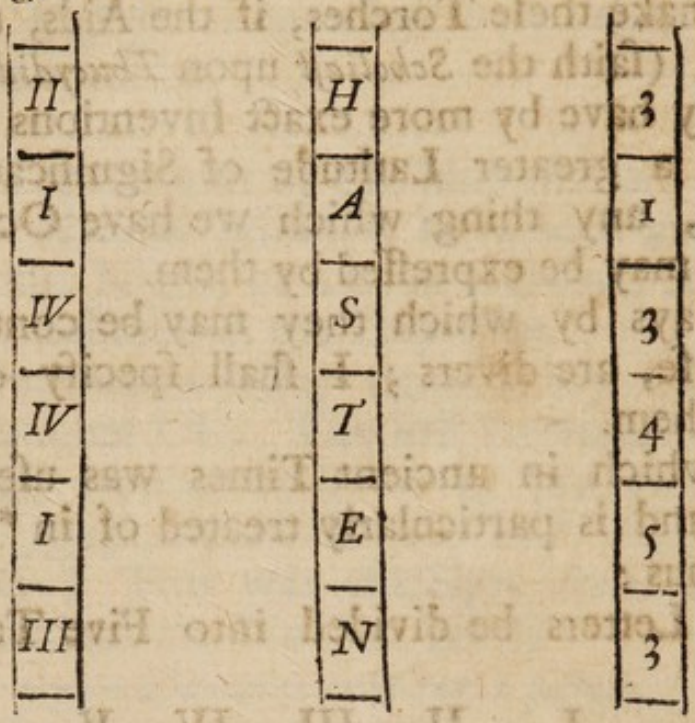
By Ten Torches.

	I	II	III	IV	V
1	a	f	l	q	w
2	b	g	m	r	x
3	c	h	n	s	y
4	d	i	o	t	z
5	e	k	p	u	

Let there be provided Ten Torches, Five being placed on the Right Hand, and Five on the Left: Let so many Torches be lifted up on the Right Hand, as may shew the number of the Table; and so many on the Left, as may shew the number of that Letter

Letter in it which you would expreſs: As in this following Example, wherein the ſeveral Numbers, both at the Right and Left Hand, do ſignify the word HASTEN.

The Right Hand. The Left Hand.



That is, Two Lights being lifted up on the Right Hand, ſhew the ſecond Column; and at the ſame time Three Torches appearing on the Left Hand, denotes the Third Letter in that Column, which is *H.* Thus a ſingle Torch being diſcovered on both ſides, doth ſignify the firſt Letter of the firſt Column, which is *A*; and ſo of the reſt.

By three Torches. *Lib. de Experiment.*

There is another way mentioned by *Joachimus Fortius*, unto the performance of which there are only Three Lights required: One Torch being ſhewed alone, ſhall ſignify the Eight firſt Letters, *A. B. C. D. E. F. G. H.* Two together, the Eight next, *I. K. L. M. N. O. P. Q.* And all Three the reſt, *R. S. T. V. W. X. Y. Z.*

One Light being diſcovered once, ſignifies *A*; if twice, *B*: Two Lights being ſhewed once, do denote the Letter *I*; if twice, *K*, &c.

According

According to this way, if I would expreſs the ord FAMIN, the Torches muſt be contri- ed; one Light muſt be lifted up ſix times for the etter *F*; one Light once for *A*; two Lights four imes for *M*; two Lights once for *I*; two Lights ve times for *N*.

But here it will be requiſite that there be ſome in- rmiſſion betwixt the expreſſion of ſeveral Letters, ecauſe otherwiſe there muſt needs be a great con- ıſion amongſt thoſe that belong to the ſame number f Torches. In which reſpect, this way is much ıore tedious and inconvenient than the former In- ention out of *Polybius*.

It is eaſie to conceive, how by the Alphabet con- ſting of two Letters tranſpoſed through five Pla- es, ſuch a Manner of Diſcourſing may be other- iſe contrived, only by two Torches. But then ere muſt be five Shews, to expreſs every Letter. By two Torches.

There is another way of Speaking, by the Diffe- nces of Motion in two Lights; which for its Quickneſs and Speed, is much to be preferred before ny of the reſt; the manner of it is thus: Provide vo Torches on long Poles: Let them be placed ſo r from one another, that they may ſeem unto your onfederate to be about four Cubits diſtance. By e divers Elevations or Depreſſions of theſe, in- ining of them to the Right Hand, or to the Left, verally or both together, it is eaſie to expreſs all e Alphabet.

One Light alone being diſcovered, muſt ſtand for ; lifted up, for *E*; depreſſed, for *I*; inclined to e Right Hand, for *O*; unto the Left Hand, for

Two Lights elevated, for *B*; depreſſed, for *C*; clined to the Right Hand, for *D*; to the Left and, for *F*.

Two Lights being ſtill diſcovered, and the Torch the Right Hand being lifted up, ſhall ſignifie *G*; being

being depreſſed, *H*; inclined to the Right Hand, *K*; to the Left Hand, *L*.

The Torch at the Left Hand, being elevated ſhall ſtand for *M*; depreſſed, for *N*; inclined to the Right Hand, for *P*; to the Left Hand, for *Q*.

The Torch at the Right Hand being moved towards the Left Hand, and that at the Left Hand being at the ſame time moved towards the Right Hand, ſhall ſignifie *R*: The Right Hand Torch being inclined to the Left Hand, and the other at the ſame time being elevated, ſignifies *S*; being depreſſed, *T*: The Left Hand Torch being inclined to the Right Hand, and the other at the ſame time being elevated ſignifies *W*; being depreſſed, *X*.

The Right Hand Torch being inclined to the Right Hand, and the other at the ſame time being elevated, may ſtand for *Y*; being depreſſed, for *Z*.

When any thing is thus to be expreſſed, the two Torches being diſcovered, muſt remain without any Motion, ſo long, till the Confederate ſhall by other Lights ſhew ſome Sign, that he is ready to take notice. After every one of theſe particular Motions the Torches muſt be carefully hidden and obſcured that ſo the ſeveral Letters expreſſed by them, may be the better diſtinguiſhed.

The day-time Informations by Smoak, cannot ſo conveniently be ordered according to this latter Contrivance, and therefore muſt be managed by ſome of thoſe other Ways that were ſpecified before: To which purpoſe there muſt be ſome Tunnels provided for the orderly incloſing and conveying up the Smoak. The other particulars concerning this, are in themſelves eaſie enough to be apprehended.

How theſe ſignificatory Signs will be viſible at great Diſtance. How by Multiplication of them in ſeveral Places, they may be contrived for many Scores of Miles, will eaſily be diſcerned from the Situation and Uſe of Beacons, by which the Intima-

tic

See *Barcla. Argen. l.* 1.

ons of Publick Danger and Preparations, have been ftentimes ſuddenly ſpread over this whole Iſland.

This may further be advantaged by the Uſe of *alilæus* his Perſpective.

'Tis ſtoried of the Inhabitants in *China*, that when ny Merchants do happen upon the Shores of that ingdom, they are preſently examined, whence ey come, what Commodities they bring, and of hat Number they are: Which being known, the atch (ſet for that purpoſe) do preſently inform the ing of their Anſwers, by Smoak in the Day, and ires in the Night: Who by the ſame Means does as eedily return them his Pleaſure, whether they all be admitted or kept out: And ſo that is eaſily ſpatched in ſome few Hours, which could not be erformed the ordinary Way, without the Trouble many Days. *Busbequius Epiſt. Tur. ep.* 4.

The Practice of all theſe ſecret and ſwift Meſſaes, may perhaps ſeem very difficult at the firſt; but does alſo the Art of Writing and Reading to an nlettered Man: Cuſtom and Experience will make e one as facile and ready as the other. *Polyb. l.* 10.

That theſe ways of Information already explain-, whether by the Species of *Sound* or *Sight*, are e ſame with thoſe intimated in *Nuntius Inanimatus*; ay be clearly evident to any one who does but thoughly peruſe that Diſcourſe, and compare it with vers other the like Paſſages of the ſame Author, his *Domingo Gonſales*.

1. For the Species of Sound, his Words are theſe, *uribus nihil percipi niſi perſonum, neminem fugit. Erit itur neceſſe ut is, cui aliquid auditu mediante nunciatum erit, ſonos audiat, eoſque diſtinguibiles pro numero audidorum; quæ cum ſint infinita, infinita, etiam ſit opor-, ſonorum edendorum varietas. Satis tamen erit ut ſtinguantur vel genere, vel tempore, modo etiam & nuero.* Which Paſſage, together with that other Inntion in *Domingo Gonſales*, concerning the Lan- *Nunc. Inan. p.* 162.

guage of the Lunary Inhabitants, before explained in the eighteenth Chapter; I say, both these, being compared with the Discoveries and Experiments of the same kind that are here discoursed of, may plainly manifest, that they are both performed by the same Means.

2. For the Species of Sight, his words are these, *Si oculis amici absentis aliquid cupis repræsentare, idque citius quam corpus aliquod sublunare ad locum tam longo intervallo disjunctum possit perferri; oportet ut ideæ, sive formæ visibiles, augeantur, quantitate, multiplicentur numero, & pro rerum significandarum varietate varientur, vel qualitate, vel quantitate, vel situ, vel ordine.* Which Passage being compared with that other way of Compact, betwixt *Gonsales* and his Man *Diego*, mentioned in the other Discourse; it may evidently appear, that the Ways of Intimation which were there meant, are performed after the same Manner according to which they are here discoursed of.

Nunc. Inani. p. 16.

Man in the Moon, *p.* 21.

He does indeed mention out of *Busbequius*, the Practice of those Informations amongst the Inhabitants of *China*, and thinks that they were used too by the *Romans*; but withal he wonders how that now amongst us, they should be altogether forgotten; and the restoring of them to these Places and Times, seems to be his chief Aim, in the Promise of that Discourse.

The particular Example which he mentions, is this: Suppose that one at *London* would send a Message to *Bristol*, *Wells*, *Exeter*, or though it were any remoter Place: *Neq; enim longinquitatem viæ multum moror, si detur facultas sternendi, & permeabilem efficiendi.* That is, the Greatness of Distance can be no Impediment, if the Space betwixt be fitted with such high Mountains, and Beacon Hills, as may serve for these kind of Discoveries. Suppose (I say) this Messenger should set forth from *London*, in the very point of Noon, he would notwithstanding ar-

rive at *Bristol* before Twelve of the Clock that Day: That is, a Message may by these means be conveyed so great a distance, in fewer Minutes than those which make the Differecce betwixt the two Meridians of those Places.

If according to this, we should interpret that Passage out of *Trithemius*, concerning the three *Saturnine* Angels, that in Twenty four Hours can convey News from any part of the World; that Author might then in one respect, be freed from the Aspersion of Diabolical Magick, which for this very Reason hath heretofore been imputed to him. But this by the Way. See before Cap. 15.

It may be, the Resolution of those great Promises in *Nuncius Inanimatus*, to such easie Causes as they are here ascribed unto, will not be answerable to Men's Expectation; every one will be apt to mistrust some greater matter than is here expresst: But 'tis thus also in every other the like Particular; for Ignorance is the Mother of Wonder, and Wonder does usually create unto it self many wild Imaginations; which is the Reason why Men's Fancies are so prone to attribute all unusual and unknown Events, unto stranger Causes than either Nature or Art hath designed for them.

CONCLUSION.

THE Poets have feigned *Mercury* to be the chief Patron of Thieves and Treachery, *Horat. l. 1. Od. 10. Ovid. Metam. l. 11. Homer. in Hymnis. Nat. Comes Mytholog. l. 5. c. 5.*

Ἀρχὸς φηλητῶν.

To which purpose they relate that he filched from *Venus* her Girdle, as She embraced him in Congratulation of a Victory; that he robbed *Jupiter* of his Scepter, and would have stoln his Thunderbolt too,

but that he feared to burn his Fingers. And the Astrologers observe, that those who are born under this Planet, are naturally addicted to Theft and Cheating.

If it be feared that this Discourse may unhappily advantage others in such unlawful Courses; 'tis considerable, that it does not only teach how to deceive, but consequently also how to discover Delusions. And then besides, the chief Experiments are of such Nature, that they cannot be frequently practised, without just Cause of Suspicion, when as it is in the Magistrates Power to prevent them. However, it will not follow, that every thing must be suppress which may be abused. There is nothing hath more occasioned Troubles and Contention, than the Art of Writing, which is the Reason why the Inventor of it is fabled to have sown Serpents Teeth: And yet it was but a barbarous Act of *Thamus*, the *Egyptian* King, therefore to forbid the Learning of Letters: We may as well cut out our Tongues, because that Member is *a world of wickedness*. If all those useful Inventions that are liable to abuse, should therefore be concealed, there is not any Art or Science which might be lawfully profest.

Cali. Rho. antiq. Lect. l. 22. c. 15.

James 3.

FINIS.

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JOHN WILKINS, late Lord
Bishop of CHESTER.

LONDON:

To His Highneſs the

Prince Elector PALATINE.

May it pleaſe Your Highneſs,

I *Should not thus have preſented my* Diverſions *where I owe my Study and* Buſineſs, *but that where All is due, a Man may not juſtly withhold any Part.*

This following Diſcourſe was compoſed ſome Years ſince, at my ſpare Hours in the Univerſity. The Subject of it is mixed Mathematicks; *which I did the rather at ſuch Times make choice of, as being for the* Pleaſure *of it more proper for Recreation, and for the* Facility, *more ſuitable to my Abilities and Leiſure.*

I ſhould not, Sir, have been ambitious of any ſo Great (*I could not of any* Better) *Patronage, had not my Relation both engaged and emboldened me to this Dedication.*

They that know Your Highneſs, how great an Encourager You are, and how able a Judge in all Kind of Ingenious Arts and Literature, muſt needs acknowledge Your Preſſures and Low Condition to be none of the leaſt Miſchiefs (amongſt thoſe many other) under which the Commonwealth of Learning does now ſuffer.

It would in many Reſpects much conduce to the general Advancement of Religion and Learning, if the Reformed Churches, in whoſe Cauſe and Defence Your Family hath ſo deeply ſuffer'd, were but effectually mindful of their Engagements to it. And particularly, if theſe preſent Unhappy Differences of this Nation, did not occaſion too much Forgetfulneſs of their former Zeal and Profeſſions for the Vindicating *of Your Family, and the* Reſtoring *of Your Highneſs: The Haſtening and Accompliſhment of which, together with the Increaſe of all Heavenly Bleſſings upon Your Highneſs, ſhall be the hearty daily Prayer of,*

Your Highneſs's
moſt Humble and moſt Devoted
Servant and Chaplain,
John Wilkins.

To the Reader.

IT is related of *Heraclitus*, That when his Scholars had found him in a Tradeſman's Shop, whither they were aſhamed to enter; he told them, *Quod neque tali loco dii deſunt immortales*; That the gods were as well converſant in ſuch Places, as in others: Intimating, that a Divine Power and Wiſdom might be diſcerned, even in thoſe common Arts which are ſo much deſpiſed: And tho' the Manual Exerciſe and Practice of them be eſteemed ignoble, yet the Study of their General Cauſes and Principles, cannot be prejudicial to any other (tho' the moſt ſacred) Profeſſion.

It hath been my uſual Cuſtom in the Courſe of my other Studies, to propoſe divers Mathematical or Philoſophical Enquiries, for the Recreation of my Leiſure Hours; and as I could gather Satisfaction, to compoſe them into ſome Form and Method.

Some of theſe have been formerly publiſhed, and I have now ventured forth this Diſcourſe; wherein, beſides the great *Delight and Pleaſure*, (which every Rational Reader muſt needs find in ſuch Notions as carry with them their own Evidence and Demonſtration) there is alſo much *real Benefit* to be learned; particularly for ſuch Gentlemen as employ their Eſtates in thoſe chargeable Adventures of Draining Mines, Coalpits, *&c.* who may from hence learn the chief Grounds and Nature of Engines, and thereby more eaſily avoid the Deluſions of any cheating Impoſtor: And alſo for ſuch *common Artificers*, as are well skill'd in the *Practice* of theſe Arts, who may be much advantaged by the right Underſtanding of their Grounds and *Theory*.

Ramus hath obſerved, That the Reaſon why *Germany* hath been ſo Eminent for Mechanical Inventions, is, becauſe there have been publick Lectures of this kind inſtituted amongſt them; and thoſe, not only in the Learned Languages, but alſo in the vulgar Tongue, for the Capacity of every Unlettered Ingenious Artificer. *Schol. Mathem. l. 2.*

This whole Diſcourſe I call *Mathematical Magick*; becauſe the Art of ſuch Mechanical Inventions as are here chiefly inſiſted upon, hath been formerly ſo ſtiled; and in Alluſion to vulgar Opinion, which doth commonly attribute all ſuch ſtrange Operations unto the Power of Magick: For which Reaſon the Ancients did name this Art, Θαυματοποιητικὴ, or *Mirandorum Effectrix*. *Agrippa, de Vanit. Scient. c. 42.*

The Firſt Book is called *Archimedes*, becauſe he was the chiefeſt in diſcovering of Mechanical *Powers*.

The Second is ſtiled by the Name of *Dædalus*, who is related to be one of the firſt and moſt famous amongſt the Ancients, for his Skill in making *Automata*, or ſelf-moving Engines: Both theſe being two of the firſt Authors, that did reduce Mathematical Principles unto Mechanical Experiments.

Other Diſcourſes of this kind, are for the moſt part large and voluminous, of great Price, and hardly gotten; and beſides, there are not any of them (that I know of) in our Vulgar Tongue, or which theſe Mechanical Arts of all other are moſt proper. Theſe Inconveniences are here in ſome meaſure remedied; together with the Addition (if I miſtake not) of divers Things very conſiderable, and not inſiſted upon by others.

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ARCHIMEDES,

OR,

MECHANICAL POWERS.

The First Book.

CHAP. I.

The Excellency of these Arts. Why they were concealed by the Ancients. The Authors that have treated of them.

ALL those various Studies about which the Sons of Men do busy their Endeavours, may be generally comprised under these Three Kinds.

Divine.
Natural.
Artificial.

To the first of these, is reducible, not only the peculation of Theological Truths, but also the ractice of those Virtues, which may advantage our linds in the Enquiry after their proper Happiness. nd these Arts alone may truly be styled liberal, *Quæ* Sen. Ep. 88. *berum faciunt hominem, quibus curæ virtus est*, (saith e Divine Stoick) which set a Man at Liberty from s Lusts and Passions.

To the second may be referred all that Knowledge hich concerns the Frame of this great Universe, the usual Course of Providence in the Governent of these created Things.

To the last do belong all those Inventions, where-

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by Nature is any way quickned or advanced in her Defects: These artificial Experiments being (as it were) but so many Essays, whereby Men do naturally attempt to restore themselves from the first General Curse inflicted upon their Labours.

This following Discourse does properly appertain to this latter Kind.

Now Art may be said, either to *imitate* Nature, as in Limning and Pictures; or to *help* Nature, as in Medicine; or to *overcome* and *advance* Nature, as in these Mechanical Disciplines, which in this Respect are by so much to be preferred before the other, by how much their End and Power is more excellent. Nor are they therefore to be esteemed less Noble, because more Practical; since our best and most Divine Knowledge is intended for Action; and those may justly be counted barren Studies, which do not conduce to Practice as their proper End.

But so apt are we to contemn every Thing which is common, that the Ancient Philosophers esteemed it a great Part of Wisdom to conceal their Learning from Vulgar Apprehension or Use, thereby the better to maintain it in its due Honour and Respect. And therefore did they generally veil all their Arts and Sciences under such mystical Expressions as might excite the Peoples Wonder and Reverence, fearing lest a more easy and familiar Discovery might expose them to contempt. *Sic ipsa mysteria fabularum cuniculis operiuntur, summatibus tantum viris, sapientia interprete, veri arcani conscii; Contenti sint reliqui, ad venerationem, figuris defendentibus à vilitate secretum,* saith a Platonick. *Macrobius Somn. Scip. l. 1. c. 2.*

Hence was it, that the Ancient Mathematicians did place all their Learning in abstracted Speculations; refusing to debase the Principles of that noble Profession unto Mechanical Experiments. Insomuch that those very Authors amongst them, who were most eminent for their Inventions of this Kind, are

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were willing by their own Practice to manifeſt unto the World thoſe artificial Wonders that might be wrought by theſe Arts, as *Dædalus*, *Archytas*, *Archimedes*, *&c.* were notwithſtanding ſo much infected with this blind Superſtition, as not to leave any thing in Writing concerning the Grounds and Manner of theſe Operations.

Quintilian ſpeaking to this Purpoſe of *Archimedes*, ſaith thus. *Quamvis tantum tamque ſingularem Geometriæ uſum, Archimedes, ſingularibus exemplis, & admirandis operibus oſtenderit, propter quæ non humanæ ſed divinæ ſcientiæ laudem ſit adeptus, hæſit tamen in illa Platonis perſuaſione, nec ullam Mechanicam literam prodere voluit.* *Quint. l. 1. c. 10.*

By which means, Poſterity hath unhappily loſt, not only the Benefit of thoſe particular Diſcoveries, but alſo the Proficiency of thoſe Arts in General. For when once the Learned Men did forbid the Reducing of them to particular Uſe, and Vulgar Experiment; others did thereupon refuſe theſe Studies themſelves, as being but empty and uſeleſs Speculations. Whence it came to paſs that the Science of Geometry was ſo univerſally neglected, receiving little or no Addition for many Hundred Years together. *Pet. Ram. Schol. Mathem. l. 1.*

Amongſt theſe Ancients, the Divine *Plato* is obſerved to be one of the greateſt Sticklers for this fond Opinion; ſeverely dehorting all his Followers from proſtituting Mathematical Principles, unto common Apprehenſion or Practice. Like the envious Emperor *Tiberius*, who is reported to have killed an Artificer for making Glaſs malleable, fearing leſt thereby the Price of Metals might be debaſed. So he, in his Superſtition to Philoſophy, would rather chuſe to deprive the World of all thoſe uſeful and excellent Inventions which might be thence contrived, than to expoſe that Profeſſion unto the Contempt of the ignorant Vulgar. *Plin. Nat. l. 36. c. 26.*

But

Ariſt. Quæſt. Mechan.

But his Scholar *Ariſtotle*, (as in many other particulars, ſo likewiſe in this) did juſtly oppoſe him, and became himſelf one of the firſt Authors that hath writ any methodical Diſcourſe concerning theſe Arts; chuſing rather a certain and general Benefit, before the hazard that might accrue from the vain and groundleſs Diſrepects of ſome ignorant Perſons. Being ſo far from eſteeming Geometry diſhonoured by the Application of it to Mechanical Practices, that he rather thought it to be thereby adorned, as with curious Variety, and to be exalted unto its natural End. And whereas the Mathematicians of thoſe former Ages, did poſſeſs all their Learning as covetous Men do their Wealth, only in Thought and Notion; the judicious *Ariſtotle*, like a wiſe Steward, did lay it out to particular Uſe and Improvement; rightly preferring the Reality and Subſtance of Publick Benefit, before the Shadows of ſome retired Speculation, or Vulgar Opinion.

Since him there have been divers other Authors who have been eminent for their Writings of this Nature. Such were *Hero Alexandrinus*, *Hero Mechanicus*, *Pappus Alexandrinus*, *Proclus Mathematicus*, *Vitruvius*, *Guidus Ubaldus*, *Henricus Monantholius*, *Galileus*, *Guevara*, *Merſennus*, *Bettinus*, *&c.* Beſides many others that have treated largely of ſeveral Engines, as *Auguſtin Ramelli*, *Vittorio Zoncha*, *Jacobus Beſſonius*, *Vegetius*, *Lipſius*.

Moſt of which Authors I have peruſed, and ſhall willingly acknowledge my ſelf a Debtor to them for many Things in this following Diſcourſe.

CHAP

CHAP. II.

Concerning the Name of this Art. That it may properly be ſtiled Liberal. The Subject and Nature of it.

THE Word *Mechanick* is thought to be derived ἀπὸ τῦ μήκυς καὶ ἄνειν, *multum aſcendere, pertingere*: Intimating the Efficacy and Force of ſuch Inventions. Or elſe παρὰ μὴ χαίνειν, (ſaith *Euſtathius*) *quia hiſcere non ſinit*, becauſe theſe Arts are ſo full of pleaſant Variety, that they admit not either of Sloth or Wearineſs.

Lypſius. Poliorcet. l. 2. Dial. 3. That's a ſenſeleſs abſurd Etymology, impoſed by ſome, *Quia intellectus in eis mæchatur*, as if theſe Arts did proſtitute and adulterate the underſtanding.

According to ordinary Signification, the Word is uſed in Oppoſition to the liberal Arts: Whereas in Propriety of Speech thoſe Employments alone may be ſtyled *Illiberal*, which require only ſome bodily Exerciſe, as Manufactures, Trades, *&c.* And on the contrary, that Diſcipline which diſcovers the general Cauſes, Effects, and Proprieties of Things, may truly be eſteemed as a *Species* of Philoſophy.

But here it ſhould be noted, that this Art is uſually diſtinguiſhed into a twofold Kind:

1. *Rational.*
2. *Chirurgical.*

Pappus Proœm. in Collect. Mathem. l. 8.

The *Rational* is that which treats of thoſe Principles and fundamental Notions, which may concern theſe Mechanical Practices.

The *Chirurgical* or *Manual* doth refer to the making of theſe Inſtruments, and the Exerciſing of ſuch particular Experiments. As in the Works of Architecture, Fortifications, and the like.

The firſt of theſe is the Subject of this Diſcourſe, and may properly be ſtyled *Liberal*, as juſtly deſerving the Proſecution of an ingenious Mind. For if we conſider it according to its Birth and Original, we ſhall find it to ſpring from honourable Pa-

 rentage,

rentage, being produced by *Geometry* on the one ſide, and *natural Philoſophy* on the other. If according to its Uſe and Benefit, we may then diſcern that to this ſhould be referred all thoſe Arts and Profeſſions, ſo neceſſary for human Society, whereby Nature is not only directed in her uſual Courſe, but ſometimes alſo commanded againſt her own Law. The Particulars that concern Architecture, Navigation, Husbandry, Military Affairs, *&c.* are moſt of them reducible to this Art, both for their Invention and Uſe.

Thoſe other Diſciplines of Logick, Rhetorick, *&c.* do not more protect and adorn the Mind, than theſe Mechanical Powers do the Body.

And therefore are they well worthy to be entertained with greater Induſtry and Reſpect, than they commonly meet with in theſe Times; wherein there be very many that pretend to be Maſters in all the Liberal Arts, who ſcarce underſtand any Thing in theſe Particulars.

The Subject of this Art is concerning the Heavineſs of ſeveral Bodies, or the Proportion that is required betwixt any Weight, in relation to the Power which may be able to move it. And ſo it refers likewiſe to violent and artificial Motion, as Philoſophy doth to that which is natural.

The proper End for which this Art is intended, is to teach how by Underſtanding the true Difference betwixt the *Weight* and the *Power*, a Man may add ſuch a fitting Supplement to the Strength of the Power, that it ſhall be able to move any conceivable Weight, though it ſhould never ſo much exceed that Force which the Power is naturally endowed with.

The Art it ſelf may be thus deſcribed to be a Mathematical Diſcipline, which by the Help of Geometrical Principles doth teach to contrive ſeveral Weights and Powers unto any kind, either of Motion

tion, or Reſt, according as the Artificer ſhall determine.

If it be doubted how this may be eſteemed a *Species* of Mathematicks, when as it treats of Weights, and not of Quantity: For Satisfaction to this, there are two Particulars conſiderable.

Dav. Rivaltus præf. in l. Archim. de centro gravitatis.

1. *Mathematicks* in its Latitude is uſually divided into *Pure* and *Mixed*: And though the *Pure* do handle only *abſtract Quantity* in the *General*, as *Geometry*, *Arithmetick*: Yet that which is *mixed*, doth conſider the Quantity of ſome *particular determinate* Subject. So *Aſtronomy* handles the Quantity of Heavenly Motions; *Muſick* of Sounds, and *Mechanicks* of Weights and Powers.

2. Heavineſs or Weight is not here conſidered, as being ſuch a natural *Quality*, whereby condenſed Bodies do of themſelves *tend downwards*; but rather, as being an Affection, whereby they may be meaſured. And in this Senſe, *Ariſtotle* himſelf refers it amongſt the other *Species* of *Quantity*, as having the ſame proper Eſſence, which is to be compounded of integral Parts. So a Pound doth conſiſt of Ounces, Drams, Scruples. Whence it is evident, that there is not any ſuch Repugnancy in the Subject of this Art, as may hinder it from being a true *Species* of *Mathematicks*.

Metaph. l. 10. c. 2.

CHAP. III.

Of the firſt Mechanical Faculty, the Balance.

THE Mechanical Faculties by which the Experiments of this Nature muſt be contrived, are uſually reckoned to be theſe Six.

1. *Libra.*	1. *The Ballance.*
2. *Vectis.*	2. *The Leaver.*
3. *Axis in Peritrochio.*	3. *The Wheel.*
4. *Trochlea.*	4. *The Pulley.*
5. *Cuneus.*	5. *The Wedge.*
6. *Cochlea.*	6. *The Screw.*

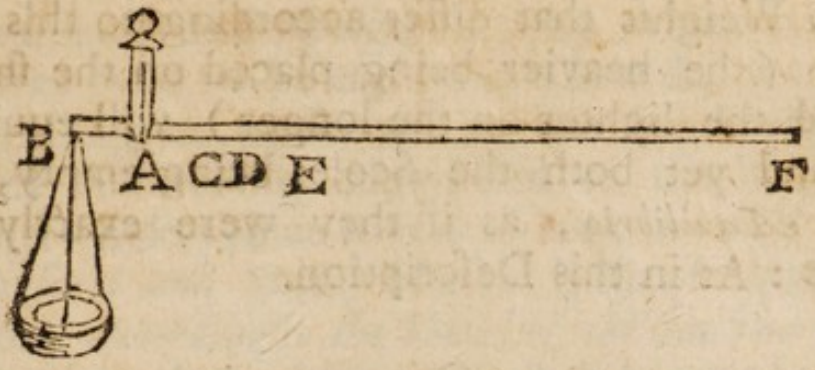
Unto ſome of which, the Force of all Mechanical Inventions muſt neceſſarily be reduced. I ſhall ſpeak of them ſeverally, and in this Order.

Firſt, concerning the Balance: This and the Leaver are uſually confounded together, as being but one Faculty; becauſe the general Grounds and Proportions of either's Force is ſo exactly the ſame. But for better Diſtinction, and more clear Diſcovery of their Natures, I ſhall treat of them ſeverally.

The firſt Invention of the Balance is commonly attributed to *Aſtrea*, who is therefore deified for the Goddeſs of Juſtice; and that Inſtrument it ſelf advanced amongſt the Celeſtial Signs.

The Particulars concerning it are ſo commonly known, and of ſuch eaſie Experiment, that they will not need any large Explication. The chief End and Purpoſe of it, is for the Diſtinction of ſeveral Ponderoſities: For the Underſtanding of which, we muſt note, that if the Length of the Sides in the Balance, and the Weights at the Ends of them, be both mutually equal, then the Beam will be in a horizontal Situation. But on the contrary, if either the Weights alone be equal, and not their Diſtances, or the Diſtances alone, and not the Weights, then the Beam will accordingly decline.

As in this following Diagram.



Suppoſe an equal Weight at *C*, unto that at *B*; (which Points are both equally diſtant from the Center *A*) it is evident that then the Beam *B F* will hang horizontally. But if the Weight ſuppoſed at *C*, be unequal to that at *B*, or if there be an equal Weight at *D E*, or any of the other unequal Diſtances; the Beam muſt then neceſſarily decline.

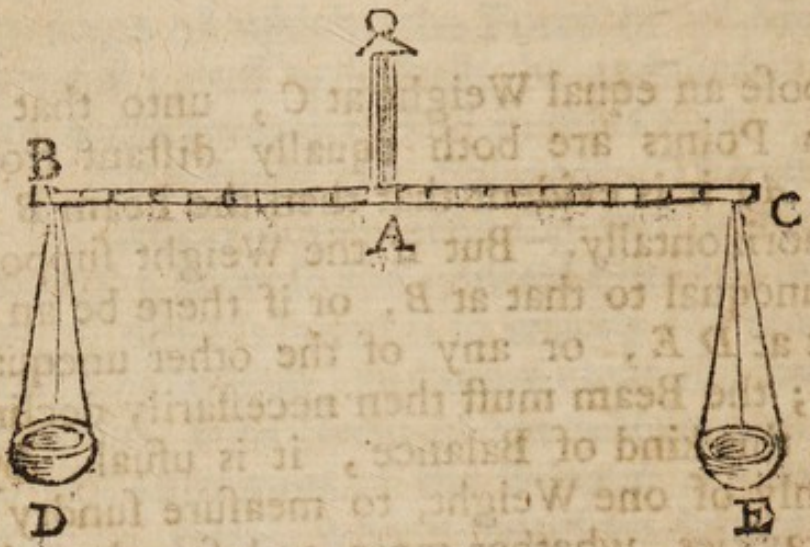
With this kind of Balance, it is uſual, by the Help only of one Weight, to meaſure ſundry different Gravities, whether more or leſs, than that by which they are meaſured. As by the Example here deſcribed, a Man may with one Pound alone, weigh any other Body within ten Pounds; becauſe the Heavineſs of any Weight doth increaſe proportionably to its Diſtance from the Center. Thus one Pound at *D*, will equiponderate unto two Pounds at *B*; becauſe the Diſtance *A D* is double unto *A B*. And for the ſame Reaſon, one Pound at *E*, will equiponderate to three Pound at *B*; and one Pound at *F*, unto ten at *B*; becauſe there is ſtill the ſame Diſproportion betwixt their ſeveral Diſtances. *Cardan. Subtil. l. 1.*

This kind of Ballance is uſually ſtiled *Romana Statera*. It ſeems to be of ancient Uſe, and is mentioned by *Ariſtotle* under the Name of φάλαγξ. *Mechan. c. 21.*

Hence it is eaſy to apprehend how that falſe Balance may be compoſed, ſo often condemned by the Wiſe-man, as being *an Abomination to the Lord*. If the Sides of the Beam be not equally divided, as *Prov. 11. 1. c. 16. 11. Item, cap. 20. 10, 23.*

Pappus Collect. Math. l. 8.

ſuppoſe one have 10 Parts, and the other 11; then any two Weights that differ according to this Proportion, (the heavier being placed on the ſhorter ſide, and the lighter on the longer) will equiponderate; and yet both the Scoles being empty, will hang in *Æquilibrio*, as if they were exactly juſt and true: As in this Deſcription.



Suppoſe *A C* to have 11 ſuch Parts, whereof *A B* has but 10, and yet both of them to be in themſelves of equal Weight; it is certain, that whether the Scoles be empty, or whether in the Scole *D* we put 11 Pound, and at *E* 10 Pound; yet both of them ſhall equiponderate, becauſe there is juſt ſuch a Diſproportion in the Length of the Sides *A C*, being unto *A B*, as 11 to 10.

The Frequency of ſuch Cozenages in theſe Days, may be evident from common Experience; and that they were uſed alſo in former Ages, may appear from *Ariſtotle*'s Teſtimony concerning the Merchants in his time. For the remedying of ſuch Abuſes, the Ancients did appoint divers Officers, ſtiled ζυγοστάται, who were to overlook the common Meaſures.

Quæſtion. Mechan. c. 2.

Budæus. Hencethe Proverb, *Zygoſtatica Fides.*

So great Care was there amongſt the *Jews*, for the Preſervation of Commutative Juſtice from all

Abuſe

Abuſe and Falſification in this kind, that the Publick Standards and Originals, by which all other Meaſures were to be try'd and allow'd, were with much Religion preſerved in the Sanctuary; the Care of them being committed to the Prieſts and *Levites*, whoſe Office it was to look unto *all manner of Meaſures and Size.* Hence is that frequent Expreſſion, *According to the Shekel of the Sanctuary*; and that Law, *All thy Eſtimations ſhall be according to the Shekel of the Sanctuary:* Which doth not refer to any Weight, or Coin, diſtinct from, and more than the Vulgar, (as ſome fondly conceive) but doth only oblige Men in their Dealing and Traffick, to make uſe of ſuch juſt Meaſures, as were agreeable unto the Publick Standards that were kept in the Sanctuary. 1 Chron. 23. 29. Exod. 30. 13. Lev. 27. 25.

The manner how ſuch Deceitful Balances may be diſcovered, is, by changing the Weights into each other Scole, and then the Inequality will be manifeſt.

From the former Grounds rightly apprehended, it is eaſy to conceive how a Man may find out the juſt Proportion of a Weight, which in any Point given, ſhall equiponderate to ſeveral Weights given, hanging in ſeveral Places of the Beam.

Some of theſe Balances are made ſo exact, (thoſe eſpecially which the Refiners uſe) as to be ſenſibly turned with the Eightieth Part of a Grain: Which (tho' it may ſeem very ſtrange) is nothing to what * *Capellus* relates of one at *Sedan*, that would turn with the Four hundredth Part of a Grain. Maſter *Greaves's* Roman Foot.

There are ſeveral Contrivances to make uſe of theſe, in meaſuring the Weight of Blows, the Force of Powder, the Strength of Strings, or other Oblong Subſtances; Condenſed Air; the diſtinct Proportion of ſeveral Metals mixed together; the different Gravity of divers Bodies in the Water, from what they have in the open Air; with divers the like ingenious Enquiries.

* *De ponderibus & nummis, l.* 1.

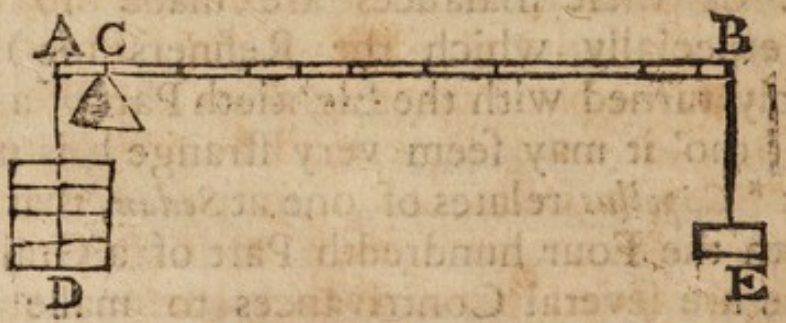
CHAP. IV.

Concerning the ſecond Mechanick Faculty, the Leaver.

THE ſecond Mechanical Faculty, is the Leaver: The firſt Invention of it is uſually aſcribed to *Neptune*, and repreſented by his Trident, which in the *Greek* are both called by one Name, and are not very unlike in Form, being both of them ſomewhat broader at one end, than in the other parts.

μόχλος. *Ariſtotle Quæſt. Mechan. cap. 4 Archimedes, de Æquiponderant l. 1. prop. 7. Vitruvius Architect. l. 10. c. 8.*

There is one main Principle concerning it, which is (as it were) the very Sum and Epitome of this whole Art. The meaning of it is thus expreſſed by *Ariſtotle*, Ὁ τὸ κινούμενον βάρος πρὸς τὸ κινοῦν, τὸ μῆκος πρὸς τὸ μῆκος ἀνταπέπονθεν. That is, as the Weight is to an equivalent Power, ſo is the diſtance betwixt the Weight and the Center, unto the diſtance betwixt the Center and the Power, and ſo reciprocally. Or thus, the Power that doth equiponderate with any Weight, muſt have the ſame proportion unto it, as there is betwixt their ſeveral Diſtances from the Center or Fulciment; as in this following Figure.



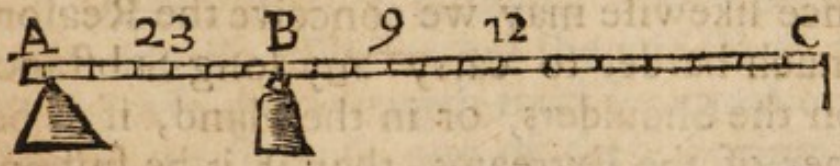
* This *Ariſtotle* calls ὑπομόχλιον. *Vitruvius*, *Preſſio*. *Whaldus Fulcimentum*. *Dan. Barbarus*, *Scabellum*.

Where ſuppoſe the Leaver to be repreſented by the Length *AB*, the Center or * Prop at the Point *C*, the Weight to be ſuſtained *D*, the Power that doth uphold it *E*.

Now

Now the meaning of the foreſaid **Principle** doth mport thus much; that the Power at *E*, muſt beat he ſame proportion to the Weight *D*, as the Diſtance *C A* doth to the other *C B*; which, becauſe : is Octuple in the preſent Example, therefore it vill follow that one Pound at *B*, or *E*, will equiponerate to eight Pounds at *A*, or *D*; as is expreſſed n the Figure. The Ground of which Maxim is his, becauſe the Point *C* is ſuppoſed to be the Cener of Gravity, on either ſide of which, the Parts re of equal Weight.

And this kind of proportion is not only to be oberved when the Power doth *preſs downwards*, (as in he former Example) but alſo in the other Species f violent Motion; as *Lifting*, *Drawing*, and the ike. Thus if the Prop or Fulciment were ſuppoſed o be at the extremity of the Leaver,

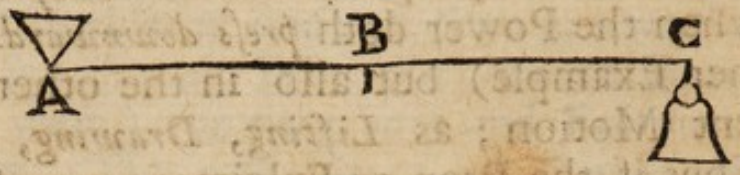


s in this Diagram at *A*, then the Weight *B* would equire ſuch a difference in the Strengths or Powrs that did ſuſtain it, as there is betwixt the ſeveral Diſtances *A C*, and *B C*. For as the Diſtance *A B* s unto *A C*, ſo is the Power at *C* to the Weight at ; that is, the Power at *A* muſt be double to that t *C*, becauſe the Diſtance *B C* is twice as much as *A*. From whence it is eaſie to conceive, how ny Burden carried betwixt two Perſons, may be roportioned according to their different Strengths. f the Weight were imagined to hang at the Numer 2, then the Power at *C* would ſuſtain but two f thoſe Parts, whereof that at *A* did uphold 16. f it be ſuppoſed at the Figure 3, then the Strength t *C*, to that at *A*, would be but as Three to Fifteen.

The right underſtanding of this doth much conduce to the Explication of the Pulley.

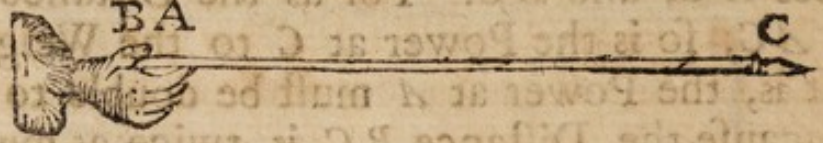
teen. But if it were ſituated at the Figure 9, then each of the Extremities would participate of it alike becauſe that being the middle, both the Diſtances are equal. If at the Number 12, then the Strength at C is required to be double unto that at *A*. And in the like manner are we to conceive of the other intermediate Diviſions.

Thus alſo muſt it be, if we ſuppoſe the Power to be placed betwixt the Fulciment and the Weight, as in this Example.



Where, as *A C* is to *A B* ſo is the Power at *B*, to the Weight at C.

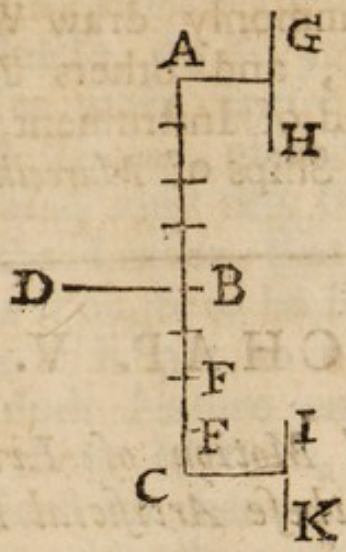
Hence likewiſe may we conceive the Reaſon why it is much harder to carry any long Subſtance, either on the Shoulders, or in the Hand, if it be held by either of the Extreams, than if it be ſuſtained by the middle of it. The Strength that muſt equiponderate at the nearer end, ſometimes increaſing the Weight almoſt double to what it is in it ſelf.



Imagine the Point *A* to be the place where any long Subſtance (as ſuppoſe a Pike) is ſuſtained; it is evident from the former Principle, that the ſtrength at *B* (which makes it lie level) muſt be equal to all the length *A C*, which is almoſt the whole Pike.

And as it is in the depreſſing, or elevating, ſo likewiſe is it in the drawing of any Weight, as a Coach, Plow, or the like.

Le



Let the Line *D B* repreſent the Pole or Carriage n which the Burden is ſuſtained, and the Line *A C* ne Croſs-Bar; at each of its Extremities, there is a veral Spring-Tree *G H*, and *I K*, to which either lorſes or Oxen may be faſtned. Now becauſe *A* nd *C* are equally diſtant from the middle *B*, there- re in this caſe the Strength muſt be equal on both des; but if we ſuppoſe one of theſe Spring-Trees be faſtned unto the Points *E* or *F*, then the trength required to draw on that ſide, will be ſo uch more, as the diſtance *E B* or *F B* is leſs than at of *B*; that is, either as three to four, as *E B* *B A*, or as one to two, as *F B* to *B A*. So that e Beaſt faſtned at *A*, will not draw ſo much by a uarter as the other at *E*, but half as much as one *F*.

Whence it is eaſie to conceive how a Husbandman *cum inæquales veniunt ad aratra juvenci*) may pro- ortion the Labour of Drawing, according to the veral ſtrength of his Oxen.

Unto this Mechanical Faculty ſhould be reduced ndry other Inſtruments in common uſe. Thus the ars, Stern, Maſts, *&c.* according to their force hereby they give Motion to the Ship, are to be con- eived under this Head. Thus

Ariſt. Mechan. c. 5, 6, 7 Vide Guevar. Comment.

Thus likewiſe for that Engine, whereby Brewer and Dyers do commonly draw Water, which *Ariſtotle* calls κηλόνειον, and others *Tollenon.* This being the ſame kind of Inſtrument, by which *Archimedes* drew up the Ships of *Marcellus.*

Mechan. c. 29. Pet. Crinitus, de honeſta Diſciplina l. 19. c. 2. calls it corruptly *Tellenon.*

CHAP. V.

How the Natural Motion of Living Creatures is conformable to theſe Artificial Rules.

THE former Principle being already explained concerning artificial and dead Motions, it will not be altogether impertinent, if in the next place we apply it unto thoſe that are natural in living Bodies, and examine whether theſe alſo are not governed by the ſame kind of Proportions.

In all perfect living Creatures, there is a twofold kind of motive Inſtruments:

1. Primary, the Muſcles.
2. Secondary, the Members.

The Muſcles are naturally fitted to be Inſtrument of Motion, by the manner of their Frame and Compoſure; conſiſting of Fleſh as their chief Material and beſides of Nerves, Ligatures, Veins, Arteries, and Membranes.

The *Nerves* ſerve for the conveyance of the motive Faculty from the Brain. The *Ligatures* for the ſtrengthning of them, that they may not flag and languiſh in their Motions. The *Veins* for their Nouriſhment. The *Arteries* for the ſupplying of them with Spirit and natural Vigor. The *Membranes* for the comprehenſion or incloſure of all theſe together, and for the diſtinction of one Muſcle from another. There are beſides divers *Fibræ*, or hairy Subſtances, which Nature hath beſtowed for the farther corroborating

ɔrating of their Motions; theſe being diſperſed ırough every Muſcle, do ſo joyn together in the ıd of them, as to make entire Nervous Bodies, hich are called *Tendons*, almoſt like the Griſtles. ow this (ſaith *Galen*) may fitly be compared to the roader part of the Leaver, that is put under the eight; which, as it ought to be ſo much the ſtrong-; by how much it is put to a greater force, ſo kewiſe by this, doth Nature enable the Muſcles ıd Nerves for thoſe Motions, which otherwiſe ould be too difficult for them. *De Placit. Hippoc. & Platon. l. 1. cap. 10.*

Whence it may evidently appear, that according the Opinion of that eminent Phyſician, theſe na-ıral Motions are regulated by the like Grounds ith the artificial.

2. Thus alſo is it in thoſe ſecondary Inſtruments Motion, the Members: Amongſt which, the and is ὄργανον ὀργάνων, the Inſtrument of In-ruments, (as *Galen* ſtiles it;) and as the Soul of an doth bear in it the Image of the Divine Wiſ-ɔm and Providence, ſo this part of the Body ſeems ſome ſort to repreſent the Omnipotency of God, hilſt it is able to perform ſuch various and won-erful Effects by the help of this Art. But now for s own proper natural Strength, in the lifting any reat Weight, this is always proportioned accord-ıg to its Extenſion from the Body, being of leaſt rce when it is fully ſtretched out, or at Arms-end, ıs we ſay) becauſe then the Shoulder-Joynt is as ıe Center of its Motion, from which the Hand in ıat poſture being very remote, the weight of any ıing it holds muſt be accordingly augmented. Whereas the Arm being drawn in, the Elbow-Joynt ɔth then become its Center, which will diminiſh ıe weight proportionably, as that part is nearer un-it than the other. *De uſu part. l. 1. c. 2.*

To this purpoſe alſo, there is another ſubtle Pro-ıem propoſed by *Ariſtotle*, concerning the Poſtures of *Mechan. c. 31.*

of ſitting and riſing up. The Quære is this, Why a Man cannot riſe up from his Seat, unleſs he firſt either bend his Body forward, or thruſt his Feet backward?

In the Poſture of Sitting, our Legs are ſuppoſed to make a right Angle with our Thighs, and they with our Backs, as in this Figure.



Where let *A B* repreſent the Back, *B C* the Thighs, *C D* the Legs. Now it is evident, that a Man cannot riſe from this Poſture, unleſs either the Back *A B* do firſt incline unto *F*, to make an acute Angle with the Thighs *B C*; or elſe that the Legs *C D* do incline towards *E*, which may alſo make an acute Angle with the Thighs *B C*; or laſtly, unleſs both of them do incline to the Points *G H*, where they may be included in the ſame Perpendicular.

For the Reſolution of which, the Philoſopher propoſes theſe two Particulars.

1. A right Angle (ſaith he) is a kind of Equality, nd that being naturally the Cauſe of Reſt, muſt eeds be an Impediment to the Motion of Riſing.

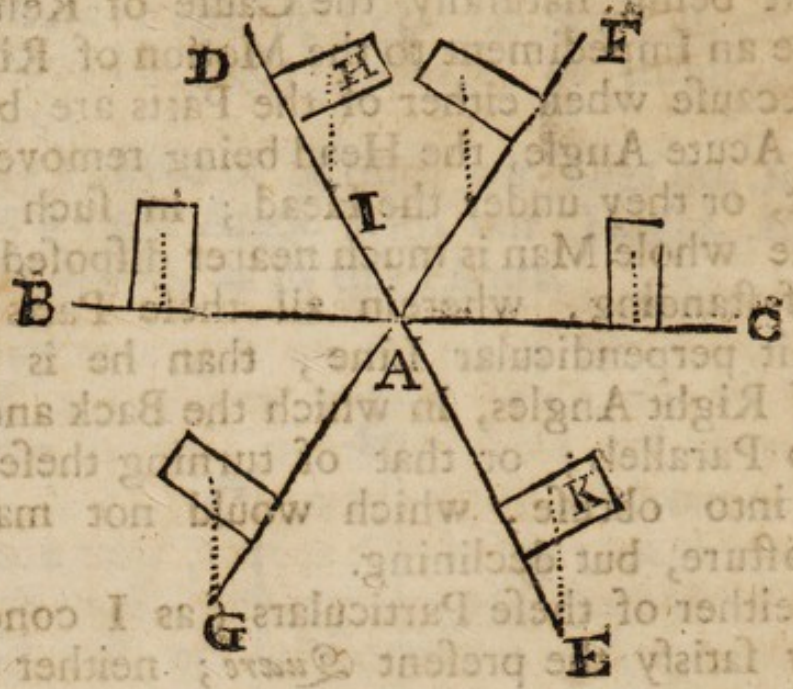
2. Becauſe when either of the Parts are brought to an Acute Angle, the Head being removed over e Feet, or they under the Head; in ſuch a Poure the whole Man is much nearer diſpoſed to the orm of ſtanding, wherein all theſe Parts are in ne ſtrait perpendicular Line, than he is by the her of Right Angles, in which the Back and Legs e two Parallels; or that of turning theſe ſtrait ngles into obtuſe, which would not make an ect Poſture, but declining.

But neither of theſe Particulars (as I conceive) fully ſatisfy the preſent *Quære*; neither do the ommentators, *Monantholius*, or *Guevara*, better reve it. Rather ſuppoſe *B C* to be a *Vectis*, or Leaer, towards the Middle of which is the Place of e Fulciment, *A B* as the Weight, *C D* the Powthat is to raiſe it.

Now the Body being ſituate in this Rectangular orm, the Weight *A B* muſt needs be augmented oportionably to its Diſtance from the Fulciment, hich is about half the Thighs: Whereas, if we ppoſe either the Weight to be inclined unto *F*, or e Power to *E*, or both of them to *G H*; then ere is nothing to be lifted up, but the bare Weight ſelf; which in this Situation, is not at all increaed with any Addition by Diſtance.

For in theſe Concluſions concerning the Leaver, e muſt always imagine that Point which is touchby a Perpendicular from the Center of Gravity, be one of the Terms. So that the diverſe Elevan or Depreſſion of the Inſtrument, will infer a eat Alteration in the Weight it ſelf; as may more early be diſcerned by this following Diagram.

Where



Where *A* is ſuppoſed to be the Place of the Prop or Fulciment; *B C*, a Leaver which ſtands horizontally; the Power and the Weight belonging unto it being equal, both in themſelves, and alſo in their Diſtances from the Prop.

But now ſuppoſe this Inſtrument to be alter'd according to the Situation *D E*; then the Weight will be diminiſhed by ſo much, as the Perpendicular from its Center of Gravity *H I*, doth fall nearer to the Prop or Fulciment at *A*: And the Power at will be ſo much augmented, as the Perpendicular from its Center (*K E*) does fall farther from the Point at *A*. And ſo on the contrary, in that other Situation of the Leaver, *F G*: Whence it is eaſy to conceive the true Reaſon, why the Inclining of the Body, or the putting back of the Leg, ſhould ſo much conduce to the Facility of riſing.

Sir *Fr. Bacon's Nat. Hiſt. Exp.* 731.

From theſe Grounds likewiſe may we underſtand why the Knees ſhould be moſt weary in Aſcending and the Thighs in Deſcending; which is, becauſe the Weight of the Body doth bear moſt upon the Knee-joints, in raiſing it ſelf up; and moſt upon

the Muſcles of the Thighs, when it ſtays it ſelf in coming down.

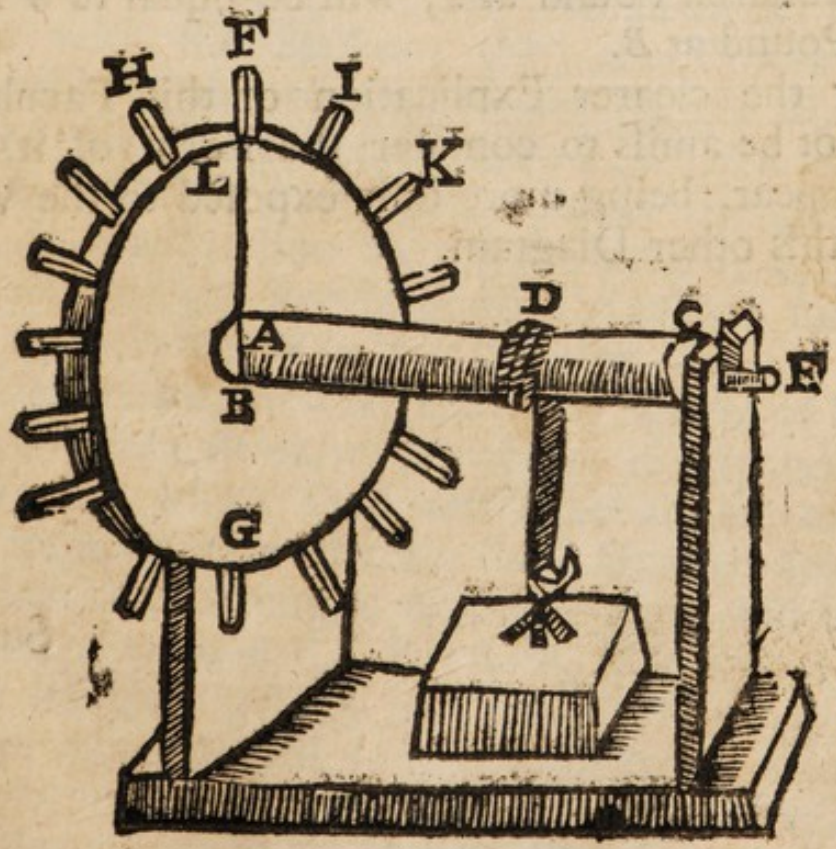
There are divers other Natural Problems to this purpoſe, which I forbear to recite We do not ſo much as go, or ſit, or riſe, without the Uſe of this Mechanical Geometry.

CHAP. VI.

Concerning the Wheel.

THE Third Mechanical Faculty is commonly ſtiled, *Axis in Peritrochio.* It conſiſts of an Axis, or Cylinder, having a Rundle about it, wherein there are faſtned divers Spokes, by which the whole may be turned round; according to this Figure.

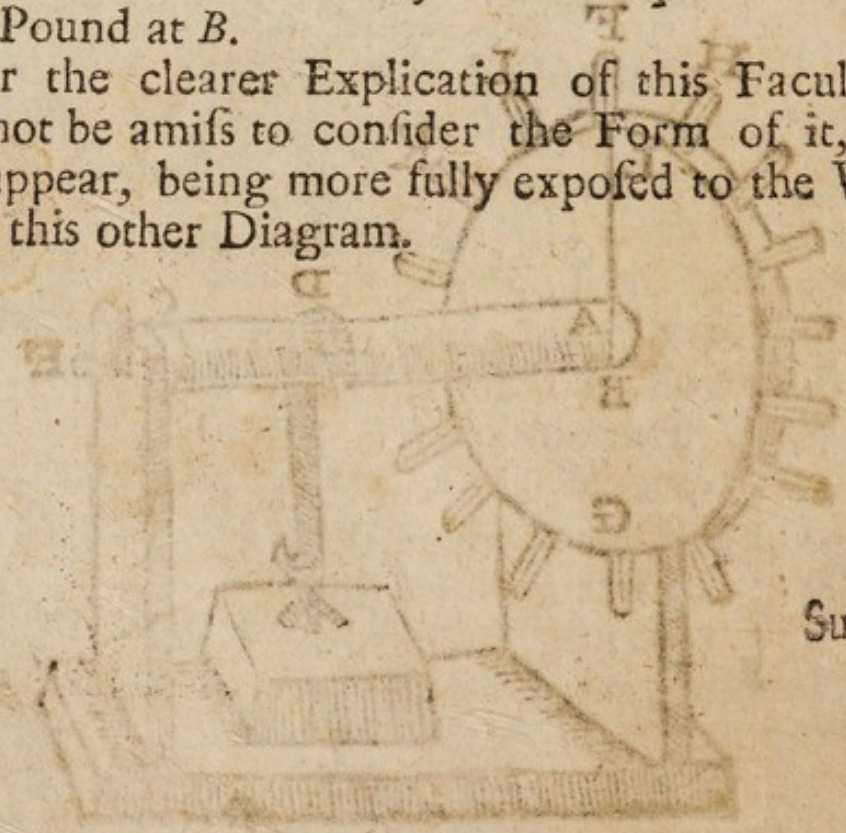
Called likewiſe ὁ τροχός. *Ariſt. Mechan. c.* 14.



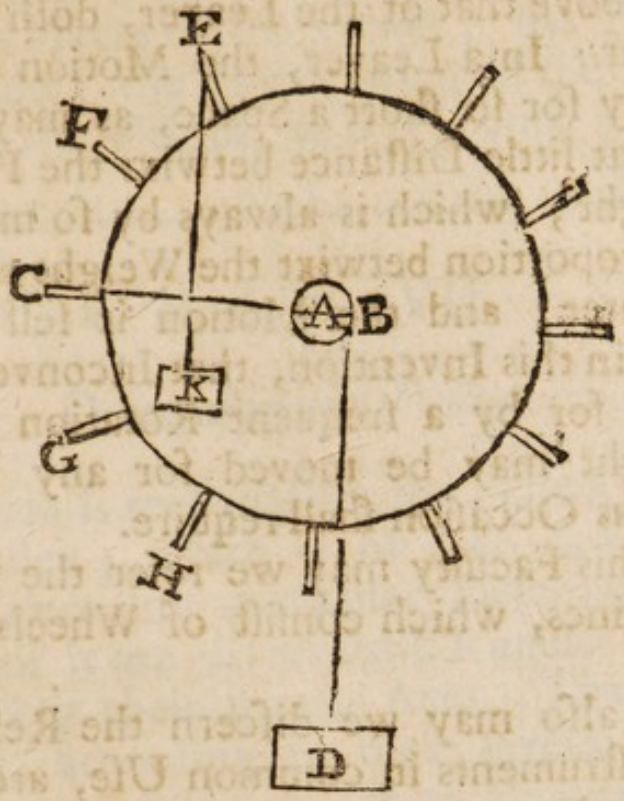
Where *B C* does repreſent the Cylinder, which is ſuppoſed to move upon a ſmaller Axis at *E* (this being all one, in compariſon to the ſeveral Proportions, as if it were a mere Mathematical Line;) *L G* is the Rundle, or Wheel; *H F I K*, ſeveral Spokes or Handles that are faſtned in it; *D*, the Place where the Cord is faſtned, for the drawing or lifting up of any Weight.

The Force of this Inſtrument doth conſiſt in that Diſproportion of Diſtance which there is betwixt the Semidiameter of the Cylinder *A B*, and the Semidiameter of the Rundle with the Spokes, *F A*. For let us conceive the Line *F B* to be as a Leaver, wherein *A* is the Center or Fulciment, *B* the Place of the Weight, and *F* of the Power. Now it is evident from the former Principles, that by how much the Diſtance *F A* is greater than *A B*, by ſo much leſs need the Power be at *F*, in reſpect of the Weight at *B*. Suppoſe *A B* to be as the Tenth part of *A F*, then that Power or Strength, which is but as a Hundred Pound at *F*, will be equal to a Thouſand Pound at *B*.

For the clearer Explication of this Faculty, it will not be amiſs to conſider the Form of it, as it will appear, being more fully expoſed to the View: As in this other Diagram.



Suppoſe



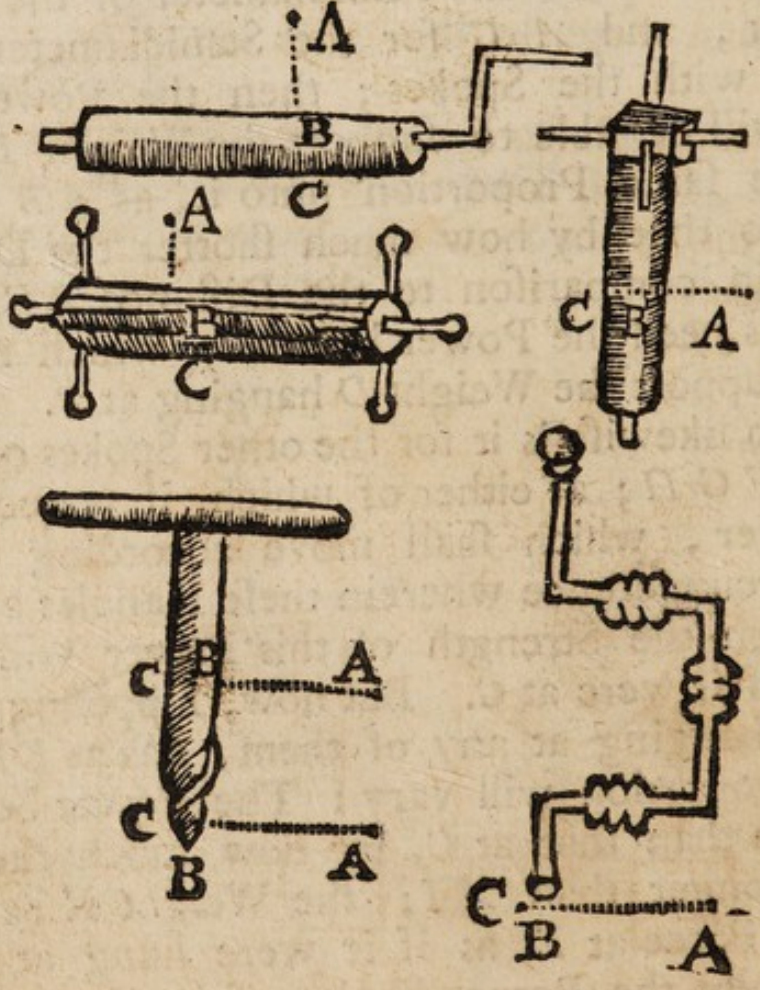
Suppoſe *A B* for the Semidiameter of the Axis or Cylinder, and *A C* for the Semidiameter of the Handle with the Spokes; then the Power at *C*, which will be able to ſupport the Weight *D*, muſt bear the ſame Proportion unto it, as *A B* doth to *A C*: So that by how much ſhorter the Diſtance *A B* is, in compariſon to the Diſtance *A C*, by ſo much leſs need the Power be at *C*, which may be able to ſupport the Weight *D* hanging at *B*.

And ſo likewiſe is it for the other Spokes or Handles, *E F G H*; at either of which, if we conceive any Power, which ſhall move according to the ſame Circumference wherein theſe Handles are placed; then the Strength of this Power will be all one, as if it were at *C*. But now, ſuppoſing a dead Weight hanging at any of them, (as at *E*) then the Diſproportion will vary: The Power being ſo much leſs than that at *C*, by how much the Line *C* is longer than *A I*; the Weight *K* being of the ſame Force at *E*, as if it were hung at *I*, in which Point the Perpendicular of its Gravity doth cut the Diameter.

The chief Advantage which this Inſtrument doth beſtow above that of the Leaver, doth conſiſt in this Particular: In a Leaver, the Motion can be continued only for ſo ſhort a Space, as may be anſwerable to that little Diſtance betwixt the Fulciment and the Weight; which is always by ſo much leſſer, as the Diſproportion betwixt the Weight and the Power is greater, and the Motion it ſelf more eaſy. But now in this Invention, that Inconvenience is remedied; for by a frequent Rotation of the Axis, the Weight may be moved for any Height, or Length, as Occaſion ſhall require.

Unto this Faculty may we refer the Force of all thoſe Engines, which conſiſt of Wheels with Teeth in them.

Hence alſo may we diſcern the Reaſon, why ſundry Inſtruments in common Uſe, are framed after the like Form with theſe following Figures.



All

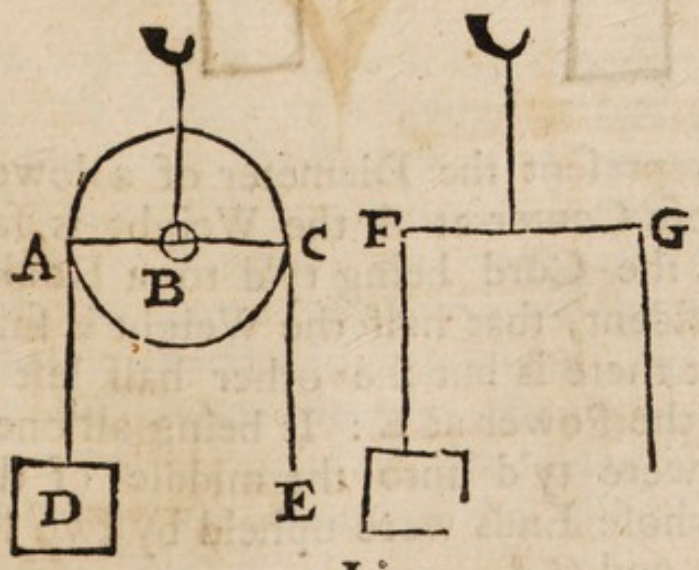
All which are but ſeveral kinds of this Third Mechanical Faculty. In which, the Points *A B C* do repreſent the Places of the Power, the Fulciment, and the Weight; the Power being in the ſame proportion unto the Weight, as *B C* is unto *B A*.

CHAP. VII.

Concerning the Pulley.

THat which is reckon'd for the Fourth Faculty, is the Pulley; which is of ſuch ordinary Uſe, that it needs not any particular Deſcription. The chief Parts of it are divers little Rundles, that are moveable about their proper Axes. Theſe are uſually divided, according to their ſeveral Situations, into the upper and lower. If an Engine have two of theſe Rundles above, and two below, it is uſually called δίσπαστος, if three, τρίσπαστος, if many, πολύσπαστος. *Ariſt. Mechan. c.19.*

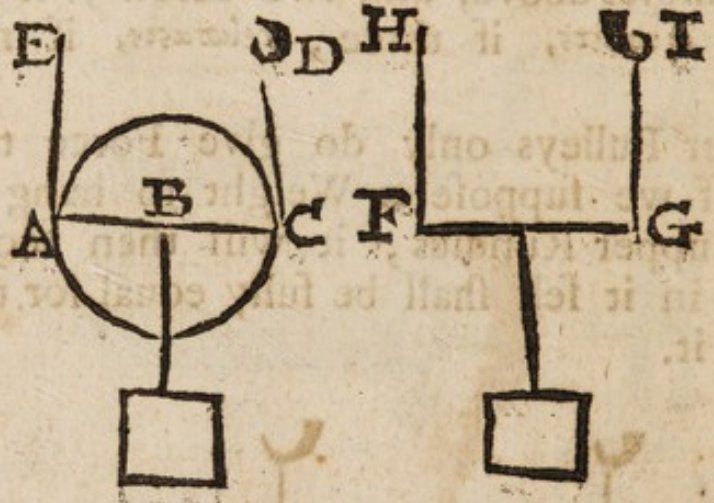
The lower Pulleys only do give Force to the Motion. If we ſuppoſe a Weight to hang upon any of the upper Rundles, it will then require a Power that in it ſelf ſhall be fully equal for the ſuſtaining of it.



The Diameter *A C* being as the Beam of a Balance, of which *B* is the Prop or Center. Now the Parts *A* and *C* being equally distant from this Center, therefore the Power at *E* must be equal to the Weight at *D*; it being all one, as if the Power and the Weight were fastned by two several Strings, at the Ends of the Balance *F G*.

Now all the upper Pulleys being of the same Nature, it must necessarily follow, that none of them do in themselves conduce to the easing of the Power, or lightening the Weight, but only for the greater Conveniency of the Motion; the Cords by this means running more easily moved, than otherwise they would.

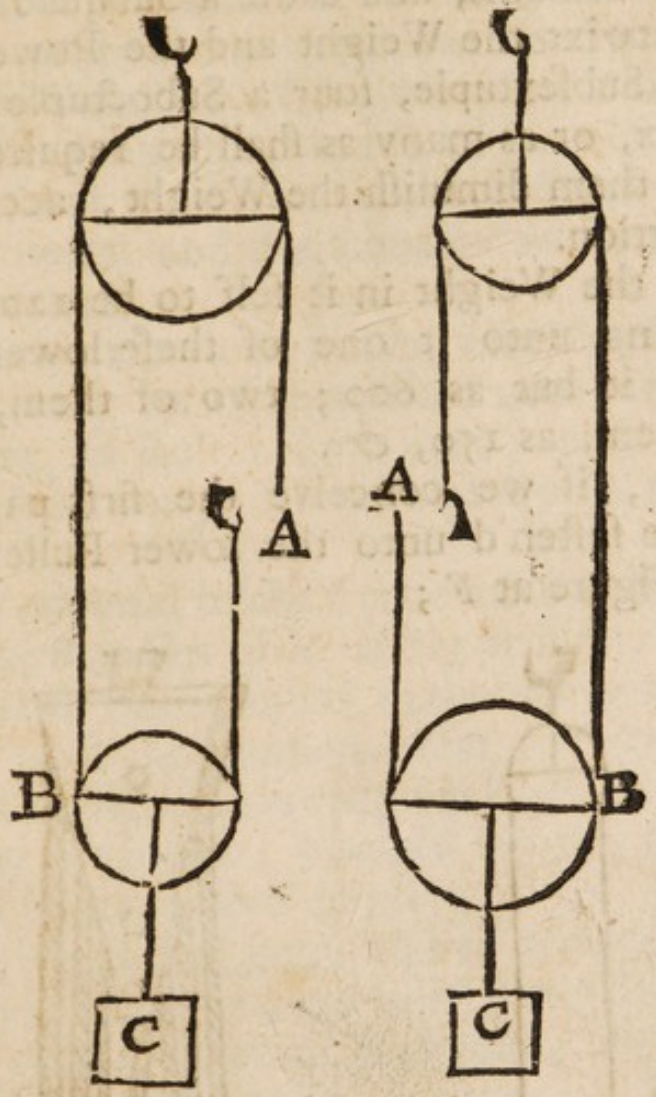
But now, suppose the Weight to be sustained above the Pulley, as it is in all those of the lower sort; and then the Power which supports it, need be but half as much as the Weight it self.



Let *A C* represent the Diameter of a lower Pulley, on whose Center at *B* the Weight is fastned, one end of the Cord being ty'd to a Hook at *D*. Now it is evident, that half the Weight is sustained at *D*, so that there is but the other half left to be sustained by the Power at *E*: It being all one, as if the Weight were ty'd unto the middle of the Balance *F G*, whose Ends were upheld by two several Strings, *F H*, and *G I*.

And

And this ſame Subduple Proportion will ſtill remain, tho' we ſuppoſe an upper Pulley joined to the Power; as in theſe two other Figures.

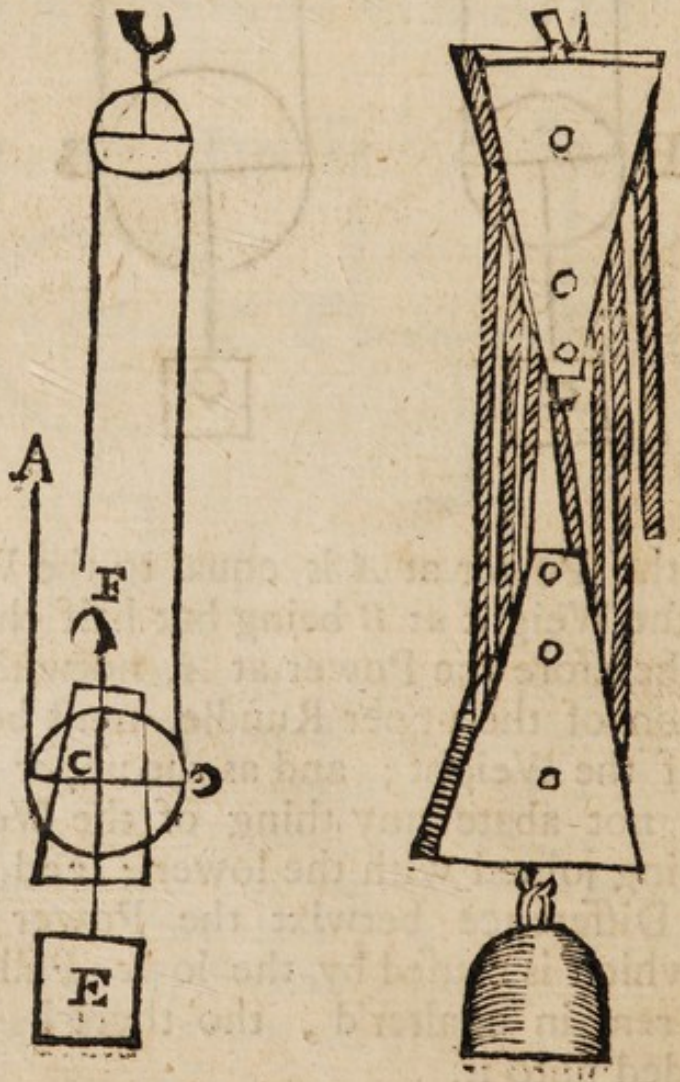


Where the Power at *A* is equal to the Weight at *B*: Now the Weight at *B* being but half the Ponderoſity *C*, therefore the Power at *A*, notwithſtanding the Addition of the upper Rundle, muſt be equivalent to half the Weight; and as the upper Pulley alone doth not abate any thing of the Weight, ſo neither being joined with the lower; and the ſame Subduple Difference betwixt the Power and the Weight, which is cauſed by the lower Pulley alone, doth ſtill remain unalter'd, tho' there be an upper Pulley added unto it.

Now, as one of these Under-Pulleys doth abate half of that Heaviness which the Weight hath in it self, and cause the Power to be in a Subduple Proportion unto it; so two of them do abate half of that which remains, and cause a Subquadruple Proportion betwixt the Weight and the Power; three of them a Subsextuple, four a Suboctuple: And so for five, six, or as many as shall be required; they will all of them diminish the Weight, according to this Proportion.

Suppose the Weight in it self to be 1200 Pound, the applying unto it one of these lower Pulleys, will make it but as 600; two of them, as 300; three of them, as 150, *&c.*

But now, if we conceive the first part of the String to be fasten'd unto the lower Pulley, as in this other Figure at *F*;



then

hen the Power at *A*, will be in a ſubtriple Proportiɔn to the Weight *E*, becauſe the Heavineſs would ɔe then equally divided unto the Three Points of the ɔwer Diameter *B*, *C*, *D*, each of them ſupporting like Share of the Burden. If unto this lower Pulɛy there were added another, then the Power would ɛ unto the Weight in a ſubquintuple Proportion. If Third, a Subſextuple, and ſo of the reſt. For we ıuſt note, that the Cords in this Inſtrument are as ɔ many Powers, and the Rundles as ſo many Leaers, or Balances.

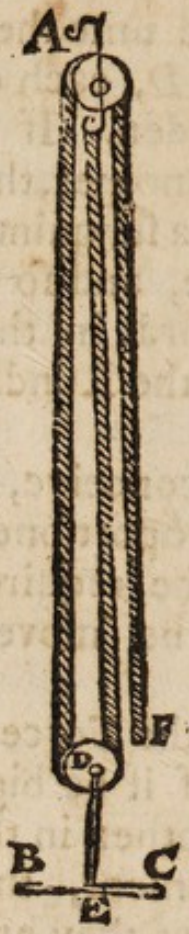
Hence it is eaſie to conceive, how the Strength of ıe Power may be proportioned according to any ıch Degree, as ſhall be required; and how any Veight given may be moved by any Power iven.

'Tis not material to the Force of this Inſtrument, hether the Rundles of it be big or little, if they be ıade equal to one another in their ſeveral Orders: ut it is moſt convenient, that the upper ſhould ıch of them increaſe as they are higher, and the oıer as they are lower; becauſe by this means the ords will be kept from tangling.

Theſe Pulleys may be multiplied according to ſuny different Situations, not only when they are ſubdinate, as in the former Examples, but alſo when ey are placed collaterally.

From the former Grounds it is eaſie to contrive a ıdder, by which a Man may pull himſelf up unto ıy Height. For the Performance of this, there is quired only an upper and a lower Rundle.

To



To the uppermoſt of theſe at *A*, there ſhould be faſtned a ſharp Grapple or Cramp of Iron, which may be apt to take hold of any Place where it lights. This part being firſt caſt up and faſtned, and the Staff *D E*, at the nether End, being put betwixt the Legs, ſo that a Man may ſit upon the other *B C*, and take hold of the Cord at *F*, it is evident that the Weight of the Perſon at *E*, will be but equal to half ſo much Strength at *F*; ſo that a Man may eaſily pull himſelf up to the Place required, by leaning but little more than half of his own Weight on the String *F*. Or if the Pulleys be multiplied, this Experiment may then be wrought with leſs Labour.

CHAP.

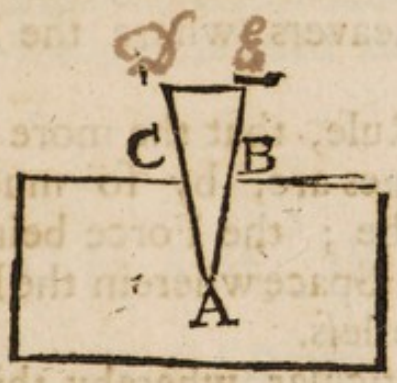
CHAP. VIII.

Of the Wedge.

THE Fifth Mechanical Faculty is the Wedge, which is a known Inſtrument, commonly uſed the Cleaving of Wood. The Efficacy and great rength of it may be reſolved unto theſe two Par-culars:

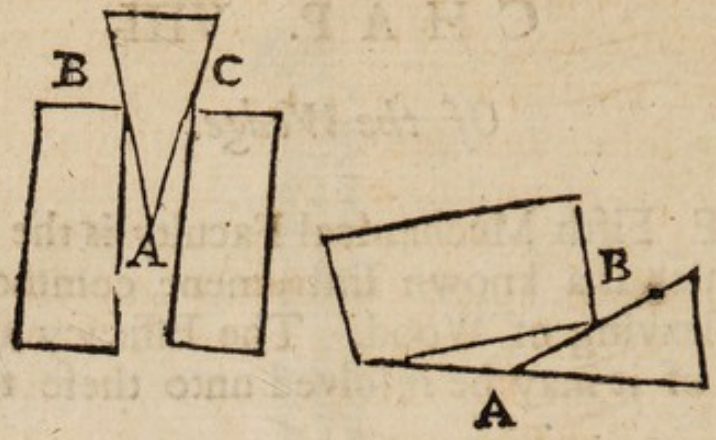
1. The Form of it.
2. The Manner whereby the Power is impreſſed on it, which is by the Force of Blows.

1. The Form of it repreſents (as it were) two eavers.



Each ſide *A D*, and *A E*, being one, the Points *C*, being inſtead of ſeveral Props or Fulciments; e Weight to be moved at *A*, and the Power that ould move it, being applyed to the Top *D E*, by e Force of ſome Stroke or Blow: As *Ariſtotle* hath plained the ſeveral Parts of this Faculty. But now, cauſe this Inſtrument may be ſo uſed that the int of it ſhall not touch the Body to be moved, as theſe other Figures: *Mechan.* c. 18.

There-



Therefore *Ubaldus* hath more exactly applyed th ſeveral Parts of it according to this Form, that th Point *A*, ſhould be as the common Fulciment, i which both the Sides do meet, and (as it were) up hold one another; the Points *B*, and *C*, repreſentin that part of the Leavers where the Weight is pla ced.

It is a general Rule, that the more acute the An gles of theſe Wedges are, by ſo much more eaſi will their Motion be; the Force being more eaſil impreſſed, and the Space wherein the Body is moved being ſo much the leſs.

The ſecond Particular whereby this Faculty hath its force, is the *Manner* whereby the Power is impreſ upon it, which is by a Stroke or Blow; the Effica cy of which doth much exceed any other Strength For tho' we ſuppoſe a Wedge being laid on a Piec of Timber, to be preſſed down with never ſo grea a Weight; nay, tho' we ſhould apply unto it th Power of thoſe other Mechanical Engines, the Pul ley, Screw, *&c.* yet the Effect would be ſcarce con ſiderable in compariſon to that of a Blow. The true Reaſon of which, is one of the greateſt Subtil ties in Nature, nor is it fully rendred by any o thoſe who have undertaken the Reſolution of it. *Ariſtotle*, *Cardan*, and *Scaliger*, do generally aſcribe it unto the Swiftneſs of that Motion: But there ſeem

* *Mechan.* c. 10. *Subtil.* l. 17. *Exercit.* 331.

eems to be ſomething more in the Matter then ſo; or otherwiſe it would follow that the quick Stroke of a light Hammer ſhould be of greater Efficacy han any ſofter and more gentle Striking of a great ledge. Or according to this, how ſhould it come o paſs, that the Force of an Arrow or Bullet diſcharged near at Hand (when the Impreſſion of that Violence whereby they are carried, is moſt freſh, nd ſo in probability the Motion at its ſwifteſt) is et notwithſtanding much leſs then it would be at a reater Diſtance. There is therefore further conſiderable, the Quality of that Inſtrument by which is Motion is given, and alſo the Conveniency of iſtance thro' which it paſſes.

Unto this Faculty is uſually reduced the Force of iles, Saws, Hatchets, *&c.* which are as it were ut ſo many Wedges faſtned unto a Vectis or eaver.

CHAP. IX.

Of the Screw.

THAT which is uſually recited for the Sixth and laſt Mechanick Faculty, is the Screw, which deſcribed to be a kind of Wedge that is multiplied, r continued by a helical Revolution about a Cylinder, receiving its Motion not from any Stroke, but om a Vectis at one End of it. It is uſually diſtinuiſhed into two ſeveral Kinds: The Male which is eant in the former Deſcription, and the Female hich is of a concave Superficies.

Pappus Collect. Mathemat. l. 8.

The



The former is noted in the Figure with the Letter *A*, the other with *F*.

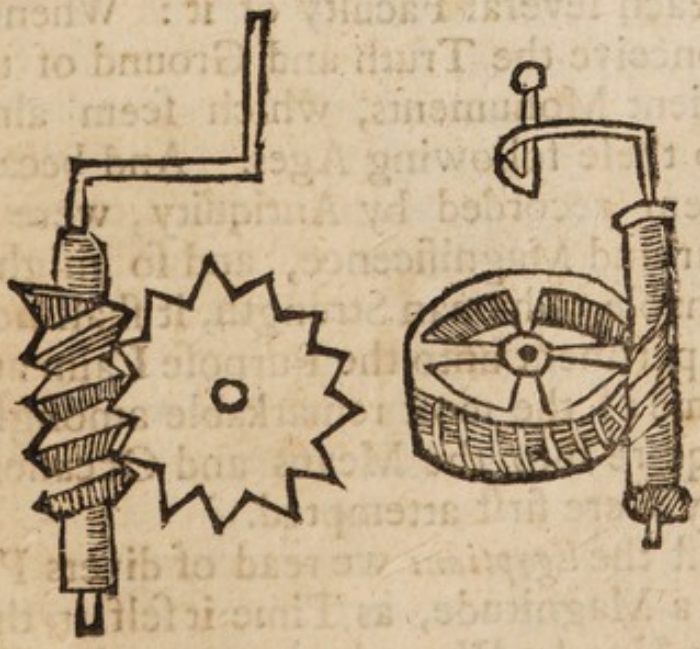
Ariſtotle himſelf doth not ſo much as mention this Inſtrument, which yet notwithſtanding is of greater Force and Subtilty than any of the reſt. It is chiefly applied to the Squeezing or Preſſing of things downwards, as in the Preſſes for Printing; for Wine, Oyl, and extracting the Juice from other Fruits. In the Performance of which, the Strength of one Man, may be of greater Force than the Weight of a heavy Mountain. It is likewiſe uſed for the Elevating or Lifting up of Weights.

The Advantage of this Faculty above the reſt, doth mainly conſiſt in this: The other Inſtruments do require ſo much Strength for the Supporting of the Weight to be moved, as may be equal unto it, beſides that other ſuperadded Power whereby it is out-weighed and moved; ſo that in the Operations by theſe, a Man does always ſpend himſelf in a continued Labour.

Thus (for Example) a Weight that is lifted up by a Wheel or Pulley, will of it ſelf deſcend, if there be not an equal Power to ſuſtain it. But now in the Compoſure of a Screw, this Inconvenience is perfectly remedied; for ſo much Force as is communicated

nunicated unto this Faculty from the Power that is pplied unto it, is ſtill retained by the very Frame nd Nature of the Inſtrument it ſelf; ſince the Mo- on of it cannot poſſibly return, but from the very me Place where it firſt began. Whence it comes o paſs, that any Weight lifted up with the Aſſiſtance f this Engine, may likewiſe be ſuſtained by it ithout the Help of any external Power; and cannot gain deſcend unto its former Place, unleſs the handle f the Screw (where the Motion firſt began) be rned back: So that all the Strength of the Power ay be employed in the Motion of the Weight, and one ſpent in the Suſtaining of it.

The chief Inconvenience of this Inſtrument is, at in a ſhort Space it will be ſcrewed unto its full ngth, and then it cannot be of any further Uſe for e Continuance of the Motion, unleſs it be re- rned back, and undone again as at the firſt. But is is uſually remedied by another Invention, com- only ſtyled a *perpetual Screw*, which hath the *Moti-* of a *Wheel*, and the *Force* of a *Screw*, being both finite.



For the Compoſure of which, inſtead of the Fe-

male

It is used in some Watches.

male, or concave Screw, there must be a little Wheel with some Notches in it, equivalent to Teeth by which the other may take hold of it, and turn it round, as in these other Figures.

This latter Engine does so far exceed all other Contrivances to this purpose, that it may justly seem a Wonder why it is not of as common Use in these Times and Places, as any of the rest.

CHAP. X.

An Enquiry into the magnificent Works of the Ancients, which much exceeding our latter Times may seem to infer a Decay in these Mechanical Arts.

THus have I briefly treated concerning the general Principles of Mechanicks, together with the distinct Proportions betwixt the Weight and the Power in each several Faculty of it: Whence it is easie to conceive the Truth and Ground of those famous Ancient Monuments, which seem almost incredible to these following Ages. And because many of them recorded by Antiquity, were of such vast Labour and Magnificence, and so mightily disproportionable to human Strength, it shall not therefore be impertinent unto the Purpose I aim at, for to specify some of the most remarkable amongst them, and to enquire into the Means and Occasion upon which they were first attempted.

Amongst the *Egyptians* we read of divers Pyramids of so vast a Magnitude, as Time it self in the Space of so many Hundred Years hath not yet devoured. *Herodotus* mentions one of them, Erected by *Cleopes* an *Egyptian* King, wherein there was not any one

Lib. 2. *c.* 175.

Stone

one leſs than 30 Foot long, all of them being tched from *Arabia*. And not much after, the ſame uthor relates, how *Amaſis* another *Egyptian*, made mſelf a Houſe of one entire Stone, which was 21 ubits long, 14 broad, and 8 Cubits high. The me *Amaſis* is reported to have made the Statue of *Sphink*, or *Egyptian* Cat, all of one ſingle Stone; hoſe Length was 143 Foot, its Height 62 Foot, e Compaſs of this Statue's Head containing 102 oot. In one of the *Egyptian* Temples conſecrated *Jupiter*, there is related to be an *Obelisk*, conſiſting of 4 Smaragds or Emeralds; the whole is 40 ubits high, 4 Cubits broad at the Bottom, and o at the Top. *Seſoſtris* the King of *Egypt*, in a emple at *Memphis*, dedicated to *Vulcan*, is reported have Erected two Statues; one for himſelf, the her for his Wife, both conſiſting of two ſeveral ones, each of which were 30 Cubits high.

Plin. l. 36. c. 12.

Plin. l. 37. cap. 5.

Diodor. Sicul. Biblioth. l. 1. *Sect.* 2.

Amongſt the *Jews* we read in Sacred Writ of *Solomon's* Temple, which for its State and Magnificence, ight have been juſtly reckoned amongſt the other onders of the World; wherein beſides the great iches of the Materials, there were Works too of great Labour. Pillars of Braſs 18 Cubits high, id 12 Cubits round; great and coſtly Stones for e Foundation of it: *Joſephus* tells us that ſome of em were 40 Cubits, others 45 Cubits long. And the ſame Chapter he mentions the three famous owers built by *Herod*; wherein every Stone being white Marble, was 20 Cubits long, 10 broad, and high. And which was the greateſt Wonder, the d Wall it ſelf was ſituated on a ſteep riſing Ground, nd yet the Hills upon it, on the Tops of which eſe Towers were placed, were about 30 Cubits gh, that 'tis ſcarce imaginable by what Strength ſo any Stones of ſuch great Magnitude ſhould be nveyed to ſo high a Place.

1 King. 7. 15. c. 5. v. 17.

De bello Juda. l. 6. cap. 6.

Amongſt the *Grecians* we read of the *Epheſian* Tem-

Plin. l. 36. cap. 14. *Pancirol. Deperd. Tit.* 32. ple dedicated to *Diana*; wherein there were 127 Columns made of ſo many ſeveral Stones, each of them 60 Foot high, being all taken out of the Quarries in *Aſia*. 'Tis ſtoried alſo of the Brazen *Coloſſus* or great Statue in the Iſland of *Rhodes*, that it was 70 Cubits high. The Thumbs of it being ſo big that no Man could graſp one of them about with both his Arms; when it ſtood upright, a Ship might have paſſed betwixt the Legs of it, with all its Sails fully diſplayed; being thrown down by an Earthquake, the Braſs of it did load 900 Camels. But above all Ancient Deſigns to this Purpoſe, that would have been moſt wonderful, which a *Grecian* Architect did propound unto *Alexander*, to cut the Mountain *Athos* into the Form of a Statue, which in his Right Hand ſhould hold a Town capable of Ten thouſand Men, and in his Left a Veſſel to receive all the Water that flowed from the ſeveral Springs in the Mountain. But whether *Alexander* in his Ambition did fear that ſuch an Idol ſhould have more Honour than he himſelf, or whether in his good Husbandry, he thought that ſuch a *Microcoſm* (if I may ſo ſtyle it) would have coſt him almoſt as much as the Conquering of this great World, or whatever elſe was the Reaſon, he refuſed to attempt it.

Plin. l. 34. cap. 3.

Vitruv. Archit. l. 2.

Suet. Ner. Amongſt the *Romans* we read of a Brazen *Coloſſus*, made at the Command and Charges of *Nero*, which was 120 Foot high; *Martial* calls it *Sydereus*, or Starry.

Hic ubi Sydereus propius videt aſtra Coloſſus.

Pancirol. Deperd. Tit. 28. And it is ſtoried of *M. Curio*, that he erected two *Theatres* ſufficiently capacious of People, contrived moveable upon certain Hinges; ſometimes there were ſeveral Plays and Shows in each of them, neither being any Diſturbance to the other; and ſometimes they were both turned about, with the People in them, and the Ends meeting together, did make a perfect *Amphitheatre*; So that the Spectators which

were

vere in either of them, might jointly behold the ame Spectacles.

There were beſides at *Rome* ſundry *Obelisks*, made f ſo many entire Stones, ſome of them 40, ſome o, and others 90 Cubits high. The chief of them vere brought out of *Egypt*, where they were dug ut of divers Quarries, and being wrought into orm, were afterwards (not without incredible La- our, and infinite Charges) conveyed unto *Rome*. n the Year 1586, there was erected an old *Obelisk* vhich had been formerly dedicated unto the Memo- y of *Julius Cæſar*. It was one ſolid Stone, being an phite or kind of ſpotted Marble. The Height of was 107 Foot, the Breadth of it at the Bottom was 2 Foot, at the Top 8. Its whole Weight is reckon- d to be 956148 Pounds; beſides the Heavineſs of l thoſe Inſtruments that were uſed about it, which as it is thought) could not amount to leſs then 042824 Pounds. It was tranſplaced at the Char- es of Pope *Sixtus* the Fifth, from the left Side of he *Vatican* unto a more eminent Place about a hun- red Foot off, where now it ſtands. The moving f this *Obelisk* is celebrated by the Writings of above 6 ſeveral Authors, (ſaith *Monantholius*) all of them entioning it, not without much Wonder and raiſe. Now if it ſeem ſo ſtrange and glorious an At- mpt to move this *Obelisk* for ſo little a Space, what en may we think of the Carriage of it out of *Egypt*, nd divers other far greater Works performed by An- quity? This may ſeem to infer that theſe Mecha- cal Arts are now loſt, and decayed amongſt the any other Ruins of Time: Which yet notwith- nding cannot be granted, without much Ingrati- de to thoſe Learned Men, whoſe Labours in this nd we enjoy, and may juſtly boaſt of. And there- re for our better underſtanding of theſe Particu- rs, it will not be amiſs to enquire both *why*, and *w* ſuch Works ſhould be performed in thoſe former

Idem Tit. 31.

Comment. in Mechan. Ariſt. c. 19.

and ruder Ages, which *are not*, and (as it ſhould ſeem) *cannot* be effected in theſe later and more Learned Times. In the Examination of which, we ſhall find that it is not the want of Art that diſables us for them, ſince theſe Mechanical Diſcoveries are altogether as perfect, and (I think) much more exact now, than they were heretofore; but it is, becauſe we have not either the ſame *Motives* to attempt ſuch Works, or the ſame *Means* to effect them as the Ancients had.

CHAP. XI.

That the Ancients had divers Motives *and* Means *for ſuch vaſt Magnificent Works, which we have not.*

THE *Motives* by which they were excited to ſuch Magnificent Attempts, we may conceive to be chiefly Three:

Religion.
Policy.
Ambition.

1. *Religion.* Hence was it that moſt of theſe ſtately Buildings were intended for ſome Sacred Uſe, being either Temples or * Tombs, all of them Dedicated to ſome of their Deities. It was an inbred Principle in thoſe ancient Heathen, that they could not chuſe but merit very much by being liberal in their outward Services. And therefore we read of *Cræſus*, that being overcome in a Battel, and taken by *Cyrus*, he did revile the Gods of Ingratitude, becauſe they had no better Care of him, who had ſo frequently adored them with coſtly Oblations. And as they did conceive themſelves bound to part with their Lives in defence of their Religion, ſo

* As Pyramids, Obelisks.

Herodot. l. 1.

ſo likewiſe to employ their utmoſt Power and Eſtate about any ſuch Deſign which might promote or advance it. Whereas now, the generality of Men, eſpecially the wiſeſt Sort amongſt them, are in this reſpect of another Opinion, counting ſuch great and immenſe Labours, to be at the beſt but Glorious Vanities. The Temple of *Solomon* indeed was to be a Type, and therefore it was neceſſary that it ſhould be ſo extraordinarily Magnificent, otherwiſe perhaps a much cheaper Structure might have been as commendable and ſerviceable.

2. *Policy.* That by this means they might find out Employment for the People, who of themſelves being not much civiliz'd, might by Idleneſs quickly grow to ſuch a Rudeneſs and Barbariſm, as not to be bounded within any Laws of Government. Again, by this Means the Riches of the Kingdom did not lie idlely in their Kings Treaſuries, but was always in Motion; which could not but be a great Advantage and Improvement to the Commonwealth. And perhaps ſome of them feared leſt if they ſhould leave too much Money unto their Succeſſors, it might be an occaſion to enſnare them in ſuch idle and vain Courſes, as would ruin their Kingdoms: Whereas in theſe latter Ages, none of all theſe politick Incitements can be of any force, becauſe now there is Employment enough for all, and Money little enough for every one. *Plin. l. 6. c. 12.*

3. *Ambition* to be known unto Poſterity; and hence likewiſe aroſe that incredible Labour and Care they beſtowed, to leave ſuch Monuments behind them as might * *continue for ever*, and make them famous unto all After-ages. This was the reaſon of *Abſalom*'s Pillar, ſpoken of in Scripture, *to keep his Name in remembrance.* And doubtleſs this too was the end which many other of the Ancients have aimed at, in thoſe (as they thought) everlaſting Buildings. Pſal. 45. 11. 2 Sam. 18 18.

But now these later Ages are much more active and stirring; so that every ambitious Man may find so much Business for the present, that he shall scarce have any leisure to trouble himself about the future. And therefore in all these Respects, there is a great disproportion betwixt the Incitements of those former and these later times, unto such Magnificent Attempts.

Again, as they differ much in their *Motives* unto them, so likewise in the Means of effecting them.

There was formerly more Leisure and Opportunity, both for the Great Men to undertake such Works, and for the People to perfect them. Those past Ages were more quiet and peaceable, the Princes rather wanting Employment, than being over-press'd with it, and therefore were willing to make choice of such great Designs, about which to busy themselves. Whereas now the World is grown more politick, and therefore more troublesome; every Great Man having other private and necessary Business about which to employ both his Time and Means. And so likewise for the Common People, who then living more wildly, without being confined to particular Trades and Professions, might be more easily collected about such famous Employments; whereas now, if a Prince have any occasion for an Army, it is very hard for him to raise so great a Multitude as were usually employed about these Magnificent Buildings. We read of 360000 Men that were busied for Twenty Years in making one of the *Ægyptian* Pyramids. And *Herodotus* tells us of 1000000 Men who were as long in building another of them. About the Carriage of one Stone for *Amasis* the distance of twenty Days Journey, there was for Three Years together employed 2000 chosen Men, Governors, besides many other Under-Labourers. 'Twas the Opinion of * *Josephus* and *Nazianzen*, that these Pyramids were built by *Joseph* for Grana-

Lib. 2.

Antiq. l. 2. 5.

Granaries againſt the Years of Famine. Others think that the Brick made by the Children of *Iſrael*, was employed about the framing of them, becauſe we read that the Tower of *Babel* did conſiſt of Brick or artificial Stone, *Gen.* 11. 3. And if theſe were the Labourers that were buſied about them, 'tis no wonder though they were of ſo vaſt a Magnitude; for we read that the Children of *Iſrael* at their coming out of *Ægypt*, were numbred to be Six hundred thouſand, and Three thouſand, and Five hundred and Fifty Men, *Numb.* 1. 46. So many handfuls of Earth would almoſt make a Mountain, and therefore we may eaſily believe that ſo great a Multitude in ſo long a ſpace as their Bondage laſted, for above four hundred Years, might well enough accompliſh ſuch vaſt Deſigns.

In the building of *Solomon*'s Temple, there were Threeſcore and Ten thouſand that bare Burdens, and Fourſcore thouſand Hewers in the Mountains, *Kings* 5. 15.

The *Epheſian* Temple was built by all *Aſia* joyning together; the 127 Pillars were made by ſo many Kings, according to their ſeveral Succeſſions, the whole Work being not finiſhed under the ſpace of Two hundred and Fifteen Years. Whereas the tranſplacing of that Obelisk at *Rome* by *Sixtus* the Vth. (ſpoken of before) was done in ſome few Days by Five or Six hundred Men; and as the Work was much leſs than many other recorded by Antiquity, ſo the Means by which it was wrought, was yet far leſs in this reſpect than what is related of them.

2. The abundance of Wealth, which was then incroſſed in the poſſeſſion of ſome few particular Perſons, being now diffuſed amongſt a far greater Number. There is now a greater equality amongſt Mankind, and the flouriſhing of Arts and Sciences hath ſo ſtirred up the Sparks of Men's natural Nobility, and made them of ſuch active and induſtri-

ous Spirits, as to free themſelves in a great meaſure from that Slavery, which thoſe former and wilder Nations were ſubjected unto.

In building one of the Pyramids, there was expended for the Maintenance of the Labourers with Radiſh and Onyons, no leſs than Eighteen hundred Talents, which is reckoned to amount unto 1880000 Crowns, or thereabouts. And conſidering the cheapneſs of theſe things in thoſe Times and Places, ſo much Money might go farther than a Sum ten times greater could do in the Maintenance of ſo many now.

In *Solomon*'s Temple we know how the extraordinary Riches of that King, the general flouriſhing of the whole State, and the Liberality of the People did jointly concur to the Building of the Temple. *Pecuniarum copia & populi largitas, majora dictu conabatur,* (ſaith *Joſephus.*) The *Rhodian Coloſſus* is reported to have coſt Three hundred Talents the making; and ſo were all thoſe other famous Monuments of proportionable Expence.

De Bell. Jud. l. 6. cap. 6.

Pancirollus ſpeaking of thoſe Theatres that were erected at the Charges of ſome private *Roman* Citizens, ſaith thus: *Noſtro hoc ſæculo vel Rex ſatis haberet quod ageret ædificio ejuſmodi erigendo*; and a little after upon the like Occaſion, *Res mehercule miraculoſa, quæ noſtris temporibus vix à potentiſſimo aliquo rege poſſit exhiberi.*

Deperd. Tit. 18.

3. Add unto the two former Conſiderations, that exact *Care* and indefatigable *Induſtry* which they beſtowed in the raiſing of thoſe Structures; theſe being the chief and only Deſigns on which many of them did employ all their beſt Thoughts and utmoſt Endeavours. *Cleopes* an *Ægyptian* King is reported to have been ſo deſirous to finiſh one of the Pyramids, that having ſpent all about it he was worth, or could poſſibly procure, he was forced at laſt to proſtitute his own Daughter for neceſſary Maintenance.

nance. And we read of *Ramiſes* another King of *Ægypt*, how that he was ſo careful to erect an Obelisk, about which he had employed 20000 Men, that when he feared leſt through the negligence of the Artificers, or weakneſs of the Engine, the Stone might fall and break, he tyed his own Son to the Top of it, that ſo the care of his Safety might make the Workmen more circumſpect in their Buſineſs. And what ſtrange Matters may be effected by the meer diligence and labour of great Multitudes, we may eaſily diſcern from the wild *Indians*, who having not the Art or Advantage of Engines, did yet by their unwearied Induſtry remove Stones of an incredible greatneſs. *Acoſta* relates that he himſelf meaſured one at *Tiaguanaco*, which was Thirty eight Foot long, Eighteen broad, and Six thick; and he affirms, that in their ſtatelieſt Ædifices there were many other of much vaſter Magnitude.

Plin. l. 36. *c.* 9.

Hiſtor. Ind. l. 6. *c.* 14.

From all which Conſiderations, it may appear, that the ſtrangeneſs of thoſe ancient Monuments above any that are now effected, does not neceſſarily infer any defect of Art in theſe later Ages. And I conceive, it were as eaſie to demonſtrate the Mechanical Arts in theſe times to be ſo far beyond the knowledge of former Ages, that had we but the ſame Means as the Ancients had, we might effect far greater Matters than any they attempted, and that too in a ſhorter ſpace, and with leſs Labour.

CHAP.

CHAP. XII.

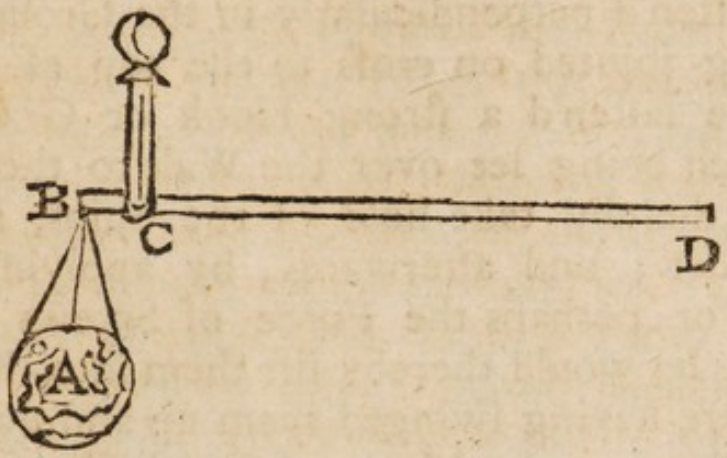
Concerning the Force of the Mechanick Faculties; particularly the Balance and Leaver. How they may be contrived to move the whole World, or any conceivable Weight.

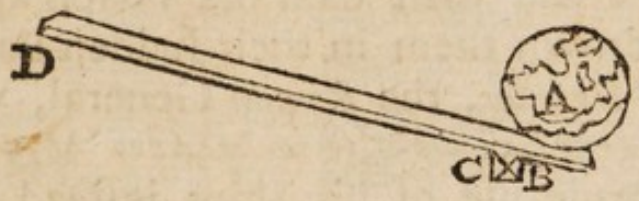
ALL theſe Magnificent Works of the Ancients before ſpecify'd, are ſcarce conſiderable in reſpect of Art, if we compare them with the famous Speeches and Acts of *Archimedes*: Of whom it is reported, that he was frequently wont to ſay, how that he could move *Datum pondus, cum data potentiâ*; the greateſt conceivable Weight, with the leaſt conceivable Power: And that if he did but know where to ſtand and faſten his Inſtrument, he could move the World, all this great Globe of Sea and Land. Which *Promiſes*, tho' they were altogether above the vulgar Apprehenſion or Belief, yet becauſe his Acts were ſomewhat anſwerable thereunto, therefore the King of *Syracuſe* did enact a Law, whereby every man was bound to believe whatever *Archimedes* would affirm.

'Tis eaſy to demonſtrate the Geometrical Truth of thoſe ſtrange Aſſertions, by examining them according to each of the forenamed *Mechanick* Faculties, every one of which is of infinite Power.

To begin with the two firſt of them, the Balance and the Leaver, (which I here join together, becauſe the Proportions of both are wholly alike;) 'tis certain, tho' there ſhould be the greateſt imaginable Weight, and the leaſt imaginable Power, (ſuppoſe the whole World, and the Strength of one Man, or Infant;) yet if we conceive the ſame Diſproportion betwixt their ſeveral Diſtances in the former Faculties, from the Fulciment, or Center of Gravity, they would both equiponderate. And if the

the Diſtance of the Power from the Center, in comparison to the Diſtance of the Weight, were but any thing more than the Heavineſs of the Weight is in reſpect of the Power, it may then be evident from the former Principles, that the Power would be of greater Force than the Weight, and conſequently able to move it.





Thus, if we ſuppoſe this great Globe at *A* to contain 24000000000000000000000000 Pounds, allowing a Hundred Pound for each Cubical Foot in it, (as *Stevinius* hath calculated) yet a Man or Child at *D*, whoſe Strength perhaps is but equivalent to One hundred, or Ten Pounds Weight, may be able to outweigh and move it; if there be but a little greater Diſproportion betwixt the two Diſtances *C D* and *C B*, than there is betwixt the Heavineſs of the Weight, and the Strength of the Power; that is, if the Diſtance *C D*, unto the other Diſtance *C B*, be any thing more than 24000000000000000000000000 unto 100 or 10, every *Static. l. 3. prop.* 10.

ry ordinary Inſtrument doth include all theſe Parts *really*, tho' not ſenſibly diſtinguiſhed.

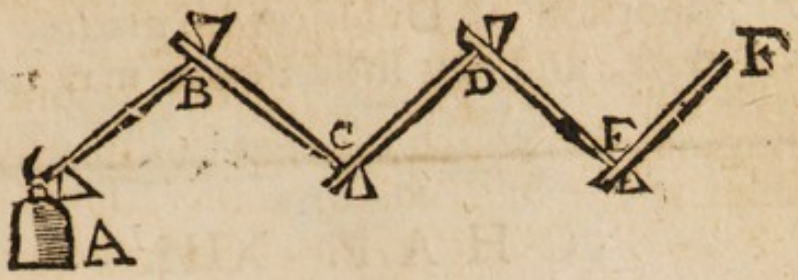
Lipſius Poliorcet. l. 1. Dialog. 6.

Under this latter Faculty, I did before mention that Engine, by which *Archimedes* drew up the *Roman* Ships at the Siege of *Syracuſe*. This is uſually ſtiled *Tollenon*, being of the ſame Form with that which is commonly uſed by Brewers and Dyers, for the drawing of Water. It conſiſts of two Poſts; the one faſten'd perpendicularly in the Ground, the other being jointed on croſs to the top of it. At the end he faſten'd a ſtrong Hook or Grapple of Iron, which being let over the Wall to the River, he would thereby take hold of the Ships, as they paſſed under; and afterwards, by applying ſome Weight, or perhaps the Force of Screws to the other end, he would thereby lift them into the open Air; where having ſwinged them up and down till he had ſhaken out the Men and Goods that were in them, he would then daſh the Veſſels againſt the Rocks, or drown them in their ſudden Fall: Inſomuch that *Marcellus*, the *Roman* General, was wont to ſay, Τὸν μὲν ναυσὶν ὥσπερ κωθωνίζειν ἐν θαλάττῃ Ἀρχιμήδη, That *Archimedes* made uſe of his Ships inſtead of Buckets to draw Water with.

Plutarch in his Life.

This Faculty will be of the ſame Force, not only when it is continued in one, but alſo when it is multiplied in divers Inſtruments; as may be conceived in this other Form; which I do not mention, as if it could be ſerviceable for any other Motion, (ſince the Space by which the Weight would be moved, will be ſo little as not to fall under Senſe) but only for the better Explication of this Mechanick Principle, and for the right underſtanding of that Force ariſing from Multiplication in the other Faculties, which do all depend upon this. The Wheel, and Pulley, and Screw, being but as ſo many Leavers of a Circular Form and Motion, whoſe Strength may be therefore continued to a greater Space.

Imagine



Imagine the Weight *A* to be a Hundred thouſand Pounds, and the Diſtance of that Point, wherein every Leaver touches either the Weight, or one another from the Point where they touch the Prop, to be but one ſuch Part, whereof the Remainder contains ten; then according to the former Grounds, 10000 at *B* will equiponderate to *A*, which is 100000; ſo that the ſecond Leaver hath but 10000 Pounds to move. Now, becauſe this obſerves the ſame Proportions with the other, in the Diſtances of its ſeveral Points, therefore 1000 Pounds at *C* will be of equal Weight to the former: And the Weight at *C* being but as a Thouſand Pound, that which is but as a Hundred at *D*, will be anſwerable unto it; and ſo ſtill in the ſame Proportion, that which is but 10 at *E*, will be equal to 100 at *D*; and that which is but one Pound at *F*, will alſo be equal to ten at *E*. Whence it is manifeſt, that one Pound at *F* is equal to 100000 at *A*; and the Weight muſt always be diminiſhed in the ſame Proportion as ten to one, becauſe in the multiplication of theſe Leavers, the Diſtance of the Point where the Inſtrument touches the Weight, from that where it touches the Prop, is but as one ſuch Part, whereof the Remainder contains ten. But now if we imagine it to be as the Thouſandth Part, then muſt the Weight be diminiſhed according to this Proportion; and then in the ſame multiplication of Leavers, 1 Pound will be equal to 1000 000 000 000 000 Pounds: So that tho' we

ſuppoſe

ſuppoſe the Weight to be never ſo heavy, yet let the Diſproportion of Diſtances be greater, or the Leavers more, and any little Power may move it.

CHAP. XIII.

Of the Wheel: By Multiplication of which, it is eaſy to move any imaginable Weight.

THE Wheel, or *Axis in Peritrochio*, was before demonſtrated to be of equivalent Force with the former Faculties. If we conceive the ſame Difference betwixt the Semidiameter of the Wheels, or Spokes *A C*, and the Semidiameter of the *Axis A B*, as there is betwixt the Weight of the World, and the Strength of a Man; it may then be evident, that this Strength of one Man, by the help of ſuch an Inſtrument, will equiponderate to the Weight of the whole World. And if the Semidiameter of the Wheel *A C*, be but any thing more in reſpect of the Semidiameter of the *Axis A B*, than the Weight of the World ſuppoſed at *D*, is in compariſon to the Strength of a Man at *C*; it may then be manifeſt from the ſame Grounds, that this Strength will be of ſo much greater Force than the Weight, and conſequently able to move it.

See the figure, *c.* 6.

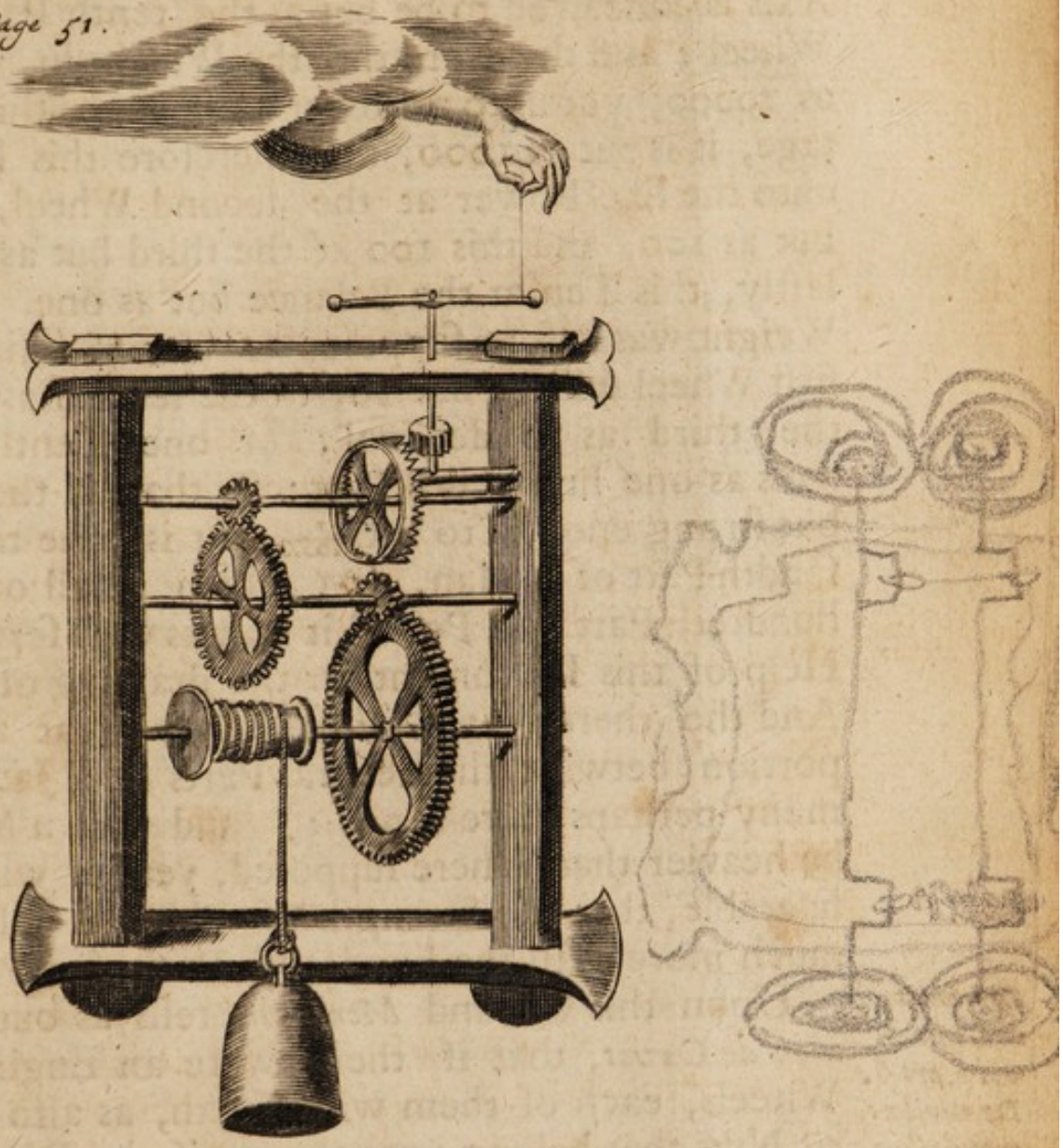
An Engine of many Wheels is commonly called *Gloſſocomus*.

The Force of this Faculty may be more conveniently underſtood and uſed by the Multiplication of ſeveral Wheels, together with Nuts belonging unto each of them; as it may be eaſily experimented in the ordinary Jacks that are uſed for the roaſting of Meat, which commonly conſiſt but of three Wheels; and yet if we ſuppoſe a Man ty'd in the place of the Weight, it were eaſy by a ſingle Hair faſtned unto the Fly or Balance of the Jack, to draw him up from the Ground: As will be evident from this following Figure.

How to pull a man above Ground with a ſingle Hair.

Where

Page 51.



Where ſuppoſe the Length of the Fly or Balance in compariſon to the Breadth of its Axis, to be as 10 to one, and ſo for the three other Wheels in reſpect of the Nuts that belong unto them; (tho' this Difference be oftentimes leſs, as we may well allow it to be); withal ſuppoſe the Weight (or a Man tied in the Place of it) to be a hundred Pounds: I ſay according to this Suppoſition, it is evident that the

Power

Power at the Balance which ſhall be equal to the Weight, need be but as 1 to 10000. For the firſt Axis is conceived to be but as the tenth Part of its Wheel; and therefore tho' the Weight in it ſelf be as 10000, yet unto a Power that hath this Advantage, it is but as 1000, and therefore this Thouſand unto the like Power at the ſecond Wheel, will be but as 100, and this 100 at the third but as 10; and laſtly, this Ten at the Balance but as one. But the Weight was before ſuppoſed to be 100, which to the firſt Wheel will be but 10, to the ſecond as one, to the third as a decimal, or one Tenth to the Sails as one hundredth Part: So that if the Hair be but ſtrong enough to lift $\frac{1}{10000}$ that is, one ten thouſandth Part of a Man, or (which is all one) one hundreth Part of a Pound, it may as well ſerve by the Help of this Inſtrument for the drawing of him up. And tho' there be not altogether ſo great a Diſproportion betwixt the ſeveral Parts of a Jack (as in many perhaps there is not;) and tho' a Man may be heavier than is here ſuppoſed, yet 'tis withal conſiderable, that the Strength of a Hair is able to bear much more than the hundredth Part of a Pound.

Comment. in Gen. c. 1. v. 10. art. 6. De viribus motricibus Theor. 16.

Upon this Ground *Merſennus* tells us out of *Solomon de Cavet*, that if there were an Engine of 12 Wheels, each of them with Teeth, as alſo the Axes or Nuts that belong unto them; if the Diameter of theſe Wheels were unto each *Axis*, as a hundred to one; and if we ſuppoſe theſe Wheels to be ſo placed, that the Teeth of the one might take hold of the *Axis* that belongs unto the next, and that the *Axis* of the Handle may turn the firſt Wheel, and the Weight be tied unto the Axis of the laſt; with ſuch an Engine as this, ſaith he, a Child (if he could ſtand any where without this Earth) might with much eaſe move it towards him.

For

For according to the former Supposition, that this Globe of Sea and Land did contain as many hnndred Pounds as it doth Cubical Feet, *viz.* 240000000000000000000000, it may be evident that any Strength, whose Force is but equivalent to 3 Pounds, will by such an Engine be able to move it.

Of this kind was that Engine so highly extolled by *Stevinus*, which he calls *Pancration*, or *Omnipotent*, preferring it before the Inventions of *Archimedes*. It consisted of Wheels and Nuts, as that before specified is supposed. Hither also should be referred the Force of Racks, which serve for bending of the strongest Bows, as also that little Pocket Engine, wherewith a Man may break or wrench open any Door, together with divers the like Instruments in common Use.

De Statica praxi.

Ramelli Fig. 160.

CHAP. XIV.

Concerning the infinite Strength of Wheels, Pulleys, and Screws. That it is possible by the Multiplication of these, to pull up any Oak by the Roots with a Hair, lift it up with a Straw, or blow it up with ones Breath, or to perform the greatest Labour with the least Power.

FRom what hath been before delivered concerning the Nature of the Pulley, it is easie to understand how this Faculty also may be proportioned betwixt any Weight, and any Power, as being likewise of infinite Strength.

'Tis reported of *Archimedes*, that with an Engine of Pulleys, to which he applied only his Left Hand, he lifted up * 5000 Bushels of Corn at once, and

* 7000 saith *Zetzes Chiliad.* 2. *Hist.* 35.

drew a Ship with all its Lading upon dry Land. This Engine *Zetzes* calls *Triſpatum*, or *Triſpaſtum*, which ſignifies only a threefold Pulley: But herein he doth evidently miſtake, for 'tis not poſſible that this alone ſhould ſerve for the Motion of ſo great a Weight; becauſe ſuch an Engine can but make a Subſextuple, or at moſt a Subſeptuple Proportion betwixt the Weight and Power; which is much too little to reconcile the Strength of a Man unto ſo much Heavineſs. Therefore *Ubaldus* doth more properly ſtyle it, *Polyſpaſton*; or an Inſtrument of many Pulleys. How many, were eaſie to find out, if we did exactly know the Weight of thoſe Ancient Meaſures; ſuppoſing them to be the ſame with our Buſhel in *England*, which contains 64 Pints or Pounds, the whole would amount to 320000 Pounds; half of which would be lightned by the Help of one Pulley, Three Quarters by two Pulleys, and ſo onward, according to this Subduple, Subquadruple, and Subſextuple Proportion. So that if we conceive the Strength of the Left Hand to be equivalent unto 20 or 40 Pounds, it is eaſie to find out how many Pulleys are required to enable it for the Motion of ſo great a Weight.

Præf. ad Mechan.

Comment. in Gen. c. 1. v. 10. art. 6.

Upon this Ground *Merſennus* tells us, that any little Child with an Engine of an hundred double Pulleys, might eaſily move this Great Globe of Earth, tho' it were much heavier than it is. And in reference to this kind of Engine (ſaith *Monantholius*) are we to underſtand that Aſſertion of *Archimedes*, (as he more immediately intended it) concerning the Poſſibility of moving the World.

Præf. ad Mechan. Ariſtotle.

The Wedge was before demonſtrated to be as a double Vectis or Leaver, and therefore it would be needleſs to explain particularly how this likewiſe may be contrived of infinite Force.

The Screw is capable of Multiplication, as well

as

as any of the other Faculties, and may perhaps be more ſerviceable for ſuch great Weights, than any of the reſt. *Archimedes* his Engine of greateſt Strength, called *Cariſtion*, is by ſome thought to conſiſt of theſe. *Axes habebat cum infinitis Cochleis.* And that other Engine of his called *Helix*, (mentioned by * *Athenæus*) wherewith he lifted *Hiero*'s great Ship into the Sea, without any other Help, is moſt likely to be framed of perpetual Screws, ſaith *Rivaltus*.

Stevin. de Static. prax.

See *Beſſon.*

* *Deipnoſophiſt. l. 5. Oper. exter. Archimed.*

Whence it may evidently appear, that each of theſe Mechanick Faculties are of infinite power, and may be contrived proportionable unto any conceivable Weight. And that no natural Strength is any way comparable unto theſe artificial Inventions.

'Tis reported of *Sampſon*, that he could carry the Gates of a City upon his Shoulders; and that the ſtrongeſt Bonds were unto him but as Flax burnt with Fire, and yet his Hair being ſhaved off, all his Strength departed from him. We * read of *Milo* that he could carry an Ox upon his Back, and yet when he tried to tear an Oak aſunder that was ſomewhat riven before, having drawn it to its utmoſt, it ſuddenly joined together again, catching his Hands in the Cleft, and ſo ſtrongly manacled him, that he became a Prey to the wild Beaſts.

Judg. 15.

* *A. Gell. Noct. Att. l. 15. c. 16.*

But now by theſe Mechanical Contrivances, it were eaſy to have made one of *Sampſon*'s Hairs that was ſhaved off, to have been of more Strength than all of them when they were on. By the Help of theſe Arts it is poſſible (as I ſhall demonſtrate) for any Man to lift up the greateſt Oak by the Roots with a Straw, to pull it up with a Hair, or to blow it up with his Breath.

Suppoſe the Roots of an Oak to extend a thouſand Foot Square, (which is almoſt a Quarter of a Mile) and Forty Foot deep, each Cubical Foot being an

hundred Pound Weight; which tho' it be much beyond the Extenſion of any Tree, or the Weight of Earth; the Compaſs of the Roots in the Ground (according to common Opinion) not extending further than the Branches of it in the Air, and the Depth of it not above ten Foot, beyond which the greateſt Rain doth not penetrate (ſaith * *Seneca.*) *Ego vinearum diligens foſſor affirmo nullam pluviam eſſe tam magnam, quæ terram ultra decem pedes in altitudinem madefaciat.* And becauſe the Root muſt receive its nouriſhment from the Help of Showers, therefore it is probable that it doth not go below them. So that (I ſay) tho' the Proportions ſuppoſed do much exceed the real Truth, yet it is conſiderable that ſome great Overplus muſt be allowed for that Labour which there will be in the forcible Divulſion or Separation of the Parts of the Earth which are continued.

* *Nat. Qu. l. 3. c. 7.*

According to this Suppoſition, the Work of forcing up the Oak by the Roots, will be equivalent to the lifting up of 4000000000 Pound Weight, which by the Advantage of ſuch an Engine, as is here deſcribed, may be eaſily performed with the leaſt conceivable Power.

The



The whole Force of this Engine doth conſiſt in wo double Pulleys, twelve Wheels, and a Sail.)ne of theſe Pulleys at the Bottom will diminiſh alf of the Weight, ſo that it ſhall be but as ooooooooo, and the other Pulley will abate ¾ three uarters of it; ſo that it ſhall be but as 1000000000. nd becauſe the Beginning of the String being faſt-

ned unto the lower Pulley, makes the Power to be in a ſubquintuple Proportion unto the Weight, therefore a Power that ſhall be as 1000000000, that is, a Subquadruple, will be ſo much ſtronger than the
See ch. 7. Weight, and conſequently able to move it. Now ſuppoſe the Breadth of all the Axes and Nuts to be unto the Diameters of the Wheel as ten to one; and it will then be evident that to a Power at the Firſt Wheel, the Weight is but as 100000000. To the Second as 10000000. To the Third as 1000000. To the Fourth as 100000. To the Fifth as 10000. To the Sixth as 1000. To the Seventh as 100. To the Eighth as 10. To the Ninth as 1. To the Tenth as $\frac{1}{10}$, one Decimal. To the Eleventh as $\frac{1}{1000}$. To the Twelfth as $\frac{1}{10000}$. And to the Sails yet leſs. So that if the Strength of the Straw, or Hair, or Breath, be but equal to the Weight of one thouſandth Part of a Pound, it may be of ſufficient Force to pull up the Oak.

If in this Engine we ſuppoſe the Diſproportion betwixt the Wheels and Nuts to be as a hundred to one, then it is very evident that the ſame Strength of Breath, or a Hair, or a Straw, would be able to move the whole World, as will be eaſily found by Calculation. Let this great Globe of Sea and Land be imagined (as before) to weigh ſo many hundred Pounds as it contains Cubical Feet; namely, 2400000000000000000000000 Pounds. This will be to the firſt Pulley, 120000000000000000000000. To the 2d leſs than 60000000000000000000000. But for more eaſie and convenient reckoning, let it be ſuppoſed to be ſomewhat more, *viz.* 100000000000000000000000. This to the firſt

Wheel

Wheel will be but as	1000000000000000000000.
To the Second as	100000000000000000000.
To the Third as	10000000000000000000.
To the Fourth as	1000000000000000000.
To the Fifth	100000000000000.
To the Sixth	10000000000000.
To the Seventh	1000000000.
To the Eighth	100000000.
To the Ninth	1000000.
To the Tenth	10000.
To the Eleventh	100.
To the Twelfth	1.
To the Sails as	$\frac{1}{100}$.

So that a Power which is much leſs than the hundredth Part of a Pound will be able to move the World.

It were needleſs to ſet down any particular Explication, how ſuch Mechanical Strength may be applied unto all the Kinds of local Motion; ſince this in it ſelf is ſo facil and obvious, that every ordinary Artificer doth ſufficiently underſtand it.

The Species of local violent Motion are by *Ariſtotle* reckoned to be theſe Four: *Phyſ. l. 7. c. 3.*

- *Pulſio.*
- *Tractio.*
- *Vectio.*
- *Vertigo.*

Thruſting, Drawing, Carrying, Turning. Unto ſome of which all theſe Artificial Operations muſt neceſſarily be reduced, the Strength of any Power being equally appliable unto all of them: So that there is no Work impoſſible to theſe Contrivances; but there may be as much acted by this Art, as can be fancied by Imagination.

CHAP. XV.

Concerning the Proportion of Slowneſs and Swiftneſs in Mechanical Motions.

HAving already diſcourſed concerning the Strength of theſe Mechanical Faculties; it remains for the more perfect Diſcovery of their Natures, that we treat ſomewhat concerning thoſe two Differences of Artificial Motion:

{ Slowneſs, and Swiftneſs.

Without the right underſtanding of which, a Man ſhall be expoſed to many abſurd Miſtakes, in attempting of thoſe Things which are either in themſelves impoſſible, or elſe not to be performed with ſuch Means as are apply'd unto them. I may ſafely affirm, that many, if not moſt Miſtakes in theſe Mechanical Deſigns, do ariſe from a Miſapprehenſion of that Difference which there will be betwixt the Slowneſs or Swiftneſs of the Weight and Power, in compariſon to the Proportion of their ſeveral Strengths.

Hence it is, that ſo many Engines invented for Mines and Water-works, do ſo often fail in the Performance of that for which they were intended; becauſe the Artificers many times do forget to allow ſo much time for the working of their Engine, as may be proportionable to the Difference betwixt the Weight and Power that belong unto them: Whereas, he that rightly underſtands the Grounds of this Art, may as eaſily find out the Lif-

ference

ference of Space and Time required to the Motion of the Weight and Power, as he may their different Strengths; and not only tell how any Power may move any Weight, but alſo in what a Space of *Time* it may move it any Space or *Diſtance*.

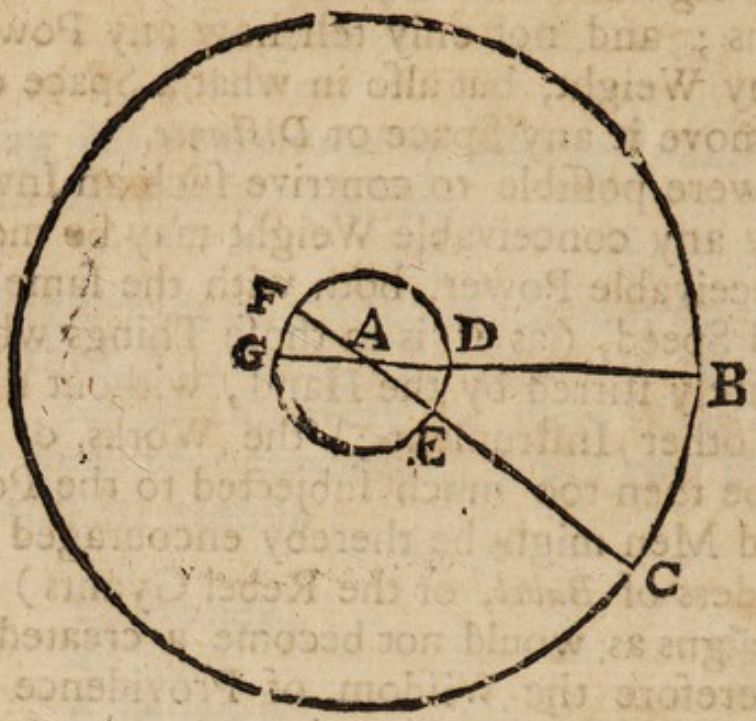
If it were poſſible to contrive ſuch an Invention, whereby any conceivable Weight may be moved by any conceivable Power, both with the ſame Quickneſs and Speed, (as it is in thoſe Things which are immediately ſtirred by the Hand, without the Help of any other Inſtrument;) the Works of Nature would be then too much ſubjected to the Power of Art, and Men might be thereby encouraged (with the Builders of *Babel*, or the Rebel Gyants) to ſuch bold Deſigns as would not become a created Being. And therefore the Wiſdom of Providence hath ſo confined theſe Human Arts, that what any Invention hath in the *Strength* of its Motion, is abated in the *Slowneſs* of it; and what it hath in the extraordinary *Quickneſs* of its Motion, muſt be allowed for in the great *Strength* that is required unto it.

For it is to be obſerved as a general Rule, that the Space of Time or Place, in which the Weight is moved, in compariſon to that in which the Power doth move, is in the ſame Proportion as they themſelves are unto one another.

So that if there be any great Difference betwixt the Strength of the Weight and the Power, the ſame kind of Differences will there be in the Spaces of their Motion.

To illuſtrate this by an Example:

Let



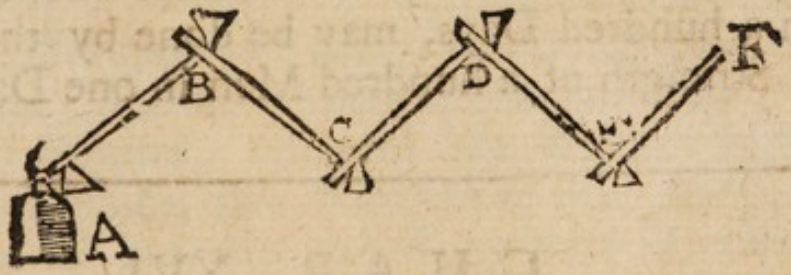
Let the Line *G A B* repreſent a Balance, or Leaver; the Weight being ſuppoſed at the Point *G*, the Fulciment at *A*, and the Power ſuſtaining the Weight at *B*. Suppoſe the Point *G*, unto which the Weight is faſtned, to be elevated unto *F*, and the oppoſite Point *B* to be depreſſed unto *C*; 'tis evident that the Arch *F G*, or (which is all one) *D E*, doth ſhew the Space of the Weight, and the Arch *B C* the Motion of the Power. Now both theſe Arches have the ſame Proportion unto one another, as there is betwixt the Weight and the Power, or (which is all one) as there is betwixt their ſeveral Diſtances from the Fulciment. Suppoſe *A G* unto *A B* to be as one unto four; it may then be evident, that *F G*, or *D E*, will be in the ſame Proportion unto *B C*: For as any two Semidiameters are unto one another, ſo are the ſeveral Circumferences deſcribed by them, as alſo any proportional Parts of the ſame Circumferences.

And as the Weight and Power do thus differ in the Spaces of their Motions, ſo likewiſe in the Slow-

neſs

neſs of it; the one moving the whole Diſtance *B C*, in the ſame time wherein the other paſſes only *G F*. So that the Motion of the Power from *B* to *C*, is four times ſwifter than that of the Weight from *G* to *F*. And thus will it be, if we ſuppoſe the Diſproportions to be far greater; whether or no we conceive it, either by a *Continuation* of the ſame Inſtrument and Faculty, as in the former Example; or by a *Multiplication* of divers, as in Pulleys, Wheels, *&c.* By how much the Power is in it ſelf leſs than the Weight, by ſo much will the Motion of the Weight be ſlower than that of the Power.

To this purpoſe, I ſhall briefly touch at one of the Diagrams expreſſed before in the Twelfth Chapter, concerning the Multiplication of Leavers.



In which, as each Inſtrument doth diminiſh the Weight according to a decuple Proportion, ſo alſo do they diminiſh the *Space* and *Slowneſs* of its Motion. For if we ſhould conceive the firſt Leaver *B* to be depreſſed unto its loweſt, ſuppoſe ten Foot, yet the Weight *A* would not be raiſed above one Foot: But now the ſecond Leaver, at its utmoſt, could move but a Tenth Part of the firſt, and the third Leaver but a Tenth Part of the ſecond; and ſo of the reſt. So that the laſt Leaver *F* being depreſſed, will paſs a *Space* 100000 greater, and by a Motion, 100000 ſwifter than the Weight at *A*.

Thus are we to conceive of all the other Faculties, wherein there is conſtantly the ſame Diſpro-

portion

portion betwixt the Weight and Power, in reſpect of the Spaces and Slowneſs of their Motions, as there is betwixt their ſeveral Gravities. If the Power be unto the Weight but as One unto a Hundred, then the Space through which the Weight moves, will be a hundred times leſs, and conſequently the Motion of the Weight a hundred times ſlower than that of the Power.

So that it is but a vain and impoſſible Fancy for any one to think that he can move a great Weight with a little Power, in a little Space; but in all theſe Mechanical Attempts, that Advantage which is gotten in the Strength of the Motion, muſt be ſtill allowed for the Slowneſs of it.

Tho' theſe Contrivances do ſo extreamly increaſe the Power, yet they do proportionably protract the Time. That which by ſuch Helps one man may do in a hundred Days, may be done by the immediate Strength of a hundred Men in one Day.

CHAP. XVI.

That it is poſſible to contrive ſuch an Artificial Motion, as ſhall be of a Slowneſs proportionable to the Swiftneſs of the Heavens.

IT were a pretty Subtilty to enquire after, Whether or no it be not poſſible to contrive ſuch an Artificial Motion, that ſhould be in ſuch a Proportion ſlow, as the Heavens are ſuppoſed to be ſwift.

For the exact Reſolution of which, it would be requiſite that we ſhould firſt pitch upon ſome *Medium*, or indifferent Motion, by the Diſtance from which, we may judge of the Proportions on either ſide, whether Slowneſs, or Swiftneſs. Now, becauſe there is not any ſuch *Natural Medium*, which

may

may be absolutely stiled an indifferent Motion, but that the Swiftness and Slowness of every thing is still proportioned either to the Quantity of Bodies in which they are, or some other particular End for which they are designed; therefore we must take Liberty to suppose such a Motion; and this we may conceive to be about 1000 Paces, or a Mile in an Hour.

The Starry Heaven, or 8th Sphere is thought to move 42398437 Miles in the same Space: So that if it may be demonstrated that it is possible to contrive such a Motion, which going on in a constant direct Course, shall pass but the 42398437 Part of a Mile in an Hour; it will then be evident, that an artificial Motion may be slow, in the same Proportion as the Heavens are swift.

Now it was before manifested, that according to the Difference betwixt the Weight and Power, so will the Difference be betwixt the Slowness or Swiftness of their Motions; whence it will follow, that in such an Engine, wherein the Weight shall be 42398437 Pounds, and the Power that doth equiponderate it, but the 42398437 Part of a Pound (which is easie to contrive) in this Engine the Power being supposed to move with such a Swiftness as may be answerable to a Mile an Hour, the Weight will pass but the 42398437 Part of a Mile in the same Space, and so consequently will be proportionably slow unto the Swiftness of the Heavens.

It is related by our Country-man *I. Dee*, that he and *Cardan* being both together in their Travels, did see an Instrument which was at first sold for 20 Talents of Gold, wherein there was one Wheel, which constantly moving round amongst the rest, did not finish one Revolution under the Space of seven thousand Years. Preface to *Euclid.*

But if we farther consider such an Instrument of Wheels as was mentioned before in the 14th Chapter,

with

with which the whole World might be eaſily moved, we ſhall then find that the Motion of the Weight by that, muſt be much more ſlow, than the Heavens are ſwift. For tho' we ſuppoſe (ſaith *Stevinus*) the Handle of ſuch an Engine with 12 Wheels to be turned about 4000 Times in an Hour, (which is as often as a Man's Pulſe doth beat) yet in 10 Years Space the Weight by this would not be moved above $\frac{.0512}{2488}$ooooooooooooooo Parts of one Foot, which is nothing near ſo much as a Hairs breadth. And it could not paſs an Inch in 1000000 Years, ſaith *Merſennus*.

De ſtat. pract.

Phænom. Mechan. Prop. 11.

The Truth of which we may more eaſily conceive, if we conſider the Frame and Manner of this 12 wheel'd Engine. Suppoſe that in each Axis or Nut, there were ten Teeth, and on each Wheel a thouſand: Then the Sails of this Engine muſt be turned a hundred Times, before the firſt Wheel, (reckoning downward) could be moved round once, and Ten thouſand Times before the ſecond Wheel can finiſh one Revolution, and ſo through the 12 Wheels, according to this multiplied Proportion.

So that beſides the Wonder which there is in the Force of theſe Mechanical Motions, the extream Slowneſs of them is no leſs admirable. If a Man conſiders that a Body ſhould remain in ſuch a conſtant direct Motion, that there could not be one Minute of Time, wherein it did not rid ſome Space and paſs on further, and yet that this Body in many Years together ſhould not move ſo far as a Hair's Breadth.

Which notwithſtanding may evidently appear from the former Inſtance. For ſince it is a natural Principle, that there can be no Penetration of Bodies; and ſince it is ſuppoſed, that each of the Parts in this Engine do touch one another in their Superficies; therefore it muſt neceſſarily follow, that the

Weight

Weight does begin and continue to move with the Power; and (however it is insensible) yet it is certain there must be such a Motion so extreamly slow as is here specified. So full is this Art of rare and incredible Subtilties.

I know it is the Assertion of *Cardan*, *Motus valde tardi, necessario quietes habent intermedias.* Extream slow Motions have necessarily some intermediate Stops and Rests. But this is only said, not proved, and he speaks it from sensible Experiments, which in this case are fallible: Our Senses being very incompetent Judges of the several Proportions, whether Greatness or Littleness, Slowness or Swiftness, which there may be amongst things in Nature. For ought we know, there may be some *Organical* Bodies as much less than ours, as the Earth is bigger. We see what strange Discoveries of extream minute Bodies, (as Lice, Wheal-worms, Mites, and the like) are made by the *Microscope*, wherein their several Parts (which are altogether insensible to the bare Eye) will distinctly appear: And perhaps there may be other Insects that live upon them as they do upon us. 'Tis certain that our Senses are extreamly disproportioned for comprehending the whole Compass and Latitude of Things And because there may be such difference in the *Motion* as well as in the *Magnitude* of Bodies; therefore, tho' such extream Slowness may seem altogether impossible to Sense and common Apprehension, yet this can be no sufficient Argument against the Reality of

De varietate rerum l. 9. c. 47.

CHAP.

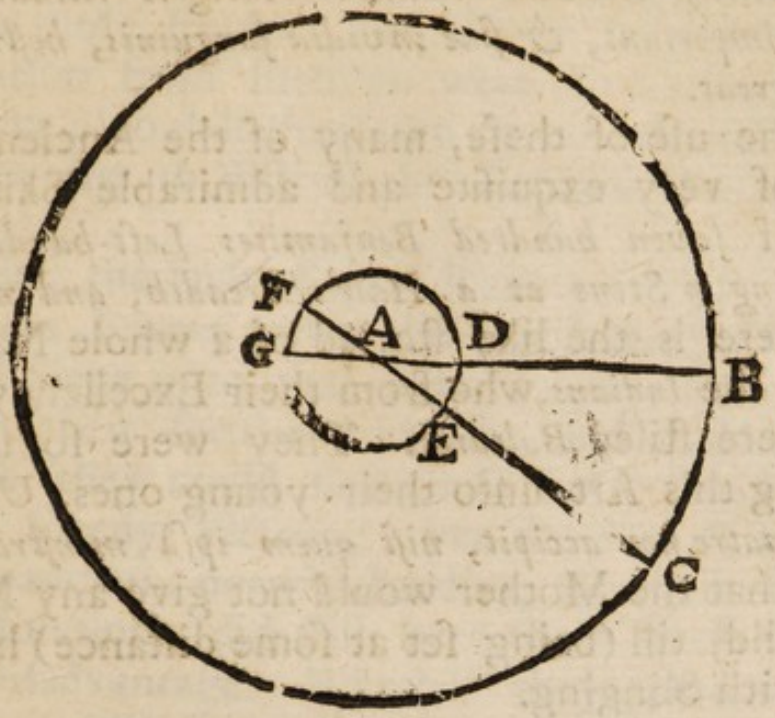
CHAP. XVII.

Of Swiftneſs: How it may be increaſed to any kind of Proportion. Concerning the great Force of Archimedes *his Engines. Of the* Balliſta.

BY that which hath been already explained concerning the Slowneſs of Motion, we may the better underſtand the Nature of Swiftneſs, both of them (as is the Nature of Oppoſites) being produced by contrary Cauſes. As the greatneſs of the Weight in reſpect of the Power, and the great diſtance of the Power from the Fulciment in compariſon to that of the Weight, does cauſe a ſlow Motion; ſo the greatneſs of the Power above the Weight, and the greater diſtance of the Weigh from the Center, in compariſon to that of the Power, does cauſe a ſwift Motion.

And as it is poſſible to contrive a Motion unto any kind of Slowneſs, by finding out an anſwerable Diſproportion betwixt the Weight and Power, ſo likewiſe unto any kind of Swiftneſs: For ſo much as the Weight does exceed the Power, by ſo much will the Motion of the Weight be ſlower, and ſo much as the Power does exceed the Weight, by ſo much will the Motion of the Weight be ſwifter.

In



In the Diagram ſet down before, if we ſuppoſe F to be the place of the Power, and C of the Weight, the Point *A* being the Fulciment or Center, then in the ſame ſpace of time wherein the Power does move from *F* to *G*, the Weight will paſs from *C* to *B*. Theſe Diſtances having the ſame diſproportion unto one another, as there is betwixt *AF* and *AC*, which is ſuppoſed to be Quadruple. So that in this Example, the Weight will move four times ſwifter than the Power; and according as the Power does exceed the Weight in any greater diſproportion, ſo will the ſwiftneſs of the Weight be augmented.

Hence may we conceive the Reaſon of that great Force which there is in Slings, which have ſo much a greater ſwiftneſs than a Stone thrown from the Hand, by how much the end of the Sling is farther off from the Shoulder-Joint, which is the Center of Motion. The Sacred Hiſtory concerning *David*'s Victory over *Goliah*, may ſufficiently evidence the force of theſe. *Vegetius* relates that it was uſual this way to ſtrike a Man dead, and beat the Soul out of

1 Sam. 17. 49.

Lipſius Polior. l. 4. Dialog. 2.

his Body, without ſo much as breaking his Armour or fetching Blood. *Membris integris læthale tamen vulnus important, & ſine invidia ſanguinis, hoſtis lapidi ictu intereat.*

In the uſe of theſe, many of the Ancients have been of very exquiſite and admirable Skill. We read of *ſeven hundred Benjamites Left-handed, that could ſling a Stone at a Hair's breadth, and not miſs.* And there is the like ſtoried of a whole Nation amongſt the *Indians*, who from their Excellency in this Art, were ſtiled *Baleares*. They were ſo ſtrict in teaching this Art unto their young ones, *Ut cibum puer à matre non accipit, niſi quem ipſâ monſtrante percuſſit*; that the Mother would not give any Meat to her Child, till (being ſet at ſome diſtance) he could hit it with Slinging.

Judges 20. 16.

ἀπὸ τῆς σφενδόνης, *Diodor. Sicul. Biblioth. l. 5. L. Florus Hiſt. l. 3. cap. 8. Io. Boemus Aubanus de moribus gentium, l. 3. c. 26.*

For the farther Illuſtration of this Subject, concerning the *Swiftneſs* of Motion, I ſhall briefly ſpecify ſome Particulars concerning the Engines of War uſed by the Ancients. Amongſt theſe, the moſt famous and admirable were thoſe invented by *Archimedes*; by which he did perform ſuch ſtrange Exploits, as (were they not related by ſo many and ſuch judicious Authors) would ſcarce ſeem credible even to theſe more Learned Ages. The Acts of that moſt famous Engineer, are largely ſet down by [a] *Polybius*, [b] *Tzetzes*, [c] *Proclus*, [d] *Plutarch*, [e] *Livy*, and divers others. From the firſt of whom alone, we may have ſufficient Evidence for the Truth of thoſe Relations: For beſides that he is an Author noted to be very grave and ſerious in his Diſcourſe, and does ſolemnly promiſe in one Place that he will relate nothing, but what either he himſelf was an Eye-witneſs of, or elſe what he had received from thoſe that were ſo: I ſay, beſides all this, it is conſiderable, that he himſelf was Born not above Thirty Years after the Siege of *Syracuſe*. And afterwards having occaſion to tarry ſome Weeks in that City, when

[a] *Hiſtor. l. 4.*
[b] *Hiſtor. Chilios 2. Hiſtor. 35.*
[c] *Li. 2. c. 3.*
[d] *Marcellus.*
[e] *Hiſtor. l. 24.*

Hiſtor. l. 4. juxta initium.

when he travelled with *Scipio*, he might there perhaps see those Engines himself, or at least take his information from such as were Eye-witnesses of their force: So that there can be no colourable Pretence for any to distrust the Particulars related of them.

In brief, the Sum of their Reports is this. When the *Roman* Forces under the Conduct of *Marcellus*, had laid Siege unto that famous City, (of which, both by their former Successes, and their present strength, they could not chuse but promise themselves a speedy Victory;) yet the Arts of this one Mathematician, notwithstanding all their Policies and Resolutions, did still beat them back to their great Disadvantage. Whether they were near the Wall, or farther from it, they were still exposed to the force of his Engines, καὶ μακρὰν ἀφεστῶτας, καὶ συνέγγυς ὄντας; ἃ μόνον ἀπράκτους παρεσκεύαζε πρὸς τὰς ἰδίας βοηθολάς, ἀλλὰ καὶ διέφθειρε τὰς πλείστας αὐτῶν. From the Multitude of those Stones and Arrows which he shot against them, was he stiled ἑκατόγχειρ or *Briareus*. Those Defensive Engines that were made by the *Romans* in the form of Pent-Houses, for to cover the Assailants from the Weapons of the Besieged, these would be presently batter in pieces with great Stones and Blocks. Those high Towers erected in some of the Ships, out of which the *Romans* might more conveniently fight with the Defendants on the Wall, these also were so broken by his Engines, that no Cannon, or other Instrument of Gunpowder, (saith a Learned Man) had they been then in use, could have done greater Mischief. In brief, he did so molest them with his frequent and prodigious Batteries, that the Common Soldiers were utterly discouraged from any hopes of Success.

Cæl. Rhod. Ant. lect. l. 2. c. 16. Plutæus Testudo.

Sir Walt. Raleigh Histor. l. 5. c. 3. §. 16.

What was the particular Frame and Manner of these Engines, cannot certainly be determined; but to contrive such as may perform the like strange

Effects, were not very difficult to any one who is thoroughly verſed in the Grounds of this Art. Tho perhaps thoſe of *Archimides* in reſpect of diver Circumſtances, were much more exact and proper for the Purpoſes to which they were intended, than the Invention of others could be; he himſelf being ſo extraordinarily ſubtle and ingenious above the common ſort of Men.

'Tis probable that the general kind of theſe Engines were the ſame with thoſe that were uſed afterwards, amongſt the *Romans* and other Nations. Theſe were commonly divided into two ſorts; ſtiled

Balliſtæ.
Catapultæ.

Vid. Naudæum de Stud. Militar. l. 2.

Both which Names are ſometimes uſed promiſcuouſly; but according to their Propriety, † *Balliſta* does ſignifie an Engine for the ſhooting of Stones, and *Catapulta* for Darts or Arrows.

† Ἀπὸ τῦ βάλλειν, called alſo λιθοβόλον. πετροβόλον. *Fundibalus. Petraria. Lib.* 3.

The former of theſe was fitted either to carry divers leſſer Stones, or elſe one greateſt one. Some of theſe Engines made for great Stones, have been proportioned to ſo vaſt and immenſe a Weight, as may ſeem almoſt incredible; which occaſioned that in *Lucan*,

At ſaxum quoties ingenti verberis ictu
Excutitur, qualis rupes quam vertice montis
Abſcidit impulſu ventorum adjuta vetuſtas,
Frangit cuncta rumes; nec tantum corpora preſſa
Exanimat, totos cum ſanguine diſſipat artus.

With theſe they could eaſily batter down the Walls and Towers of any Fort. So *Ovid.*

Quam grave balliſtæ mœnia pulſat onus.

And *Statius*---*Quo turbine bellica quondam.*
Librati ſaliunt portarum in clauſtra molares.

Lipſius Poliorcet. l. 3. *Dial.* 3.

The Stones that were caſt from theſe, were of any form, *Enormes & ſepulchrales*, Mill-ſtones or Tomb-ſtones. Sometimes for the farther annoyance

and

nd terror of any Beſieged Place, they would by heſe throw into it dead Bodies, either of Men or Horſes, and ſometimes only parts of them as Men's Heads.

Athenæus mentions one of theſe *Balliſtæ* that was proportioned unto a Stone of three Talents Weight, each Talent being 120 Pounds (ſaith *Vitruvius*), ſo that the whole will amount to 360 Pounds. But it is ſtoried of *Archimedes*, that he caſt a Stone into one of *Marcellus* his Ships, which was found to weigh ten Talents. There is ſome difference amongſt * Authors, concerning what kind of Talent this ſhould be underſtood, but it is certain that in *Plutarch*'s Time, (from whom we have this Relation) one Talent did amount to 120 Pounds (ſaith *Suidas:*) According to which Account, the Stone it ſelf was of no leſs then twelve hundred pound Weight. A Weapon (one would think) big enough for thoſe Rebel Gyants that fought againſt the Gods. Now the greateſt Cannon in uſe, does not carry above 64 pound Weight, which is far ſhort of the ſtrength in theſe Mathematical Contrivances. Amongſt the *Turks* indeed, there have been ſometimes uſed ſuch Powder Inſtruments, as may equal the force of thoſe invented by *Archimedes*. *Gab. Naudæus* tells us of one Bullet ſhot from them at the Siege of *Conſtantinople*, which was of above 1200 pound Weight; This he affirms from the Relation of an Archbiſhop, who was then preſent, and did ſee it; the Piece could not be drawn by leſs then a hundred and fifty Yoak of Oxen, which might almoſt have ſerved to draw away the Town it ſelf. But though there hath been perhaps ſome one or two Cannons of ſuch a prodigious Magnitude, yet it is certain that the biggeſt in common Uſe, does come far ſhort of that Strength which was ordinarily in theſe Mechanical Engines.

Deipnoſoph. l. 5.

Archit. l. 10. c. ult. λίθον δεκαταλαντον.

Plut. Marcell.

* *Dav. Rivaltus Commen. in Archim. Oper. Ext.*

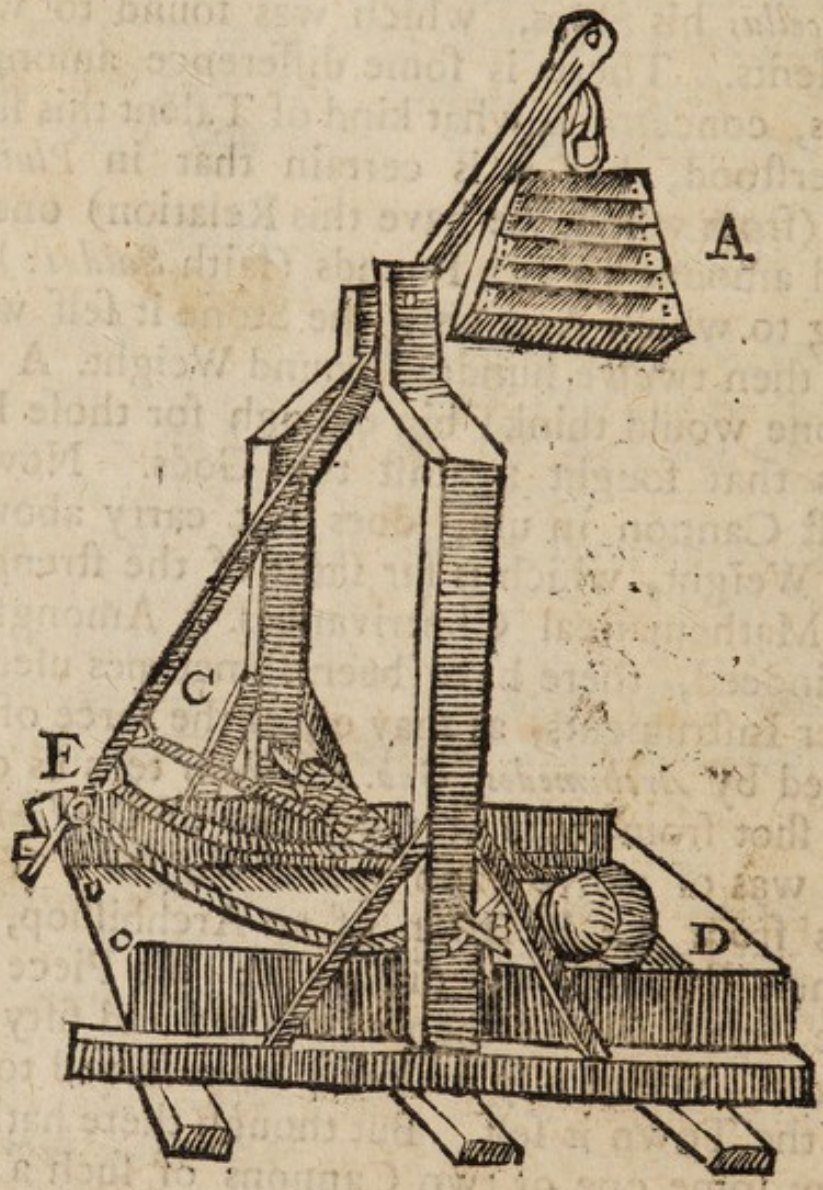
Naudæus de ſtudio. Milit. l. 2.

De Stud. Mil. l. 2.

See *Rob. Valturius de re Milit. l. 10. c. 4.*

There are divers Figures of these *Ballistæ*, set ou by *Vegetius*, *Lipsius*, and others; but being withou any Explication, it is not very facil to discover i what their Forces did consist

I have here expressed one of them most easy t be apprehended; from the Understanding of which you may the better guess at the Nature of th rest.



That great Box or Cavity at *A*, is supposed to be full of some heavy Weight, and is forced up by the turning of the Axis and Spokes *B C*. The Stone or Bullet to be discharged, being in a kind of Sling

at

t *D*; which when the greater Weight *A* deſcends, will be violently whirled upwards, till that end of he Sling at *E*, coming to the Top will fly off, and liſcharge the Stone as the skilful Artiſt ſhould direct t.

CHAP. XVIII.

Concerning the Catapultæ, or Engines for Arrows.

THE other kind of Engine was called *Catapulta*, ἀπὸ τ πέλτης, which ſignifies a Spear or Dart, becauſe it was uſed for the Shooting off ſuch Weapons: Some of theſe were proportioned unto Spears of twelve Cubits long; they did carry with ſo great a Force, *ut interdum nimio ardore ſcintillant*, (ſaith *Ammianus*) that the Weapons diſcharged from them were ſometimes (if you can believe it) ſet on Fire by the ſwiftneſs of their Motion.

In Greek καταπέλτης. *Athenæus. Deipnoſ. l.* 5. *Lib.* 23. *Lipſius Poliorcet. l.* 3. *Dial.* 2.

The firſt Invention of theſe is commonly aſcribed to *Dionyſius* the younger, who is ſaid to have made them amongſt his other Preparations againſt *Carthage*. But we have good Reaſon to think them of more ancient Uſe, becauſe we read in Scripture, That *Uzziah made in Jeruſalem Engines invented by cunning Men to ſhoot Arrows and great Stones withal*; though it is likely theſe Inventions were much bettered by the Experience of after Ages.

Diod. Sicul. Biblioth. l. 14. *Sardus de Invent. Rerum. l.* 2. 2 Chron. 26. 15.

The uſual Form of theſe *Catapultæ*, was much after the manner of great Bows placed on Carriages, and wound up by the Strength of ſeveral Perſons. And from that great Force which we find in leſſer Bows, we may eaſily gueſs at the greater Power of theſe other Engines. 'Tis related of the *Turkiſh* Bow, that it can ſtrike an Arrow through a piece of Steel or

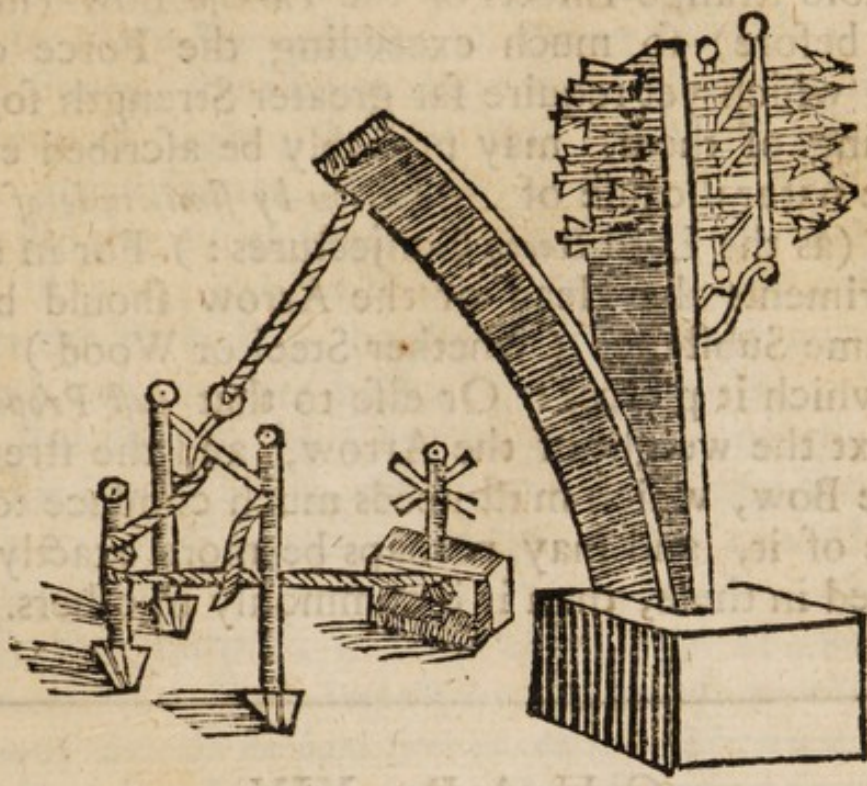
Sir Fra. Bacon. *Nat. Hiſt. Exp.* 704.

or Braſs two Inches thick, and being headed only with Wood, it pierces Timber of eight Inches. Which though it may ſeem incredible, yet it is atteſted by the Experience of divers unqueſtionable Witneſſes: *Barclay* in his *Icon animorum*, a Man of ſufficient Credit, affirms that he was an Eye-witneſs, how one of theſe Bows with a little Arrow did pierce through a piece of Steel three Fingers thick. And yet theſe Bows being ſomewhat like the long Bows in uſe amongſt us, were bent only by a Man's immediate Strength, without the help of any Bender or Rack that are uſed to others.

Some *Turkiſh* Bows are of that Strength, as to pierce a Plank of ſix Inches in thickneſs, (I ſpeak what I have ſeen) ſaith *M. Jo. Greaves* in his *Pyramodographia*. How much greater Force then may we conceive to be impreſſed by the *Catapultæ*?

Theſe were ſometimes framed for the diſcharging of two or three Arrows together, ſo that each of them might be directed unto a ſeveral Aim. But it were as eaſy to contrive them after the like manner for the Carriage of twenty Arrows, or more; as in this Figure.

Both



Both theſe kinds of Engines, when they were uſed at the Siege of any City, were commonly carried in a great wooden Turret (firſt invented by * *Demetrius.*) It was driven upon four Wheels at the bottom, each of its Sides being forty five Cubits, its Height ninety. The whole was divided in nine ſeveral Partitions, every one of which did contain divers Engines for Battery: From its Uſe in the battering and taking of Cities it is ſtiled by the Name of *Helepolis.*

He that would be informed in the nature of Bows, let him conſult *Merſennus de Balliſtica & Acontiſmologia*, where there are divers ſubtile Enquiries and Demonſtrations, concerning the Strength required to the bending of them to any Diſtance. The Force they have in the Diſcharge, according to ſeveral Bents, the Strength required to be in the String of them, the ſeveral Proportions of Swiftneſs and Diſtance in an Arrow ſhot Vertically, or Horizontally, or Tranſverſally.

*Who was therefore ſtiled *Poliorcetes.* This kind of Turret was firſt uſed at the Siege of *Cyprus*, & is thus deſcribed by *Diodorus Sicul. Biblioth. l.* 20.

Thoſe

Thoſe ſtrange Effects of the *Turkiſh* Bow (mentioned before) ſo much exceeding the Force of others, which yet require far greater Strength for the Bending of them, may probably be aſcribed either to the natural cauſe of *Attraction by ſimilitude of Subſtance* (as the Lord *Bacon* Conjectures:) For in theſe Experiments the Head of the Arrow ſhould be of the ſame Subſtance (whether Steel or Wood) with that which it pierces: Or elſe to that *juſt Proportion* betwixt the weight of the Arrow, and the ſtrength of the Bow, which muſt needs much conduce to the Force of it, and may perhaps be more exactly diſcovered in theſe, than it is commonly in others.

CHAP. XIX.

A Compariſon betwixt theſe ancient Engines, and the Gunpowder Inſtruments now in Uſe.

IT ſhall not be altogether Impertinent to enquire ſomewhat concerning the Advantages and Diſadvantages betwixt thoſe Military offenſive Engines uſed amongſt the Ancients, and thoſe of theſe later Ages.

In which Enquiry there are two Particulars to be chiefly examined.

1. The Force of theſe ſeveral Contrivances, or the utmoſt that may be done by them.

2. Their Price, or the greatneſs of the Charges required unto them.

1. As for the Force of theſe ancient Inventions, it may ſufficiently appear from thoſe many credible Relations mentioned before; to which may be added that in *Joſephus*, which he ſets down from his own Eye-ſight, being himſelf a chief Captain at the Siege of *Jotapata*, where theſe Events happened. He tells

De bello Judaico. l. 3. c. 9.

us

us that beſides the multitude of Perſons, who were ſlain by theſe *Roman* Engines, being not able to avoid their Force, by reaſon they were placed ſo far off, and out of Sight; beſides this, they did alſo carry ſuch great Stones, with ſo great a Violence, that they did therewith batter down their Walls and Towers. A great Bellied Woman walking about the City in the Day-time, had her Child ſtruck out of her Womb, and carried half a Furlong from her. A Soldier ſtanding by his Captain *Joſephus*, on the Wall, had his Head ſtruck off by another Stone ſent from theſe *Roman* Engines, and his Brains carried three Furlongs off.

To this purpoſe *Cardan* relates out of *Ammianus Marcellinus*. *Tanto impetu fertur lapis ut uno viſo lapide quamvi intacti barbari fuerint ab eo, deſtiterunt à pugnâ & abierunt.* Many foreign People being ſo amazed at the ſtrange force of theſe Engines, that they durſt not conteſt with thoſe who were Maſters of ſuch Inventions. 'Tis frequently aſſerted, that Bullets have been melted in the Air, by that Extremity of violent Motion impreſt from theſe Slings. *De variet. l. 12. c. 58.*

Fundáque contorto tranſverberat aëra plumbo,
Et mediis liquidæ glandes in nubibus errant.

So *Lucan*, ſpeaking of the ſame Engines.

Inde faces & ſaxa volant, ſpatioque ſolutæ
Aeris & calidæ liquefactæ pondere glandes.

Which Relations, though they may ſeem ſomewhat Poetical and Improbable, yet *Ariſtotle* himſelf (*De cælo lib.* 2. *c.* 7.) doth ſuppoſe them as unqueſtionable. From whence it may be inferred, that the force of theſe Engines does rather exceed than come ſhort of our Gunpowder Inventions. *Sir* Walt. Raleigh. *Hiſt. l.* 5. *c.* 3. *Sect.* 16.

Add to this that Opinion of a Learned Man (which I cited before) that *Archimedes* in the Siege of *Syracuſe* did more miſchief with his Engines, than could have been wrought by any Cannons, had they been then in Uſe. See *Lipſius de militiâ Romanâ. l.* 5.

In

In this perhaps there may be ſome Diſadvantage, becauſe theſe Mathematical Engines cannot be ſo eaſily and ſpeedily wound up, and ſo certainly levelled as the other may.

2. As for the Price or Charges of both theſe, it may be conſidered under three Particulars:

1. Their making.
2. Their Carriage or Conveyance.
3. Their Charge and Diſcharging.

In all which reſpects, the Cannons now in Uſe, are of much greater Coſt than theſe other Inventions.

1. The Making or Price of theſe Gun-powder Inſtruments is extreamly Expenſive, as may be eaſily judged by the weight of their Materials. A whole Cannon weighing commonly 8000 *l.* a half Cannon 5000, a Culverin 4500, a Demiculverin 3000; which whether it be in Iron or Braſs, muſt needs be very Coſtly, only for the Matter of them; beſides the farther Charges required for the Form and Making of them, which in the whole muſt needs amount to ſeveral hundred Pounds. Whereas theſe Mathematical Inventions conſiſting chiefly of Timber, and Cords, may be much more cheaply made; The ſeveral degrees of them which ſhall anſwer in proportion to the Strength of thoſe other, being at the leaſt ten times Cheaper; that is, ten Engines that ſhall be of equal force either to a Cannon or Demicannon, Culverin or Demiculverin, may be framed at the ſame Price that one of theſe will amount to: So that in this reſpect there is a great Inequality.

2. As for their Carriage or Conveyance; a whole Cannon does require at the leaſt 90 Men, or 16 Horſes, for the Draught of it; a half Cannon 56 Men, or 9 Horſes; a Culverin 50 Men, or 8 Horſes; a Demiculverin 36 Men, or 7 Horſes; Suppoſing the Way to be hard and plain, in which notwithſtanding the Motion will be very ſlow. But if the

Paſſage

Paſſgae prove riſing and ſteep, or rotten and dirty, then they will require a much greater Strength and Charge for the conveyance of them. Whereas theſe other Inventions are in themſelves more light (if there be occaſion for the Draught of them) being eaſily taken aſunder into ſeveral Parts. And beſides, their Materials are to be found every where, ſo that they need not be carried up and down at all, but may be eaſily made in the Place where they are to be uſed.

3. The Materials required to the Charging of theſe Gun-powder Inſtruments, are very Coſtly. A whole Cannon requiring for every Charge 40 Pound of Powder, and a Bullet of 64 Pounds; a half Cannon 18 Pound of Powder, and a Bullet of 24 Pounds; a Culverin 16 Pounds of Powder, and a Bullet of 19 Pounds; a Demiculverin 9 Pounds of Powder, and a Bullet of 12 Pounds: Whereas thoſe other Engines may be charged only with Stones, or (which may ſerve for Terror) with dead Bodies, or any ſuch Materials as every Place will afford without any Coſt.

So then, put all theſe together: If it be ſo that thoſe ancient Inventions did not come ſhort of theſe other in regard of Force, and if they do ſo much excel them in divers other Reſpects; it ſhould ſeem then, that they are much more Commodious then theſe latter Inventions, and ſhould be preferred before them. But this Enquiry cannot be fully determined without particulat Experience of both.

CHAP.

CHAP. XX.

That it is possible to contrive such an Artificial Motion, as may be equally swift with the supposed Motion of the Heavens.

FOR the Conclusion of this Discourse, I shall briefly Examine (as before concerning Slowness) whether it be possible to contrive such an Artificial Motion, as may be equal unto the supposed swiftness of the Heavens. This Question hath been formerly proposed and answered by *Cardan*, where he applies it unto the swiftness of the Moon's Orb; but that Orb being the lowest of all, and consequently of a dull and sluggish Motion, in comparison to the rest; therefore it will perhaps be more convenient to understand the Question concerning the eighth Sphere, or starry Heaven.

De Variet. Rerum l. 9. c. 47.

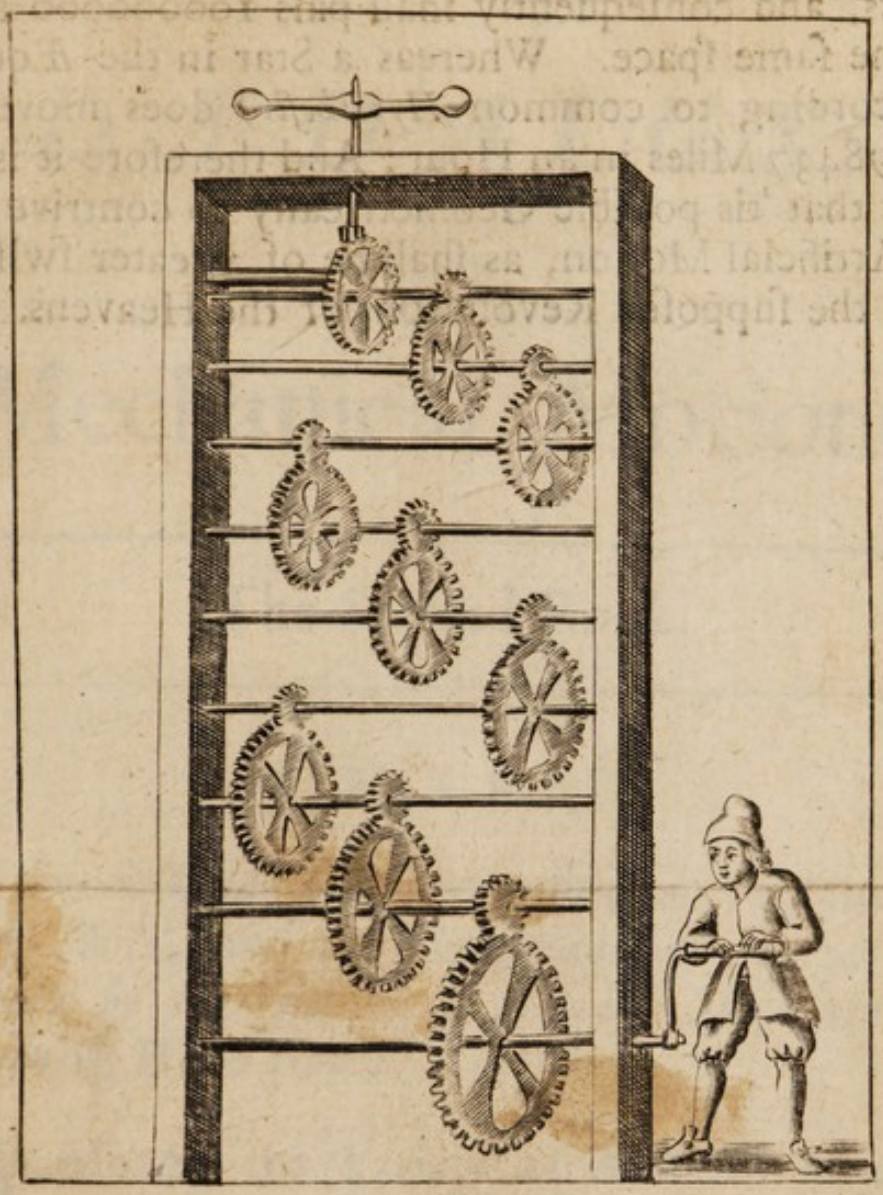
For the true Resolution of this, it should be first observed, that a material Substance is altogether incapable of so great a Celerity, as is usually ascribed to the Celestial Orbs, (as I have proved elsewhere) and therefore the Quære is not to be understood of any real and experimental, but only Notional, and Geometrical Contrivance.

The Earth a Planet, *Prop.* 9.

Now that the swiftness of Motion may be thus increased according to any conceivable Proportion, will be manifest from what hath been formerly delivered concerning the Grounds and Nature of Slowness and Swiftness. For according as we shall suppose the Power to exceed the Weight: So may the Motion of the Weight be swifter than that of the Power.

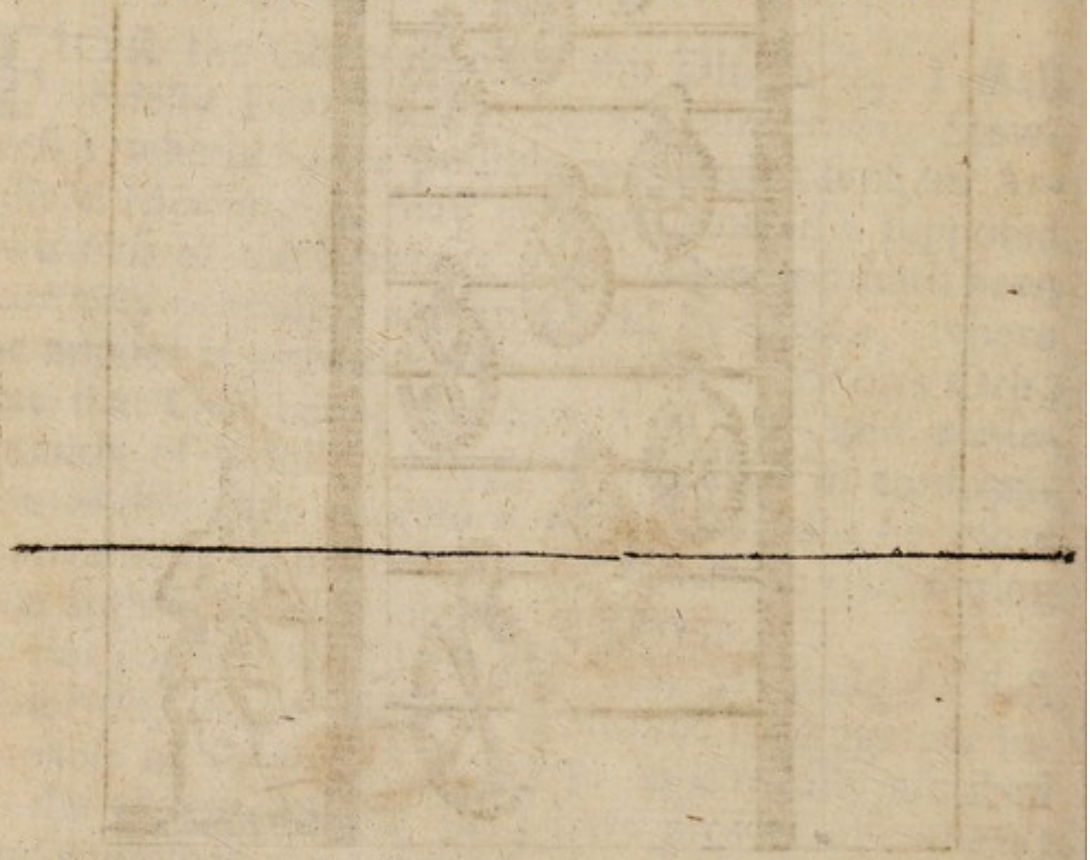
But to answer more particularly: Let us imagine every Wheel in this following Figure to have a hundred Teeth in it, and every Nut ten;

It



t may then be evident, that one Revolution of the rſt Wheel, will turn the Nut, and conſequently the econd Wheel on the ſame Axis ten times, the third Wheel a hundred times, the fourth a thouſand times, he fifth 10000, the ſixth a hundred thouſand times, he ſeventh 1000000 times, the eighth 100000000 mes, the ninth 1000000000 times, the Sails 10000000000 times: So that if we ſuppoſe the com-aſs of theſe Sails to be five Foot, or one Pace: And at the firſt Wheel is turned about after the rate of he thouſand times in an Hour: It will then be evi-ent, that the Sails ſhall be turned 10000000000000 times,

times, and consequently shall pass 100000000 Miles in the same space. Whereas a Star in the Æquator (according to common *Hypothesis*) does move but 42398437 Miles in an Hour: And therefore it is evident that 'tis possible Geometrically to contrive such an Artificial Motion, as shall be of greater swiftness then the supposed Revolutions of the Heavens.



DÆDA-

DÆDALUS:

OR,

Mechanical Motions.

The Second Book.

CHAP. I.

The divers kinds of Automata, *or Self-movers. Of Mills, and the Contrivance of ſeveral Motions by rarify'd Air. A brief Digreſſion concerning Wind-Guns.*

AMongſt the Variety of Artificial Motions, thoſe are of moſt Uſe and Pleaſure, in which, by the Application of ſome continued Strength, there is beſtowed a regular and laſting Motion.

Theſe we call the αὐτόματα, or *Self-movers*: Which Name, in its utmoſt Latitude, is ſometimes aſcribed unto thoſe Motions, that are contrived from the Strength of Living Creatures, as Chariots, Carts, *&c.* But in its Strictneſs and Propriety, it is only appliable unto ſuch Inventions, wherein the Motion is cauſed either by ſomething that belongs unto its own Frame, or elſe by ſome External Inanimate Agent.

Whence theſe αὐτόματα are eaſily diſtinguiſhable into Two ſorts:

1. Thoſe that are moved by ſomething which is extrinſical unto their own Frame; as Mills, by Water or Wind.

2. Thoſe that receive their Motion from ſomething that does belong to the Frame it ſelf; as Clocks, Watches, by Weights, Springs, or the like.

Of both which ſorts, there have been many excellent Inventions: In the Recital of them, I ſhall inſiſt chiefly on ſuch as are moſt eminent for their Rarity and Subtilty.

Amongſt the αὐτόματα that receive their Motion from ſome external Agent, thoſe of more common uſe are Mills.

And firſt, the Water-Mills; which are thought to be before the other, tho' neither the firſt Author, nor ſo much as the Time wherein they were invented is fully known. And therefore *Polydore Virgil* refers them amongſt other fatherleſs Inventions. *Pliny* indeed doth mention them, as being commonly uſed in his time; and yet others affirm, that *Belliſarius*, in the Reign of *Juſtinian*, did firſt invent them: Whence *Pancirollus* concludes, that it is likely their Uſe was for ſome Space intermitted, and being afterwards renewed again, they were then thought to be firſt diſcovered.

De invent. rerum, l. 3. c. 18.

Nat. Hiſt. l. 18. c. 16.

De Repert. Tit. 22.

However, 'tis certain that this Invention hath much abridged and advantaged the Labours of Men, who were before condemned unto this Slavery, as now unto the Galleys. And as the Force of Waters hath been uſeful for this, ſo likewiſe may it be contrived to divers other Purpoſes. Herein doth the Skill of an Artificer chiefly conſiſt, in the Application of theſe common Motions unto various and beneficial Ends; making them ſerviceable, not only

Ad Piſtrinum.

for

for the Grinding of Corn, but for the preparing of Iron, or other Oar; the making of Paper, the elevating of Water, or the like.

To this purpoſe alſo are the Mills that are driven by Wind, which are ſo much more convenient than the other, by how much their Situations may be more eaſie and common. The Motions of theſe may likewiſe be accommodated to as various Uſes as the other; there being ſcarce any Labour, to the Performance of which, an ingenious Artificer cannot apply them. To the Sawing of Timber, the Plowing of Land, or any other the like Service, which cannot be diſpatched the ordinary Way, without much Toil and Tedioufneſs. And it is a wonderful thing to conſider, how much Men's Labours might be eaſed and contracted in ſundry Particulars, if ſuch as were well skilled in the Principles and Practices of theſe Mechanical Experiments, would but thoroughly apply their Studies unto the Enlargement of ſuch Inventions.

Marcell. Vrankhein. Epiſt. ad Joh. Erneſtum.

There are ſome other Motions by Wind or Air, which (tho' they are not ſo common as the other, yet) may prove of excellent Curioſity, and ſingular Uſe. Such was that Muſical Inſtrument invented by *Cornelius Dreble*; which being ſet in the Sunſhine, would of it ſelf render a ſoft and pleaſant Harmony; but being removed into the Shade, would preſently become ſilent. The Reaſon of it was this: The Warmth of the Sun working upon ſome Moiſture within it, and rarifying the inward Air unto ſo great an Extenſion that it muſt needs ſeek for Vent or Iſſue, did thereby give ſeveral Motions unto the Inſtrument.

Like that Statue of *Memnon*, in *Egypt*, which makes a ſtrange noiſe whenever the Sun begins to ſhine upon it. *Tacit. Annal.* 2. *Strabo* affirms, that he had both ſeen and heard it.

Somewhat of this Nature are the *Æolipiles*, which are Concave Veſſels, conſiſting of ſome ſuch Material as may endure the Fire, having a ſmall Hole, at which they are filled with Water, and out of which (when the Veſſels are heated) the Air

doth iſſue forth with a ſtrong and laſting Violence. Theſe are frequently uſed for the exciting and contracting of Heat in the melting of Glaſſes, or Metals: They may alſo be contrived to be ſerviceable for ſundry other pleaſant Uſes; as for the moving of Sails in a Chimney-corner; the Motion of which Sails may be applied to the Turning of a Spit, or the like.

De Variet. Rerum, l. 12. c. 58.

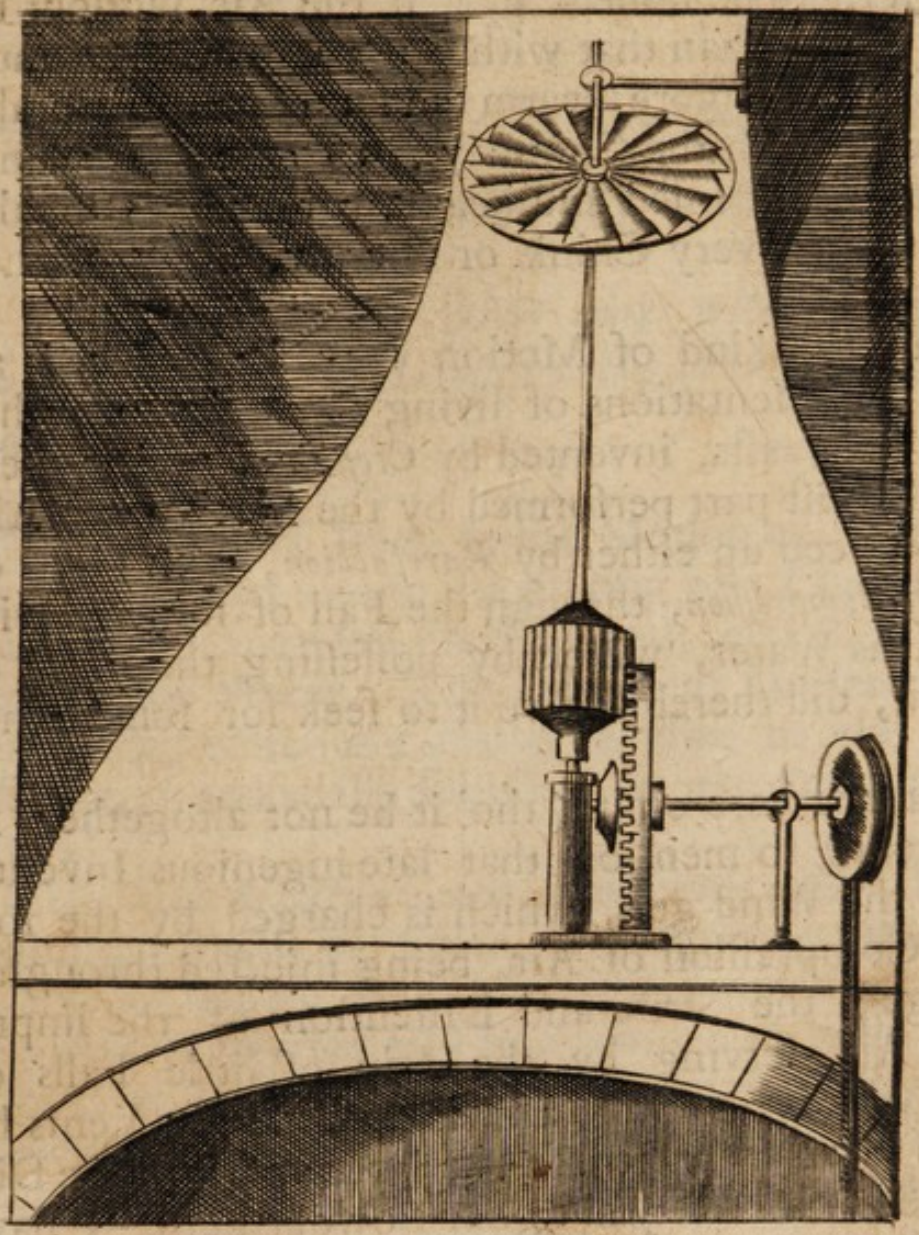
But there is a better Invention to this purpoſe, mentioned in *Cardan*, whereby a Spit may be turned (without the Help of Weights) by the Motion of the Air that aſcends the Chimney; and it may be uſeful for the Roaſting of many, or great Joints: For as the Fire muſt be increaſed according to the Quantity of Meat, ſo the Force of the Inſtrument will be augmented proportionably to the Fire. In which Contrivance, there are theſe Conveniences above the Jacks of ordinary Uſe:

1. It makes little or no Noiſe in the Motion.

2. It needs no winding up, but will conſtantly move of it ſelf, while there is any Fire to rarify the Air.

3. It is much cheaper than the other Inſtruments that are commonly uſed to this purpoſe; there being required unto it only a pair of Sails, which muſt be placed in that part of the Chimney where it begins to be ſtraitned; and one Wheel, to the Axis of which the Spit-line muſt be faſtned, according to this following Diagram.

The



The Motion of theſe Sails may likewiſe be ſerviceable for ſundry other Purpoſes, beſides the turning of a Spit; for the Chiming of Bells, or other muſical Devices; and there cannot be any more pleaſant Contrivance for continual and cheap Muſick. It may be uſeful alſo for the Reeling of Yarn, the Rocking of a Cradle, with divers the like domeſtick Occaſions. For (as was ſaid before) any conſtant Motion being given, it is eaſie for an ingenious Artificer to apply it unto various Services.

Theſe Sails will always move both Day and Night, if there is but any Fire under them, and ſometimes

though there be none. For, if the Air without be much colder than that within the Room, then must this which is more warm and rarified, naturally ascend through the Chimney, to give Place unto the more condensed and heavy, which does usually blow in at every Chink or Cranny, as Experience shews.

Unto this kind of Motion may be reduced all those Representations of living Creatures, whether Birds, or Beasts, invented by *Ctesibius*, which were for the most part performed by the Motion of Air, being forced up either by *Rarefaction*, with Fire, or else by *Compression*, through the Fall of some heavier Body, as Water, which by possessing the Place of the Air, did thereby drive it to seek for some other Vent.

I cannot here omit (tho' it be not altogether so pertinent) to mention that late ingenious Invention of the Wind-gun, which is charged by the forcible Compression of Air, being injected through a Syringe; the Strife and Distention of the imprisoned Air, serving by the Help of little Falls or Shuts within; to stop and keep close the Vents by which it was admitted. The Force of it in the Discharge is almost equal to our Powder-guns. I have found upon frequent Trials (saith *Mersennus*) that a leaden Bullet Shot from one of these Guns against a stone Wall, the Space of 24 Paces from it, will be beaten into a thin Plate. It would be a considerable Addition to this Experiment, which the same Author mentions a little after, whereby he will make the same Charge of Air to serve for the Discharge of several Arrows or Bullets after one another, by giving the Air only so much Room, as may immediately serve to impress a Violence in sending away the Arrow or Bullet, and then screwing it down again to its former Confinement, to fit it for another Shooting. But against this there may be many considerable

Phænomena pneumatica, prop. 32.

ſiderable Doubts, which I cannot ſtand to diſcuſs.

CHAP. II.

Of a Sailing Chariot, that may without Horſes be driven on the Land by the Wind, as Ships are on the Sea.

THe Force of Wind in the Motion of Sails may be applied alſo to the driving of a Chariot, by which a Man may ſail on the Land, as well as by a Ship on the Water. The Labour of Horſes or other Beaſts, which are uſually applied to this Purpoſe, being artificially ſupplied by the Strength of Winds.

That ſuch Chariots are commonly uſed in the Champion Plains of *China*, is frequently affirmed by divers credible Authors. *Boterus* mentions that they have been tried alſo in *Spain*, tho' with what Succeſs he doth not ſpecifie. But above all other Experiments to this Purpoſe, that ſailing Chariot at *Sceveling* in *Holland*, is more eminently remarkable. It was made by the Direction of *Stephinus*, and is celebrated by many Authors. * *Walchius* affirms it to be of ſo great a Swiftneſs for its Motion, and yet of ſo great a Capacity for its Burden: *Ut in medio freto ſecundis ventis commiſſas naves, velocitate multis paraſangis poſt ſe relinquat, & paucarum horarum ſpatio, viginti aut triginta milliaria Germanica continuo curſu emetiatur, concreditoſque ſibi plus minus vectores ſex aut decem, in petitum locum transferat, facillimo illius ad clavum qui ſedet nutu, quaqua verſum minimo labore velis commiſſum, mirabile hoc continenti currus navigium dirigentis.* That it did far exceed the Speed of any Ship, though we ſhould ſuppoſe it to be carried in the

De incremento Urbium l. 1. c. 10.

* *Fabularum decas, Fab. 9.*

the open Sea with never ſo proſperous Wind: And that in ſome few Hours Space it would convey Six or Ten Perſons, 20 or 30 *German* Miles, and all this with very little Labour of him that ſitteth at the Stern, who may eaſily guide the Courſe of it as he pleaſeth.

That eminent inquiſitive Man *Peireskius*, having travelled to *Sceveling* for the Sight and Experience of this Chariot, would frequently after with much Wonder mention the extream Swiftneſs of its Motion. *Commemorare ſolebat ſtuporem quo correptus fuerat cum vento tranſlatus citatiſſimo non perſentiſcere tamen, nempe tam citus erat quam ventus.* Though the Wind were in it ſelf very ſwift and ſtrong, yet to Paſſengers in this Chariot it would not be at all diſcernible, becauſe they did go with an equal Swiftneſs to the Wind it ſelf: Men that ran before it ſeeming to go backwards, Things which ſeem at a great Diſtance being preſently overtaken and left behind. In two Hours Space it would paſs from *Sceveling* to *Putten*, which are diſtant from one another above 14 *Horaria Milliaria*, (ſaith the ſame Author), that is, more than Two and forty Miles.

Pet. Gaſſendus. Vita Peireſkii, l. 2.

Grotius is very copious and elegant in the celebrating of this Invention, and the Author of it in divers Epigrams.

Grotii Poemata, Ep. 19.

Ventivolum Tiphys deduxit in æquora navim,
Jupiter in ſtellas, æthereamque domum.
In terreſtre ſolum virtus Stevinia, nam nec
Tiphy tuum fuerat, nec Jovis iſtud opus.

Ep. 5. And in another Place,

Impoſuit plauſtro vectantem carbaſa, malum
An potius navi, ſubdidit ille rotas?
— — Scandit aquas navis currus ruit aere prono,
Et merito dicas hic volat, illa natat.

Theſe Relations did at the firſt ſeem unto me, (and per-

erhaps they will ſo to others) ſomewhat ſtrange & in-redible. But upon farther Enquiry, I have heard them requently atteſted from the particular Eye-ſight and Experience of ſuch eminent Perſons, whoſe Names dare not cite in a Buſineſs of this Nature, which n thoſe Parts is ſo very common, and little obſerved.

I have not met with any Author who doth treat articularly concerning the Manner of framing this Chariot, tho' *Grotius* mentions an elegant Deſcripti- *Epig.* 20. n of it in Copper by one *Geynius*: And *Hondius* in *&* 21. ne of his large Maps of *Aſia*, does give another onjectural Deſcription of the like Chariots uſed in *China*.

The Form of it is related to be very ſimple and lain, after this manner.

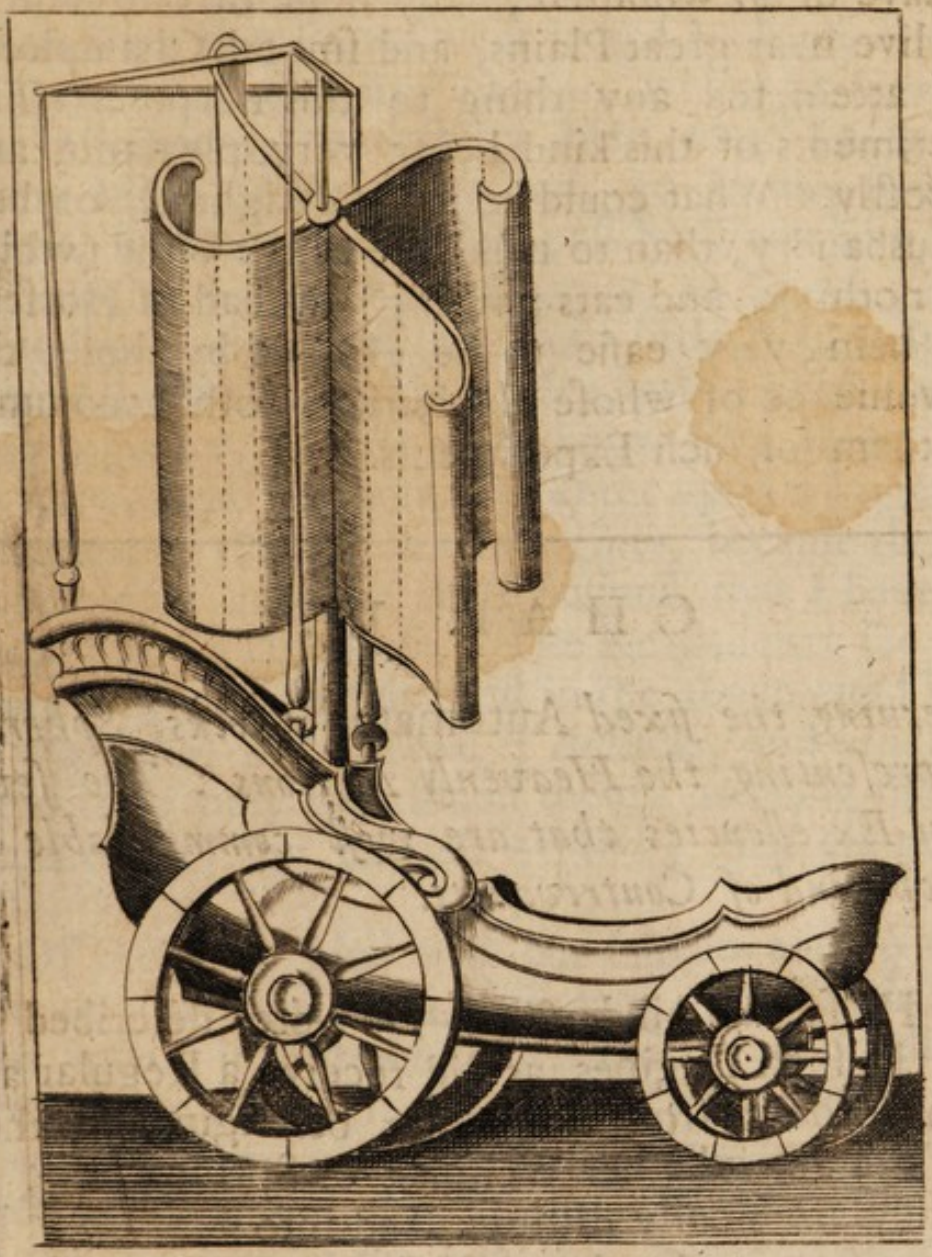


The Body of it being ſomewhat like a Boat, moving upon 4 Wheels of an equal Bigneſs, with two Sails like thoſe in a Ship; there being ſome Contrivance to turn and ſteer it, by moving a Rudder which is placed beyond the two hindmoſt Wheels; and for the ſtopping of it, this muſt be done, either by letting down the Sail, or turning it from the Wind.

Of this kind they have frequently in *Holland* other little Veſſels for one or two Perſons to go upon the Ice, having Sledges inſtead of Wheels, being driven with a Sail; the Bodies of them like little Boats, that if the Ice ſhould break, they might yet ſafely carry a Man upon the Water, where the Sail would be ſtill uſeful for the Motion of it.

I have often thought that it would be worth the Experiment to enquire, whether or no ſuch a ſailing Chariot might not be more conveniently framed with moveable Sails, whoſe Force may be impreſt from their Motion, equivalent to thoſe in a Wind-mill. Their foremoſt Wheels (as in other Chariots) for the greater Facility, being ſomewhat lower than the other, anſwerable to this Figure.





In which the Sails are ſo contrived, that the
Wind from any Coaſt will have a Force upon them
to turn them about; and the Motion of theſe Sails
muſt needs turn the Wheels, and conſequently carry
on the Chariot it ſelf to any Place (though fully a-
gainſt the Wind) whither it ſhall be directed.

The chief doubt will be, whether in ſuch a Con-
trivance, every little Ruggedneſs or Unevenneſs of
the Ground, will not cauſe ſuch a jolting of the
Chariot, as to hinder the Motion of its Sails. But
this perhaps (if it ſhould prove ſo) is capable of ſe-
veral Remedies.

I have

I have often wondred, why none of our Gentr who live near great Plains, and ſmooth Champions have attempted any thing to this Purpoſe. Th Experiments of this kind being very pleaſant, an not coſtly: What could be more delightful, or be ter Husbandry, than to make uſe of the Wind (whic coſts nothing, and eats nothing) inſtead of Horſes This being very eaſie to be effected by thoſe, th Convenience of whoſe Habitations doth accommo date them for ſuch Experiments.

CHAP. III.

Concerning the fixed Automata, *Clocks, Spheres representing the Heavenly Motions: The ſeveral Excellencies that are moſt commendable i ſuch kind of Contrivances.*

THe ſecond kind of αὐτόματα were deſcribed t be ſuch Engines, as did receive a Regular an laſting Motion from ſomething belonging to thei own Frame, whether Weights, or Springs, &c.

They are uſually diſtinguiſhed into αὐτόματα
- ἕστα, fixed and ſtationary.
- φορά, moveable and tranſient.

1. The fixed are ſuch as move only according t their ſeveral Parts, and not according to their whol Frame; in which, though each Wheel hath a diſtinc Rotation, yet the whole doth ſtill remain unmoved The chiefeſt Kind of theſe are the Clocks an Watches in ordinary uſe; the framing of which i ſo commonly known by every Mechanick, that ſhall not trouble the Reader with any Explication o it. He that deſires fuller Satisfaction, may ſee them particularly deſcribed by * *Cardan*, † *D. Flood*, an others.

* *De Varie. Rer. l. 9. c. 47.*
† *Tract. 2. part. 7. l. 1. cap. 4.*

The

The firſt Invention of theſe (ſaith *Pancirollus*) was taken from that Experiment in the Multiplication of Wheels, mentioned in *Vitruvius*, where he ſpeaks of an Inſtrument, whereby a Man may know how many Miles or Paces he doth go in any ſpace of Time, whether or no he do paſs by Water in a Boat, or Ship, or by Land in a Chariot, or Coach: They have been contrived alſo into little Pocket-Inſtruments, by which, after a Man hath walked a whole Day together, he may eaſily know how many Steps he hath taken. I forbear to enter upon a larger Explication of theſe kind of Engines, becauſe they are impertinent unto the chief Buſineſs that I have propoſed for this Diſcourſe. The Reader may ſee them more particularly deſcribed in the above-cited Place of *Vitruvius*, in * *Cardan*, † *Beſſonius*, and others; I have here only mentioned them, as being the firſt occaſion of the chiefeſt αὐτόματα, that are now in Uſe.

Repert. Tit. 10. *Architect. l.* 10. *c.* 14.

* *Subtil. l.* 18.

†*Theatrum inſtrumentorum. Wecker de ſecretis. l.* 15. *c.* 32.

Of the ſame kind with our Clocks and Watches (though perhaps more Elaborate, and Subtle) was that Sphere invented by *Archimedes*, which did repreſent the Heavenly Motions: The Diurnal, and Annual Courſes of the Sun, the Changes, and Aſpects of the Moon, *&c.* This is frequently celebrated in the Writings of the Ancients, particularly in that known *Epigram* of *Claudian*:

Mentioned by *Cicero. Tuſcul. Quæſt. l.* 1. *item De Nat. Deorum l.* 2.

Jupiter in parvo cum cerneret æthera vitro,
Riſit, & ad ſuperos talia dicta dedit;
Huccine mortalis progreſſa potentia curæ?
Jam meus in fragili luditur orbe labor.
Jura poli, rerumque fidem, legeſque Deorum,
Ecce Syracuſius tranſtulit arte ſenex.
*Incluſus variis famulatur * ſpiritus aſtris,*
Et vivum certis motibus urget opus.
Percurrit proprium mentitus Signifer annum;
Et ſimulata novo Cynthia menſe redit.

* The ſecret force from which the Motion was impreſſed.

Jamq;

Jamq; ſuum volvens audax induſtria mundum
Gaudet, & humanâ ſidera mente regit.
Quid falſo inſontem tonitru Salmonea miror?
Æmula naturæ parva reperta manus.

Excellently Tranſlated by *T. Randolph.*

Jove ſaw the Heavens fram'd in a little *Glaſs*,
And Laughing, to the Gods theſe Words did paſs
Comes then the Power of mortal Cares ſo far?
In brittle Orbs my Labours acted are.
The Statutes of the Poles, the Faith of Things,
The Laws of Gods, this *Syracuſian* brings
Hither by Art: Spirits inclos'd attend
Their ſeveral Spheres, and with ſet Motions bend
The living Work: Each Year the feigned Sun,
Each Month returns the counterfeited Moon.
And viewing now her World, bold Induſtry
Grows Proud, to know the Heavens his Subjects be
Believe, *Salmoneus* hath falſe Thunders thrown,
For a poor Hand is Nature's Rival grown.

Inſtit. l. 2. c. 5.

But, that this Engine ſhould be made of Glaſs, is ſcarce credible. *Lactantius*, mentioning the Relation of it, affirms it to conſiſt of Braſs, which is more likely. It may be the Outſide, or Caſe was Glaſs, and the Frame it ſelf of Braſs. *Cœlius Rhodoginus*, ſpeaking of the wondrous Art in the contrivance of this Sphere, breaks out into this Quære. *Nonne igitur miraculorum omnium, maximum miraculum eſt homo?* He might have ſaid *Mathematicus*: And another to this purpoſe, *Sic manus ejus naturam, ut natura ipſa manum imitata putetur.* *Pappus* tells us, that *Archimedes* writ a Book *de Sphæropœia*, concerning the manner of framing ſuch Engines; and after him, *Poſſidonius* compoſed another Diſcourſe on the ſame Subject; though now either the Ignorance, or the Envy of Time hath deprived us of both thoſe Works.

Antiq. lect. l. 2. c. 16.

Guid Ubaldus præf. ad Mechan.

Collect. Mathem. Proœm. ad l. 8.

And

And yet the Art it ſelf is not quite periſhed, for we ead of divers the like Contrivances in theſe latter Times. *Agrippa* affirms, that he himſelf had ſeen uch a Sphere; and *Ramus* tells us how he beheld two of them in *Paris*, the one brought thither amongſt other Spoils from *Sicily*, and the other out of *Germany*. And it is commonly reported, that there is et ſuch a Sphere at *Strasburg* in *Germany*. * *Ri-altus* relates how *Marinus Burgeſius* a *Norman* made wo of them in *France* for the King. And perhaps heſe latter (ſaith he) were more Exact than the for-ner, becauſe the Heavenly Revolutions are now nuch better underſtood than before. And beſides it queſtionable, whether the uſe of Steel-ſprings was nown in thoſe ancient Times; the Application of which unto theſe kind of Spheres, muſt needs be nuch more convenient than Weights.

'Tis related alſo of the Conſul *Boethius*, that a-nongſt other Mathematical Contrivances, (for which e was Famous) he made a Sphere to repreſent the un's Motion; which was ſo much admired, and alked of in thoſe Times, that *Gundibaldus*, King of *urgundy*, did purpoſely ſend over Ambaſſadors to *heodoricus* the Emperor, with Intreaties that he ould be a means to procure one of theſe Spheres om *Boethius*; the Emperor thinking hereby to make is Kingdom more Famous and Terrible unto foreign ations, doth write an Epiſtle to *Boethius*, perſwa-ing him to ſend this Inſtrument. *Quoties non ſunt cre-turi quod viderint? Quoties hanc veritatem luſoria mnia putabunt? Et quanto fuerint à ſtupore converſi, n audebunt ſe æquales nobis dicere, apud quos ſciunt pientes talia cogitaſſe.* So much were all theſe kind Inventions admired in thoſe ruder and darker imes: Whereas the Inſtruments that are now in ſe amongſt us (though not ſo much Extolled) yet altogether equal (if not exceed) the other, both Uſefulneſs and Subtilty. The chiefeſt of theſe former

De vanit. Scient. c. 22. Schol. Mathem. l. 1.

So *Cardan* too, *l. 17. Monanthi in Mecha. Ariſt. Com. c. 1.*

Dr. Hackwell, *Apol. l. 3. c. 10. ſect. 1.*

* *De vita Archimedis.*

Caſſiodor. Chron. Pet. Bertius præf. ad Conſolat. Philoſ.

Polyd. Virgil. de Invent. rerum l. 2. c. 5. Cardan Subtil.

former Engines receiving their Motion from Weights and not from Springs, (which as I said before) are of later and more excellent Invention.

The particular Circumstances, for which the *Automata* of this kind are most eminent, may be reduced to these four.

1. The lastingness of their Motion, without needing of any new supply; for which purpose there have been some Watches contrived to continue without winding up for a Week together, or longer.

2. The easiness and simplicity of their Composition; Art it self being but the facilitating and contracting of ordinary Operations; therefore the more easy and compendious such Inventions are, the more artificial should they be esteemed. And the addition of any such unnecessary Parts, as may be supplied some other way, is a sure sign of Unskilfulness and Ignorance. Those antiquated Engines that did consist of such a needless multitude of Wheels, and Springs, and Screws, (like the old *Hypothesis* of the Heavens) may be compared to the Notions of a confused Knowledge, which are always full of Perplexity and Complications, and seldom in Order; whereas the Inventions of Art are more regular, simple, and perspicuous, like the apprehensions of a distinct and thoroughly-informed Judgment. In this respect the manner of framing the ordinary *Automata*, hath been much bettered in these later Times above the former, and shall hereafter perhaps be yet more advantaged. These kind of Experiments (like all other human Arts) receiving Additions from every Days Experiment.

To this purpose there is an Invention consisting only of one hollow Orb or Wheel, whereby the Hours may be as truly distinguished, as by any ordinary Clock or Watch. This Wheel should be divided into several Cavities, through each of which successively either Sand or Water must be contrived

to

to pass; the heavineſs of theſe Bodies (being always in the aſcending ſide of the Wheel) muſt be counterpoiſed by a Plummet that may be faſtned about the Pulley on the Axis: This Plummet will leiſurely deſcend, according as the Sand by running out of one Cavity into the next, doth make the ſeveral parts of the Wheel lighter or heavier, and ſo conſequently there will be produced an equal and laſting Motion, which may be eaſily applied to the diſtinction of Hours.

3. The multitude and variety of thoſe Services for which they may be uſeful. Unto this kind may we refer thoſe Watches by which a Man may tell not only the Hour of the Day, but the Minute of the Hour, the Day of the Month, the Age and Aſpects of the Moon, *&c.* Of this nature likewiſe was that Larum mentioned by *Walchius*, which tho' it were but two or three Inches big, yet would both wake a Man, and of it ſelf light a Candle for him at any ſet Hour of the Night. And thoſe Weights or Springs which are of ſo great Force as to turn a Mill, (as ſome have been contrived) may be eaſily applied to more various and difficult Labours. *Fab. 9.* *Ramel. fig.* 130.

4. The littleneſs of their Frame. *Nunquam ars magis quam in minimis nota eſt* (ſaith *Aquinas.*) The ſmalneſs of the Engine doth much commend the Skill of the Artificer; to this purpoſe there have been Watches contrived in the form and quantity of a Jewel for the Ear, where the ſtriking of the Minutes may conſtantly whiſper unto us, how our Lives do glide away by a ſwift Succeſſion. *Cardan* tells us of a Smith who made a Watch in the Jewel of a Ring, to be worn on the Finger, which did ſhew the Hours, (*non ſolum ſagitta, ſed ictu*) not only by the Hand, but by the Finger too (as I may ſay) by ſtricking it every Hour. Jacks no bigger than a Walnut to turn any Joint of Meat. *De ſubtil. l.* 2. *item l.* 17.

CHAP. IV.

Of the Moveable and Gradient Automata, *repreſenting the Motions of Living Creatures, various Sounds, of Birds, or Beaſts, and ſome of them Articulate.*

THus much of thoſe *Automata*, which were ſaid to be fixed and ſtationary.

The other kind to be enquired after, are thoſe that are moveable and tranſient, which are deſcribed to be ſuch Engines as move not only according to their ſeveral Parts, but alſo according to their whole Frames. Theſe are again diſtinguiſhable into Two Sorts:

1. *Gradient.*
2. *Volant.*

1. The *Gradient* or *Ambulatory*, are ſuch as require ſome Baſis or Bottom to uphold them in their Motions. Such were thoſe ſtrange Inventions (commonly attributed to *Dædalus*) of ſelf-moving Statues, which (unleſs they were violently detained) would of themſelves run away. * *Ariſtotle* affirms that *Dædalus* did this by putting Quickſilver into them. But this would have been too groſs a way for ſo excellent an Artificer; it is more likely that he did it with Wheels and Weights. Of this kind likewiſe were *Vulcan's Tripodes*, celebrated by *Homer*, that were made to move up and down the Houſe, and fight with one another. He might as well have contrived them into Journey-men Statues, each of which with a Hammer in his Hand ſhould have worked at the Forge.

But amongſt theſe fighting Images, that in *Cardan* may deſerve a mention, which holding in its Hand

Plato in Menone. Ariſt. Polit. l. 1 *c.* 3.

* *De Anima l.* 1 *c.* 3. *Iliad.* 18. There have been alſo Chariots driven by the force of a Spring contrived within them.

De Variet. Rerum l. 12. *c.* 58.

Hand a Golden Apple, beautified with many coſtly Jewels; if any Man offered to take it, the Statue preſently ſhot him to Death. The touching of this Apple ſerving to diſcharge ſeveral ſhort Bows, or other the like Inſtruments that were ſecretly couched within the Body of the Image. By ſuch a Treachery was King *Chennettus* murdered (as *Boetius* relates.)

It is ſo common an Experiment in theſe Times to repreſent the Perſons and Actions of any Story by ſuch ſelf-moving Images, that I ſhall not need to explain the Manner how the Wheels and Springs are contrived within them.

Amongſt theſe Gradient *Automata*, that Iron-Spider mentioned in *Walchius*, is more eſpecially remarkable, which being but of an ordinary Bigneſs, beſides the outward Similitude, (which was very exact) had the ſame kind of Motions with a living Spider, and did creep up and down as if it had been alive. It muſt needs argue a wonderful Art and Accurateneſs, to contrive all the Inſtruments requiſite for ſuch a Motion in ſo ſmall a Frame.

There have been alſo other Motions contrived from Magnetical Qualities, which will ſhew the more wonderful, becauſe there is no apparent Reaſon of their Motion, there being not the leaſt Contiguity or Dependance upon any other Body that may occaſion it; but it is all one as if they ſhould move up and down in the open Air. Get a Glaſs ſphere, fill it with ſuch Liquors as may be clear of the ſame Colour, immixable, ſuch as are Oyl of Tartar, and Spirit of Wine: In which, it is eaſie ſo to poiſe a little Globe or other Statue, that it ſhall ſwim in the Center. Under this Glaſs Sphere, there ſhould be a Loadſtone concealed, by the Motion of which, this Statue (having a Needle touched within it) will move up and down, and may be contrived to ſhew the Hour or Sign. See ſeveral Inventions of this Kind in *Kircher de Arte Magnetica*, *l.* 2.

Fab. 9. There have been other Inventions to move on the Water. *Navigium ſponte mobile, ac ſui remigii autorem, faciam nullo negotio,* ſaith *Scaliger, Exerc.* 326.

There have been ſome artificial Images, which beſides their ſeveral Poſtures in walking up and down, have been made alſo to give ſeveral Sounds, whether of Birds, as Larks, Cuckoes, *&c.* or Beaſts, as Hares, Foxes. The Voices of which Creatures ſhall be rendred as clearly and diſtinctly by theſe artificial Images, as they are by thoſe natural living Bodies, which they repreſent.

There have been ſome Inventions alſo which have been able for the Utterance of articulate Sounds, as the Speaking of certain Words. Such are ſome of the *Egyptian* Idols related to be. Such was the Brazen Head made by Friar *Bacon*, and that Statue, in the framing of which *Albertus Magnus* beſtowed 30 Years, broken by *Aquinas*, who came to ſee it, purpoſely that he might boaſt, how in one Minute he had ruined the Labour of ſo many Years.

Cæl. Rhod. lect. Ant. l. 2. c. 17. Maiolus Colloq.

Now the Ground and Reaſon how theſe Sounds were contrived, may be worth our Enquiry.

Firſt then, for thoſe of Birds or Beaſts, they were made from ſuch Pipes or Calls, as may expreſs the ſeveral Tones of thoſe Creatures which are repreſented: Theſe Calls are ſo commonly known and uſed, that they need not any further Explication.

But now, about articulate Sounds there is much greater Difficulty. *Walchius* thinks it poſſible entirely to preſerve the Voice, or any Words ſpoken in a hollow Trunk, or Pipe, and that this Pipe being rightly opened, the Words will come out of it in the ſame Order wherein they were ſpoken. Somewhat like that cold Countrey, where the Peoples diſcourſe doth freeze in the Air all Winter, and may be heard the next Summer, or at a great Thaw. But this Conjecture will need no Refutation.

Jab. 52

The more ſubſtantial Way for ſuch a Diſcovery, is by marking how Nature her ſelf doth employ the ſeveral Inſtruments of Speech, the Tongue, Lips, Throat,

Throat, Teeth, *&c.* To this purpoſe the *Hebrews* have aſſigned each Letter unto its proper Inſtrument. And beſides, we ſhould obſerve what inarticulate Sounds do reſemble any of the particular Letters. Thus we may note the trembling of Water to be like the Letter *L*, the quenching of hot things to the Letter *Z*, the ſound of Strings, unto the Letters *Ng*, the jirking of a Switch the Letter *Q*, &c. By an exact Obſervation of theſe Particulars, it is (perhaps) poſſible to make a Statue ſpeak ſome Words.

Bacon. Nat. hiſt. exper. 139. 200.

CHAP. V.

Concerning the Poſſibility of Framing an Ark for ſubmarine Navigations. The Difficulties and Conveniences of ſuch a Contrivance.

IT will not be altogether impertinent unto the Diſcourſe of theſe gradient *Automata*, to mention what *Merſennus* doth ſo largely and pleaſantly deſcant upon, concerning the making of a Ship, wherein Men may ſafely ſwim under the Water.

Tract. de Magnetis Proprietatibus.

That ſuch a Contrivance is feaſible and may be effected, is beyond all Queſtion, becauſe it hath been already experimented here in *England* by *Cornelius Dreble*; but how to improve it unto Publick Uſe and Advantage, ſo as to be ſerviceable for remote Voyages, the carrying of any conſiderable Number of Men, with Proviſions and Commodities, would be of ſuch excellent Uſe, as may deſerve ſome further Enquiry.

Concerning which there are two things chiefly conſiderable:

The { many Difficulties with their Remedies.
great Conveniences.

1. The Difficulties are generally reducible to theſe Three Heads.

1. The letting out, or receiving in any thing, as there ſhall be occaſion without the Admiſſion of Water. If it have not ſuch a Convenience, theſe kind of Voyages muſt needs be very dangerous and uncomfortable, both by Reaſon of many noiſome, offenſive Things, which ſhould be thruſt out, and many other needful Things which ſhould be receiv'd in. Now herein will conſiſt the Difficulty, how to contrive the opening of this Veſſel ſo, that any thing may be put in or out, and yet the Water not ruſh into it with much Violence, as it doth uſually in the Leak of a Ship.

In which Caſe, this may be a proper Remedy; let there be certain Leather Bags made of ſeveral Bigneſſes, which for the Matter of them ſhould be both *tractable* for the Uſe and Managing of them, and ſtrong to keep out the Water; for the Figure of them, being long and open at both Ends. Anſwerable to theſe, let there be divers Windows, or open Places in the Frame of the Ship, round the Sides of which one End of theſe Bags may be fixed, the other End coming within the Ship, being to open and ſhut as a Purſe. Now if we ſuppoſe this Bag thus faſtned, to be tied cloſe about towards the Window, then any thing that is to be ſent out, may be ſafely put into that End within the Ship, which being again cloſe ſhut, and the other End looſened, the thing may be ſafely ſent out without the Admiſſion of any Water.

So again, when any thing is to be taken in, it muſt be firſt receiv'd into that Part of the Bag towards the Window, which being (after the thing is with-

within it) close tied about, the other end may then be safely opened. It is easie to conceive, how by this means any Thing or Person may be sent out, or receiv'd in, as there shall be occasion; how the Water, which will perhaps by Degrees leak into several Parts, may be emptied out again, with divers the like Advantages. Tho' if there should be any Leak at the Bottom of this Vessel, yet very little Water would get in, because no Air could get out.

2. The second Difficulty in such an Ark will be the Motion or fixing of it according to occasion: The directing of it to several Places, as the Voyage shall be designed, without which, it would be very useless, if it were to remain only in one Place, or were to remove only blindfold, without any certain Direction: And the Contrivance of this may seem very difficult, because these submarine Navigators will want the usual Advantages of Winds and Tides for Motion, and the Sight of the Heavens for Direction.

But these Difficulties may be thus remedied; As for the *Progressive* Motion of it, this may be effected by the Help of several Oars, which in the outward Ends of them, shall be like the Fins of a Fish to contract and dilate. The Passage where they are admitted into the Ship being tied about with such Leather Bags (as were mentioned before) to keep out the Water. It will not be convenient perhaps that the Motion in these Voyages should be very swift, because of those Observations and Discoveries to be made at the Bottom of the Sea, which in a little space may abundantly recompense the Slowness of its Progress.

If this Ark be so ballast as to be of equal Weight with the like Magnitude of Water, it will then be easily moveable in any Part of it.

As for the Ascent of it, this may be easily contrived, if there be some great Weight at the Bottom

of the Ship (being part of its Ballaſt) which by ſome Cord within may be looſened from it: As this Weight is let lower, ſo will the Ship aſcend from it (if need be) to the very Surface of the Water; and again, as it is pulled cloſe to the Ship, ſo will it *deſcend*.

For *Direction* of this Ark, the Mariners Needle may be uſeful in reſpect of the *Latitude* of Places; and the Courſe of this Ship being more regular than others, by reaſon it is not ſubject to Tempeſts or unequal Winds, may more certainly guide them in judging of the *Longitude* of Places.

3. But the greateſt Difficulty of all will be this, how the Air may be ſupplied for Reſpiration; How conſtant Fires may be kept in it for Light and the Dreſſing of Food, how thoſe Viciſſitudes of Rarefaction and Condenſation may be maintained.

It is obſerved, that a Barrel or Cap, whoſe Cavity will contain Eight Cubical Feet of Air, will not ſerve a Urinator or Diver for Reſpiration, above one quarter of an Hour; the Breath which is often ſucked in and out, being ſo corrupted by the mixture of Vapours, that Nature rejects it as unſerviceable. Now in an Hour a Man will need at leaſt 300 and Sixty Reſpirations, betwixt every one of which there ſhall be 10 ſecond Minutes, and conſequently a great Change and Supply of Air will be neceſſary for many Perſons, and any long Space.

And ſo likewiſe for the keeping of Fire; a cloſe Veſſel containing 10 Cubical Feet of Air, will not ſuffer a Wax Candle of an Ounce to burn in it above an Hour before it be ſuffocated; tho' this Proportion (ſaith *Merſennus*) doth not equally increaſe for ſeveral Lights, becauſe Four Flames of an equal Magnitude will be kept alive the Space of 16 ſecond Minutes, tho' one of theſe Flames alone in the ſame Veſſel will not laſt above 35, or at moſt 30 ſeconds; which may be eaſily tried in large glaſs Bottles, having Wax Candles lighted in them, and with their Mouths inverted in Water.

For

For the Reſolution of this Difficulty, though I will not ſay, that a Man may, by Cuſtom (which in other things doth produce ſuch ſtrange incredible Effects) be enabled to live in the open Water, as the Fiſhes do, the Inſpiration and Expiration of Water ſerving inſtead of Air, this being uſual with many Fiſhes that have Lungs; yet it is certain, that long Uſe and Cuſtom may ſtrengthen Men againſt many ſuch Inconveniencies of this kind, which to unexperienced Perſons may prove very hazardous: And ſo it will not perhaps be unto theſe ſo neceſſary, to have the Air for breathing ſo pure and defecated, as is required for others.

But further, there are in this Caſe theſe Three Things conſiderable.

1. That the Veſſel it ſelf ſhould be of a large Capacity, that as the Air in it is corrupted in one part, ſo it may be purified and renewed in the other: Or if the meer Refrigeration of the Air would fit it for Breathing, this might be ſomewhat helped with Bellows, which would cool it by Motion.

2. It is not altogether improbable, that the Lamps or Fires in the Middle of it, like the reflected Beams in the firſt Region, rarefying the Air, and the circumambient Coldneſs towards the ſides of the Veſſel, like the ſecond Region, cooling and condenſing of it, would make ſuch a Viciſſitude and Change of Air, as might fit it for all its proper Uſes.

3. Or if neither of theſe Conjectures will help, yet *Merſennus* tells us in another Place, that there is in *France* one *Barrieus* a Diver, who hath lately found out another Art, whereby a Man might eaſily continue under Water for ſix Hours together; and whereas Ten Cubical Feet of Air will not ſerve another Diver to breathe in for half an Hour, he by the Help of a Cavity, not above one or two Foot at moſt, will have Breath enough for ſix Hours, and a Lanthorn ſcarce above the uſual Size to keep a Can-

Harmon. l. 4. prop. 6. Monit. 5.

Candle burning as long as a Man pleaſe, which (if it be true, and were commonly known) might be a ſufficient Help againſt this greateſt Difficulty.

As for the many Advantages and Conveniences of ſuch a Contrivance, it is not eaſie to recite them.

1. 'Tis *Private*; a Man may thus go to any Coaſt of the World inviſibly, without being diſcovered or prevented in his Journey.

2. 'Tis *Safe*; from the Uncertainty of *Tides*, and the Violence of *Tempeſts*, which do never move the Sea above Five or Six Paces deep. From *Pirates* and *Robbers* which do ſo infeſt other Voyages: From Ice and great Froſts, which do ſo much endanger the Paſſages towards the Poles.

3. It may be of very great Advantage againſt a Navy of Enemies, who by this means may be undermined in the Water, and blown up.

4. It may be of ſpecial uſe for the Relief of any Place that is Beſieged by Water, to convey unto them Inviſible Supplies; and ſo likewiſe for the Surprizal of any Place that is acceſſible by Water.

5. It may be of unſpeakable Benefit for Submarine Experiments and Diſcoveries; as,

The ſeveral Proportions of Swiftneſs betwixt the aſcent of a Bladder, Cork, or any other light Subſtance, in compariſon to the deſcent of Stones or Lead. The deep Caverns, and Subterraneous Paſſages, where the Sea-water, in the Courſe of its Circulation, doth vent it ſelf into other Places, and the like. The Nature and Kinds of Fiſhes, the ſeveral Arts of Catching them, by alluring them with Lights, by placing divers Nets about the Sides of this Veſſel, ſhooting the greater ſort of them with Guns, which may be put out of the Ship by the help of ſuch Bags as were mentioned before, with divers the like Artifices and Treacheries, which may be more ſucceſsfully practiſed by ſuch who live ſo

famili-

amiliarly together. Theſe Fiſh may ſerve not on- for Food, but for Fewel likewiſe, in reſpect of hat Oil which may be extracted from them; the vay of Dreſſing Meat by Lamps, being in many Reſpects the moſt convenient for ſuch a Voyage.

The many freſh Springs that may probably be net with in the bottom of the Sea, will ſerve for he Supply of Drink, and other Occaſions.

But above all, the Diſcovery of ſubmarine Treaures is more eſpecially conſiderable; not only in egard of what hath been drowned by Wrecks, but he ſeveral precious Things that grow there; as Pearl, Coral, Mines; with innumerable other Things of great Value, which may be much more aſily found out, and fetch'd up by the help of this, han by any other uſual way of the Urinators.

To which purpoſe, this great Veſſel may have ome leſſer Cabins tyed about it, at various Diſtanes; wherein ſeveral Perſons, as Scouts, may be odged for the taking of Obſervations, according s the Admiral ſhall direct them: Some of them beng frequently ſent up to the Surface of the Water, s there ſhall be Occaſion.

All kind of Arts and Manufactures may be exerciſed in this Veſſel. The Obſervations made by it, nay be both Written, and (if need were) Printed here likewiſe. Several Colonies may thus inhabit, aving their Children born, and bred up without he knowledge of Land, who could not chuſe but e amazed with ſtrange Conceits upon the Diſcovey of this Upper World.

I am not able to judge what other Advantages here may be ſuggeſted, or whether Experiment would fully anſwer to theſe Notional Conjectures. But however, becauſe the Invention did unto me eem ingenious and new, being not impertinent to he preſent Enquiry, therefore I thought it might e worth the mentioning.

CHAP.

CHAP. VI.

Of the volant Automata, Archytas *his Dove, and* Regiomontanus *his Eagle. The Possibility, and great Usefulness of such Inventions.*

THE *volant,* or flying *Automata,* are such Mechanical Contrivances as have a Self-motion, whereby they are carried aloft in the open Air like the flight of Birds. Such was that Wooden Dove made by *Archytas,* a Citizen of *Tarentum,* and one of *Plato*'s Acquaintance: And that Wooden Eagle framed by *Regiomontanus* at *Noremberg,* which, by way of Triumph, did fly out of the City to meet *Charles* the Fifth. This latter Author is also reported to have made an Iron Fly, *Quæ ex artificis manu egressa, convivas circumvolitavit, tandemque veluti defessa in Domini manus reversa est*; which, when he invited any of his Friends, would fly to each of them round the Table, and at length (as being weary) return unto its Master.

Diog. Laer. l. 8. Pet. Crinitus de honest. discip. l. 17. c. 12. Ramus Schol. Mathem. l. 2. Dubartas 6 days 1 W. 1. Dee Preface to *Euclid.*

Cardan seems to doubt the possibility of any such Contrivance: His Reason is, because the Instruments of it must be firm and strong, and consequently they will be too heavy to be carried by their own force; but yet (saith he) if it be a little helped in the first rising, and if there be any Wind to assist it in the Flight, then there is nothing to hinder, but that such Motions may be possible. So that he doth in effect grant as much as may be sufficient for the Truth and Credit of those ancient Relations; and to distrust them without a stronger Argument, must needs argue a blind and perverse Incredibility. As for his Objection concerning the heavines of the Materials in such an Invention, it may be answered,

De Variet. rerum lib. 12. c. 58.

That

That it is eaſie to contrive ſuch Springs, and other Inſtruments, whoſe Strength ſhall much exceed their Heavineſs. Nor can he ſhew any cauſe why theſe Mechanical Motions may not be as ſtrong, (though not ſo laſting) as the natural Strength of Living Creatures.

Scaliger conceives the framing of ſuch volant *Automata* to be very eaſie. *Volantis columbæ machinulam, cujus autorem Archytam tradunt, vel facillime profiteri audeo.* Thoſe ancient Motions were thought to be contrived by the force of ſome included Air: So *Gellius*, *Ita erat ſcilicet libramentis ſuſpenſum, & aurâ ſpiritus incluſa, atque occultà conſitum, &c.* As if there had been ſome Lamp, or other Fire within it, which might produce ſuch a forcible Rarefaction, as ſhould give a Motion to the whole Frame.

Subtil. Exercit. 326.

Noct. Attic. l. 10. cap. 12. where he thinks it ſo ſtrange an Invention, that he ſtiles it *Res abhorrens à fide. Athan. Kircher de Magnete l. 2. par. 4. Proem.* doth promiſe a large Diſcourſe concerning theſe kind of Inventions in another Treatiſe, which he ſtiles *Oedipus Aegyptiacus.*

But this may be better performed by the ſtrength of ſome ſuch Spring, as is commonly uſed in Watches. This Spring may be applied unto one Wheel, which ſhall give an equal Motion to both the Wings; theſe Wings having unto each of them another ſmaller Spring, by which they may be contracted and lifted up: So that being forcibly depreſſed by the ſtrength of the great and ſtronger Spring, and lifted up again by the other two; according to this Suppoſition, it is eaſie to conceive how the Motion of Flight may be performed and continued.

The Wings may be made either of *ſeveral Subſtances joined*, like the Feathers in ordinary Fowl, as *Dædalus* is feigned to contrive them, according to that in the Poet,

---Ignotas animum dimittit in artes,
Naturamque novat, nam ponit in ordine pennas
A minimo cœptas longam breviore ſequente,
Ut clivo creviſſe putes, &c.

Ovid. Metam. l. 8.

Or elſe of *one continuate Subſtance*, like thoſe of Bats. In framing of both which, the beſt Guidance is to follow (as near as may be) the Direction of Nature,

ture, this being but an Imitation of a Natural Work Now in both theſe, the ſtrength of each part is proportioned to the force of its Employment. But nothing in this kind can be perfectly determined without a particular Trial.

Though the compoſing of ſuch Motions may be a ſufficient Reward to any one's Induſtry in the ſearching after them, as being in themſelves of excellent Curioſity, yet there are ſome other Inventions depend upon them of more general Benefit, and greater Importance. For, if there be any ſuch artificial Contrivances that can fly in the Air, (as is evident from the former Relations, together with the Grounds here ſpecified, and, I doubt not, may be eaſily effected by a diligent and ingenious Artificer) then it will clearly follow, that it is poſſible alſo for a Man to fly himſelf; it being eaſie from the ſame Grounds, to frame an Inſtrument wherein any one may ſit, and give ſuch a Motion unto it, as ſhall convey him aloft through the Air. Than which there is not any imaginable Invention, that could prove of greater Benefit to the World, or Glory to the Author; and therefore it may juſtly deſerve their Enquiry, who have both Leiſure and Means for ſuch Experiments.

But in theſe practical Studies, unleſs a Man be able to go the Tryal of Things, he will perform but little. In ſuch Matters,

Horace. ---*Studium ſine divite venâ*,

(as the Poet ſaith) a general Speculation, without particular Experiment, may conjecture at many things, but can certainly effect nothing; and therefore I ſhall only propoſe unto the World, the Theory and general Grounds that may conduce to the eaſie and more perfect Diſcovery of the Subject in Queſtion, for the Encouragement of thoſe that have both Minds and Means for ſuch Experiments. This ſame Scholar's Fate,

Res anguſta domi, and
---*Curta ſuppellex*,
is that which hinders the promoting of Learning in ſundry Particulars, and robs the World of many excellent Inventions. We read of *Ariſtotle*, that he was allowed by his Pupil *Alexander* 800 Talents a Year, for the Payment of Fiſhers, Fowlers, and Hunters, who were to bring him in ſeveral Creatures, that ſo by his particular Experience of their Parts and Diſpoſitions, he might be more fitly prepared to write of their Natures. The Reaſon why the World hath not many *Ariſtotles*, is becauſe it hath ſo few *Alexanders*.

Amongſt other Impediments of any ſtrange Invention, or Attempts, it is none of the meaneſt Diſcouragements, that they are ſo generally derided by common Opinion; being eſteemed only as the Dreams of a melancholy and diſtempered Fancy. *Euſebius* ſpeaking, with what neceſſity every thing is confined by the Laws of Nature, and the Decrees of Providence, ſo that nothing can go out of that way unto which naturally it is deſigned; as a Fiſh cannot reſide on the Land, nor a Man in the Water, or aloft in the Air; infers, that therefore none will venture upon any ſuch vain Attempt, as paſſing in the Air, ἢ μελαγχολίας νοσήματι ἂν ὠφελήσοι, unleſs his Brain be a little crazed with the Humour of Melancholy; whereupon he adviſes, that we ſhould not in any Particular, endeavour to tranſgreſs the Bounds of Nature, ἐπεὶ ἄπτερον ἔχοντα τὸ σῶμα, τὰ τῶν πτηνῶν ἁπτοίμεθα, and ſince we are deſtitute of Wings, not to imitate the Flight of Birds. That Saying of the Poet,

Demens, qui nimbos, & non imitabile fulmen, &c.

hath been an old Cenſure, applyed unto ſuch as ventured upon any ſtrange or incredible Attempt.

Contra Hierocl. confut. l. x.

Virgil Æneid. l. 6.

Hence may we conceive the Reaſon, why there is ſo little Intimation in the Writings of Antiquity, con-

concerning the poſſibility of any ſuch Invention The Ancients durſt not ſo much as mention the Art of Flying, but in a Fable.

Dædalus, ut fama eſt, fugiens Minoia regna,
Præpetibus pennis auſus ſe credere cœlo,
Inſuetum per iter gelidas enavit ad arctos, &c.

It was the Cuſtom of thoſe former Ages, in their over-much Gratitude, to advance the firſt Authors of any uſeful Diſcovery amongſt the Number of their Gods. And *Dædalus*, being ſo famous amongſt them for ſundry Mechanical Inventions (eſpecially the Sails of Ships) though they did not for theſe place him in the Heavens, yet they have promoted him as near as they could, feigning him to fly aloft in the Air, when as he did but fly in a ſwift Ship, as *Diodorus* relates the Hiſtorical Truth on which that Fiction is grounded.

So *Euſebius* too.

CHAP. VII.

Concerning the Art of Flying. The ſeveral ways whereby this hath been, or may be attempted.

I Have formerly in two other * Diſcourſes mentioned the poſſibility of this Art of Flying, and intimated a farther Enquiry into it, which is a kind of Engagement to ſome fuller Diſquiſitions and Conjectures to that purpoſe.

*World in the Moon, *cap.* 14. *Mercury*, or the Secret and Swift Meſſenger, *c.* 4.

There are four ſeveral ways whereby this Flying in the Air hath been, or may be attempted. Two of them by the ſtrength of other things, and two of them by our own Strength.

1. By Spirits, or Angels.
2. By the help of Fowls.
3. By Wings faſtned immediately to the Body.
4. By a Flying Chariot.

1. For

1. For the first, we read of divers that have passed swiftly in the Air, by the help of Spirits and Angels; whether good Angels, as * *Elias* was carried unto Heaven in a Fiery-Chariot, as † *Philip* was conveyed to *Azotus*, and *Habakkuk* from *Jewry* to *Babylon*, and back again immediately: Or by evil Angels, as our Saviour was carried by the Devil to the top of a high Mountain, and to the Pinacle of the Temple. Thus Witches are commonly related to pass unto their usual Meetings, in some remote Place; and, as they do sell Winds unto Mariners, so likewise are they sometimes hired to carry Men speedily through the open Air. *Acosta* affirms, that such kind of Passages are usual amongst divers Sorcerers with the *Indians* at this day.

Zanch. de oper. part 1. l. 4.
* 2 Kings 2. 11.
† Acts 8. 39.
Dan. Apoc. 39.
Luke 4.
Erastus de Lamus.
Hist. Ind. l. 5. c. 26

So *Kepler*, in his Astronomical Dream, doth fancy a Witch to be conveyed unto the Moon by her Familiar.

Simon Magus was so eminent for Miraculous Sorceries, that all the People in *Samaria*, from the least to the greatest, did esteem him *as the great Power of God*. And so famous was he at *Rome*, that the Emperor erected a Statue to him with this Inscription, *Simoni Deo Sancto*. 'Tis storied of this Magician, that having challenged St. *Peter* to do Miracles with him, he attempted to fly from the Capitol to the *Aventine* Hill; but when he was in the midst of the way, St. *Peter*'s Prayers did overcome his Sorceries, and violently bring him to the Ground; in which Fall having broke his Thigh, within a while after he Died.

Acts 8. 10
Hegesip. l. 3. c. 2.
Pol. Virgil. de Inven. Rerum. l. 8. c. 3.
Pet. Crinitus de Honestâ Disciplin. l. 8. c. 1. mistrusts this Relation as fabulous.

But none of all these Relations may conduce to the Discovery of this Experiment, as it is here enquired after, upon *Natural* and *Artificial* Grounds.

2. There are others, who have conjectured a possibility of being conveyed through the Air by the help of Fowls; to which purpose, that Fiction of the *Ganza's* is the most pleasant and probable. They

Non enim Lucas hoc omisisset:

are ſuppoſed to be great Fowl, of a ſtrong laſting Flight, and eaſily tameable: Divers of which may be ſo brought up, as to join together in the carrying the weight of a Man, ſo as each of them ſhall partake his proportionable ſhare of the Burden, and the Perſon that is carried may by certain Reins, direct and ſteer them in their Courſes. However this may ſeem a ſtrange Propoſal, yet it is not certainly more improbable than many other Arts, wherein the Induſtry of Ingenious Men hath inſtructed theſe Brute Creatures. And I am very confident, that one whoſe Genius doth enable him for ſuch kind of Experiments upon Leiſure, and the advantage of ſuch Helps as are requiſite for various and frequent Trials, might effect ſome ſtrange things by this kind of Enquiry.

'Tis reported as a Cuſtom amongſt the *Leucatians*, that they were wont upon a Superſtition, to precipitate a Man from ſome high Cliff into the Sea, tying about him with Strings at ſome diſtance, many great Fowls, and fixing upon his Body divers Feathers, ſpread to break the Fall; which (ſaith the Learned *Bacon*, if it were diligently and exactly contrived) would be able to hold up, and carry any proportionable Weight; and therefore he adviſes others to think further upon this Experiment, as giving ſome Light to the Invention of the Art of Flying.

Nat. Hiſt. Experim. 886.

3. 'Tis the more obvious and common Opinion, that this may be effected by Wings faſtned immediately to the Body, this coming neareſt to the Imitation of Nature, which ſhould be obſerved in ſuch Attempts as theſe. This is that way which *Fredericus Hermannus*, in his little Diſcourſe *de Arte volandi*, doth only mention and inſiſt upon; and if we may truſt credible Story, it hath been frequently attempted not without ſome Succeſs. 'Tis related of a certain *Engliſh* Monk, called *Elmerus*, about the Con-

So the ancient *Britiſh Bladuds.*

feſſor's

feſſor's time, that he did by ſuch Wings fly from a Tower above a Furlong; and ſo another from Saint *Mark*'s Steeple in *Venice*; another at *Norinberg*; and *Busbequius* ſpeaks of a *Turk* in *Conſtantinople*, who attempted ſomething this way. M. *Burton* mentioning this Quotation, doth believe that ſome new-fangled Wit ('tis his Cynical Phraſe) will ſome time or other find out this Art. Though the truth is, moſt of theſe Artiſts did unfortunately miſcarry by falling down, and breaking their Arms or Legs, yet that may be imputed to their want of Experience, and too much Fear, which muſt needs poſſeſs Men in ſuch dangerous and ſtrange Attempts. Thoſe things that ſeem very difficult and fearful at the firſt, may grow very facil after frequent Trial and Exerciſe: And therefore he that would effect any thing in this kind, muſt be brought up to the conſtant practice of it from his Youth; trying firſt only to uſe his Wings, in running on the Ground, as an Eſtrich or tame Geeſe will do, touching the Earth with his Toes; and ſo by degrees learn to riſe higher, till he ſhall attain unto Skill and Confidence. I have heard it from credible Teſtimony, that one of our own Nation hath proceeded ſo far in this Experiment, that he was able by the help of Wings, in ſuch a running Pace, to ſtep conſtantly ten Yards at a time.

Erneſtus Burgravus in Panoplia Phyſico-Vulcania. Sturmius in Lat. linguæ reſolut.

Melancholy, *Par.* 2. *Sect.* 1. *Mem.* 3.

It is not more incredible, that frequent Practice and Cuſtom ſhould enable a Man for this, than for many other things which we ſee confirmed by Experience. What ſtrange Agility and Activeneſs do our common Tumblers and Dancers on the Rope attain to by continual Exerciſe? 'Tis related of certain *Indians*, that they are able, when a Horſe is running in his full Career, to ſtand upright on his Back, to turn themſelves round, to leap down, gathering up any thing from the Ground, and immediately to leap up again, to ſhoot exactly at any

Maffæus Hiſt. Ind. l. 1.

Mark, the Horſe not intermitting his Courſe: And ſo upon two Horſes together, the Man ſetting one of his Feet upon each of them. Theſe things may ſeem impoſſible to others, and it would be very dangerous for any one to attempt them, who hath not firſt gradually attained to theſe Arts by long Practice and Trial; and why may not ſuch Practice enable him as well for this other Experiment, as for theſe Things?

There are others, who have invented ways to walk upon the Water as regularly and firmly as upon the Land. There are ſome ſo accuſtomed to this Element, that it hath been almoſt as natural to them as to the Fiſh; Men that could remain for above an Hour together under Water. *Pontanus* mentions one, who could ſwim above a hundred Miles together, from one Shoar to another, with great ſpeed, and at all times of the Year. And it is ſtoried of a certain young Man, a *Sicilian* by Birth, and a *Diver* by Profeſſion, who had ſo continually uſed himſelf to the Water, that he could not enjoy his Health out of it. If at any time he ſtaid with his Friends on the Land, he ſhould be ſo tormented with a Pain in his Stomach, that he was forced for his Health to return back again to Sea; wherein he kept his uſual Reſidence, and when he ſaw any Ships, his Cuſtom was to ſwim to them for Relief; which kind of Life he continued till he was an old Man, and died.

Treatiſe of Cuſtom.

I mention theſe things, to ſhew the great Power of Practice and Cuſtom, which might more probably ſucceed in this Experiment of Flying (if it were but regularly attempted) than in ſuch ſtrange Effects as theſe.

It is a uſual Practice in theſe Times, for our *Funambulones*, or Dancers on the Rope, to attempt ſomewhat like to Flying, when they will with their Heads forwards, ſlide down a long Cord extended; being

being faſtned at one end to the top of ſome high Tower, and the other at ſome diſtance on the Ground, with Wings fixed to their Shoulders, by the ſhaking of which they will break the force of their Deſcent. It would ſeem that ſome attempts of this kind were uſual amongſt the *Romans*. To which that Expreſſion in * *Salvian* may refer; where, amongſt other publick Shews of the Theatre, he mentions the *Petaminaria*; which Word (ſaith *Jo. Braſſicanus*) is ſcarce to be found in any other Author, being not mentioned either in *Julius Pollux*, or *Politian*. 'Tis probably derived from the *Greek* word πέτασος, which ſignifies to Fly, and may refer to ſuch kind of Rope-Dancers.

* *Deguber. Dei. l. 6. Annot. in Salvi.*

But now, becauſe the Arms extended are but weak, and eaſily wearied, therefore the Motions by them are like to be but ſhort and ſlow, anſwerable it may be to the Flight of ſuch Domeſtick Fowl as are moſt converſant on the Ground, which of themſelves we ſee are quickly weary; and therefore much more would the Arm of a Man, as being not naturally deſigned to ſuch a Motion.

It were therefore worth the Enquiry, to conſider whether this might not be more probably effected by the Labour of the Feet, which are naturally more ſtrong and indefatigable: In which Contrivance, the Wings ſhould come down from the Shoulders on each ſide, as in the other, but the Motion of them ſhould be from the Legs, being thruſt out, and drawn in again one after another, ſo as each Leg ſhould move both Wings; by which means a Man ſhould (as it were) walk or climb up into the Air; and then the Hands and Arms might be at leiſure to help and direct the Motion, or for any other Service proportionable to their Strength. Which Conjecture is not without good Probability, and ſome ſpecial Advantages above the other.

4. But the fourth and laſt way ſeems unto me altogether as probable, and much more uſeful than any of the reſt. And that is by a flying Chariot, which may be ſo contrived as to carry a Man within it; and though the ſtrength of a Spring might perhaps be ſerviceable for the Motion of this Engine, yet it were better to have it aſſiſted by the Labour of ſome intelligent Mover, as the Heavenly Orbs are ſuppoſed to be turned. And therefore if it were made big enough to carry ſundry Perſons together, then each of them in their ſeveral turns might ſucceſſively Labour in the cauſing of this Motion; which thereby would be much more conſtant and laſting, than it could otherwiſe be, if it did wholly depend on the Strength of the ſame Perſon. This Contrivance being as much to be preferred before any of the other, as ſwimming in a Ship before ſwimming in the Water.

CHAP. VIII.

A Reſolution of the two chief Difficulties that ſeem to oppoſe the Poſſibility of a flying Chariot.

THE chief Difficulties againſt the poſſibility of any ſuch Contrivance, may be fully removed in the Reſolution of theſe two *Quæries*.

1. Whether an Engine of ſuch Capacity and Weight, may be ſupported by ſo thin and light a Body as the Air?

2. Whether the Strength of the Perſons within it, may be ſufficient for the Motion of it?

Vitruvius Archit. l. 10. c. 22.

1. Concerning the firſt; when *Callias* was required by the Men of *Rhodes*, to take up that great *Helepolis*, brought againſt them by *Demetrius*, (as he had done before unto ſome leſs which he himſelf had made)

made) He anſwered that it could not be done. *Nonnulla enim ſunt quæ in exemplaribus videntur ſimilia, cum autem creſcere cæperunt, dilabuntur.* Becauſe thoſe Things that appear probable in leſſer Models, when they are increaſed to a greater Proportion, do thereby exceed the Power of Art. For Example, though a Man may make an Inſtrument to bore a Hole, an Inch wide, or half an Inch, and ſo leſs; yet to bore a Hole of a Foot wide, or two Foot, is not ſo much as to be thought of. Thus, though the Air may be able to uphold ſome leſſer Bodies, as thoſe of Birds, yet when the quantity of them is increaſed to any great Extenſion, it may juſtly be doubted, whether they will not exceed the Proportion that is naturally required unto ſuch kind of Bodies.

So *Ramus Schol. Mathem. l.* 1.

To this I anſwer, that the Engine can never be too big or too heavy, if the ſpace which it poſſeſſes in the Air, and the Motive-Faculty in the Inſtrument be anſwerable to its Weight. That Saying of *Callias* was but a groundleſs Shift and Evaſion, whereby he did endeavour to palliate his own Ignorance and Diſability. The utmoſt Truth which ſeems to be implied in it, is this: That there may be ſome Bodies of ſo great a Bigneſs, and Gravity, that it is very difficult to apply ſo much Force unto any particular Inſtrument, as ſhall be able to move them.

Againſt the Example it may be affirmed and eaſily proved, that it is equally poſſible to bore a Hole of any bigneſs, as well great as little, if we ſuppoſe the Inſtrument, and the Strength, and the Application of this Strength to be proportionable; But becauſe of the difficulty of theſe concurrent Circumſtances in thoſe greater and more unuſual Operations, therefore do they falſly ſeem to be abſolutely impoſſible.

So that the chief Inference from this Argument and Example, doth imply only thus much, that it is very difficult to contrive any ſuch motive Power, as ſhall be anſwerable to the Greatneſs and Weight of ſuch an Inſtrument as is here diſcourſed of; which doth not at all impair the Truth to be maintained: For if the poſſibility of ſuch a Motion be yielded, we need not make any ſcruple of granting the Difficulty of it; It is this muſt add a Glory to the Invention; and yet this will not perhaps ſeem ſo very difficult to any one who hath but diligently obſerved the Flight of ſome other Birds, particularly of a Kite, how he will ſwim up and down in the Air, ſometimes at a great height, and preſently again lower, guiding himſelf by his Train, with his Wings extended without any ſenſible Motion of them; and all this, when there is only ſome gentle breath of Air ſtirring, without the help of any ſtrong forcible Wind. Now I ſay, if that Fowl (which is none of the lighteſt) can ſo very eaſily move it ſelf up and down in the Air, without ſo much as ſtirring the Wings of it, certainly then it is not improbable, but that when all the due Proportions in ſuch an Engine are found out, and when Men by long Practice have arrived to any Skill and Experience, they will be able in this (as well as in many other Things) to come very near unto the imitation of Nature.

Sen. Nat. Qu. l. 1. c. 25.

As it is in thoſe Bodies which are carried on the Water, tho' they be never ſo big or ſo ponderous, (ſuppoſe equal to a City or a whole Iſland) yet they will always ſwim on the Top, if they be but any thing lighter than ſo much Water as is equal to them in Bigneſs: So likewiſe is it in the Bodies that are carried in the Air. It is not their Greatneſs (tho' never ſo immenſe) that can hinder their being ſupported in that light Element, if we ſuppoſe them to be extended unto a proportionable Space of Air.

And

And as from the former Experiments, *Archimedes* hath compoſed a ſubtle *Science* in his Book *De inſidenibus humido*, concerning the Weight of any heavy Body, in reference to the Water wherein it is; ſo from the particular Trial of theſe other Experiments, that are here enquired after, it is poſſible to raiſe a new Science, concerning the Extenſion of Bodies, in compariſon to the Air, and motive Faculties by which they are to be carried.

We ſee a great difference betwixt the ſeveral Quantities of ſuch Bodies as are commonly upheld by the Air; not only little Gnats, and Flies, but alſo the Eagle and other Fowl of vaſter Magnitude. *Cardan* and *Scaliger* do unanimouſly affirm, that there is a Bird amongſt the *Indians* of ſo great a Bigneſs, that his Beak is often uſed to make a Sheath or Scabbard for a Sword. And *Acoſta* tells us of a Fowl in *Peru* called *Candores*, which will of themſelves kill and eat up a whole Calf at a time. Nor is there any Reaſon why any other Body may not be ſupported and carried by the Air, though it ſhould as much exceed the Quantity of theſe Fowl, as they do the Quantity of a Fly. *Subtil. l.* 10. *Exercit.* 231. *Hiſtor. Nov. Orb. l.* 4. *c.* 37.

Marcus Polus mentions a Fowl in *Madagaſcar*, which he calls a *Ruck*, the Feather of whoſe Wings are 12 Paces, or Threeſcore Foot long, which can with as much eaſe ſoop up an Elephant, as our Kites do a Mouſe. If this Relation were any thing credible, it might ſerve as an abundant Proof for the preſent *Quære*. But I conceive this to be already ſo evident, that it needs not any Fable for its further Confirmation.

2. The other doubt was, whether the Strength of the other Perſons within it, will be ſufficient for the moving of this Engine? I anſwer, the main Difficulty and Labour of it will be in the raiſing of it from the Ground; near unto which, the Earths attractive Vigor is of greateſt Efficacy. But for the better effecting of this, it may be

be helped by the Strength of Winds, and by taking its firſt Riſe from ſome Mountain or other high Place. When once it is aloft in the Air, the Motion of it will be eaſie, as it is in the Flight of all kind of Birds, which being at any great Diſtance from the Earth, are able to continue their Motion for a long Time and Way, with little Labour or Wearineſs.

'Tis certain from common Relation and Experience that many Birds do croſs the Seas for divers hundred Miles together: Sundry of them amongſt us, which are of a ſhort Wing and Flight, as Blackbirds, Nightingales, *&c.* do flie from us into *Germany*, and other remoter Countries. And Mariners do commonly affirm that they have found ſome Fowl above ſix hundred Miles from any Land. Now if we ſhould ſuppoſe theſe Birds to labour ſo much in thoſe long Journies, as they do when they fly in our Sight and near the Earth, it were impoſſible for any of them to paſs ſo far without reſting. And therefore it is probable, that they do mount unto ſo high a Place in the Air, where the natural Heavineſs of their Bodies does prove but little or no impediment to their Flight: Tho' perhaps either Hunger, or the Sight of Ships, or the like accident, may ſometimes occaſion their deſcending lower; as we may gueſs of thoſe Birds which Mariners have thus beheld, and divers others that have been drowned and caſt up by the Sea.

Plin. l. 10. *c.* 23.

Whence it may appear, that the Motion of this Chariot (tho' it may be difficult at the firſt) yet will ſtill be eaſier as it aſcends higher, till at length it ſhall become utterly devoid of Gravity, when the leaſt Strength will be able to beſtow upon it a ſwift Motion: As I have proved more at large in another Diſcourſe.

World in the Moon, cap. 14.

But then, (may ſome object) If it be ſuppoſed that a Man in the Æthereal Air does loſe his own Heavi-

Heavineſs, how ſhall he contribute any force towards the Motion of this Inſtrument?

I anſwer, The Strength of any living Creature in theſe external Motions, is ſomething really diſtinct from, and ſuperadded unto its natural Gravity: As common Experience may ſhew, not only in the Impreſſion of Blows or violent Motions, as a River Hawk will ſtrike a Fowl with a far greater Force, than the meer Deſcent or Heavineſs of his Body could poſſibly perform: But alſo in thoſe Actions which are done without ſuch Help, as the Pinching of the Finger, the Biting of the Teeth, *&c.* all which are of much greater Strength than can proceed from the meer Heavineſs of thoſe Parts.

As for the other particular Doubts, concerning the extream Thinneſs and Coldneſs of this Æthereal Air, by reaſon of which, it may ſeem to be altogether impaſſible, I have already reſolved them in the above-cited Diſcourſe.

The Uſes of ſuch a Chariot may be various: Beſides the Diſcoveries which might be thereby made in the Lunary World, it would be ſerviceable alſo for the Conveyance of a Man to any remote Place of this Earth: As ſuppoſe to the *Indies* or *Antipodes*. For when once it was elevated for ſome few Miles, ſo as to be above that Orb of Magnetick Virtue, which is carried about by the Earth's diurnal Revolution, it might then be very eaſily and ſpeedily directed to any particular Place of this great Globe.

If the Place which we intended were under the ſame Parallel, why then the Earth's Revolution once in Twenty four Hours, would bring it to be under us; ſo that it would be but deſcending in a ſtraight Line, and we might preſently be there. If it were under any other Parallel, it would then only require that we ſhould direct it in the ſame Meridian, till

tilll we did come to that Parallel; and then (as before) a Man might eaſily deſcend unto it.

It would be one great Advantage in this kind of Travelling, that one ſhould be perfectly freed from all Inconveniences of Ways or Weather, not having any Extremity of Heat or Cold, or Tempeſts to moleſt him. This Æthereal Air being perpetually in an equal Temper and Calmneſs. *Pars ſuperior mundi ordinatior eſt nec in nubem cogitur, nec in tempeſtatem impellitur, nec verſatur in turbinem, omni tumultu caret, inferiora fulminant.* The upper Parts of the World are always quiet and ſerene, no Winds and Bluſtring there, they are theſe lower cloudy Regions that are ſo full of Tempeſts and Combuſtion.

Sen de Ira. l. 3. c. 6. Pacem ſumma tenent. Lucan.

As for the Manner how the Force of a Spring, or (inſtead of that) the Strength of any living Perſon, may be applied to the Motion of theſe Wings of the Chariot, it may eaſily be apprehended from what was formerly delivered.

There are divers other particulars to be more fully enquired after, for the perfecting of ſuch a flying Chariot; as concerning the Proportion of the Wings both for the Length and Breadth, in compariſon to the Weight which is to be carried by them; as alſo concerning thoſe ſpecial Contrivances, whereby the Strength of theſe Wings may be ſeverally applied, either to aſcent, deſcent, progreſſive, or a turning Motion; all which, and divers the like Enquiries can only be reſolved by particular Experiments. We know the Invention of Sailing in Ships does continually receive ſome new Addition from the Experience of every Age, and hath been a long while growing up to that Perfection unto which it is now arrived. And ſo muſt it be expected for this likewiſe, which may at firſt perhaps ſeem perplexed with many Difficulties and Inconveniences, and yet upon the Experience of frequent Trials, many things

As well too long as too ſhort, too broad as too narrow, may be an impediment to the motion, by making it more difficult, ſlow and flagging.

may

may be ſuggeſted to make it more facil and commodious.

He that would regularly attempt any Thing to his Purpoſe, ſhould obſerve this Progreſs in his Experiments; he ſhould firſt make Enquiry what kind of Wings would be moſt uſeful to this End; thoſe of a Bat being moſt eaſily imitable, and perhaps Nature did by them purpoſely intend ſome Intimation to direct us in ſuch Experiments; that Creature being not properly a Bird, becauſe not amongſt the *Ovipara*, to imply that other kind of Creatures are capable of Flying as well as Birds; and if any ſhould attempt it, that would be the beſt Pattern for Imitation.

After this he may try what may be effected by the Force of Springs in leſſer Models, anſwerable unto *Archytas* his Dove, and *Regiomontanus* his Eagle: in which he muſt be careful to obſerve the various Proportions betwixt the Strength of the Spring, the Heavineſs of the Body, the Breadth of the Wings, the Swiftneſs of the Motion, *&c.*

From theſe he may by Degrees aſcend to ſome larger Eſſays.

CHAP. IX.

Of a perpetual Motion. The ſeeming Facility and real Difficulty of any ſuch Contrivance. The ſeveral Ways whereby it hath been attempted, particularly by Chymiſtry.

IT is the chief Inconvenience of all the *Automata* before-mentioned, that they need a frequent Repair of new Strength, the Cauſes whence their Motion does proceed, being ſubject to fail, and come

to

to a Period; and therefore it would be worth our Enquiry, to examine whether or no there may be made any ſuch artificial Contrivance, which might have the Principle of moving from it ſelf; ſo that the preſent Motion ſhould conſtantly be the cauſe of that which ſucceeds.

This is that great Secret in *Art*, which, like the Philoſopher's Stone in *Nature*, hath been the Buſineſs and Study of many more refined Wits, for divers Ages together; and it may well be queſtioned, whether either of them as yet hath ever been found out; though if this have, yet, like the other, it is not plainly treated of by any Author.

Not but that there are ſundry Diſcourſes concerning this Subject, but they are rather *Conjectures* than *Experiments*. And though many Inventions in this kind, may at firſt view bear a great ſhew of probability, yet they will fail, being brought to Trial, and will not anſwer in Practice what they promiſed in Speculation. Any one who hath been verſed in theſe Experiments muſt needs acknowledge that he hath been often deceived in his ſtrongeſt Confidence; when the Imagination hath contrived the whole Frame of ſuch an Inſtrument, and conceives that the Event muſt infallibly anſwer its hopes, yet then does it ſtrangely deceive in the Proof, and diſcovers to us ſome Defect which we did not before take Notice of.

Hence it is, that you ſhall ſcarce talk with any one who hath never ſo little ſmattering in theſe Arts, but he will inſtantly promiſe ſuch a Motion, as being but an eaſy Atchievement, till further Trial and Experience hath taught him the Difficulty of it. There being no Enquiry that does more entice with the *Probability*, and deceive with the *Subtilty*. What one ſpeaks wittily concerning the Philoſopher's Stone, may be juſtly applied to this, that it is *Caſta Meretrix*, a chaſt Whore. *Quia multos invitat, neminem*

m admittit, becauſe it allures many, but admits none.

I ſhall briefly recite the ſeveral ways whereby this ath been attempted, or ſeems moſt likely to be ef-cted; thereby to contract and facilitate the Enqui-es of thoſe who are addicted to theſe kind of Ex-eriments; for when they know the defects of other nventions, they may the more eaſily avoid the ſame r the like in their own.

The ways whereby this hath been attempted, may e generally reduced to theſe three Kinds:

1. By Chymical Extractions.
2. By Magnetical Virtues.
3. By the natural Affection of Gravity.

1. The diſcovery of this hath been attempted by hymiſtry. *Paracelſus* and his Followers have brag-ed, that by their Separations and Extractions, they n make a little World which ſhall have the ſame rpetual Motions with this *Microcoſm*, with the epreſentation of all Meteors, Thunder, Snow, ain, the Courſes of the Sea in its Ebbs and Flows, d the like; But theſe miraculous Promiſes would quire as great a Faith to believe them, as a Power perform them: And tho' they often talk of ſuch eat Matters,

At nuſquam totos inter qui talia curant,
Apparet ullus, qui re miracula tanta
Comprobet ———

t we can never ſee them confirmed by any real xperiment; and then beſides, every particular Au-or in that Art hath ſuch a diſtinct Language of s own, (all of them being ſo full of Allegories and fected Obſcurities) that 'tis very hard for any one nleſs he be throughly verſed amongſt them) to find t what they mean, much more to try it.

One of theſe ways (as I find it ſet down) is this. ix five Ounces of ☿, with an equal Weight of ♄, ind them together with ten Ounces of Sublimate, olve them in a Cellar upon ſome Marble for the ſpace

Etten. Mathem. Recreat. prob. 118.

ſpace of four Days, till they become like Oil Olive; diſtil this with Fire of Chaff, or driving Fire, and it will ſublime into a dry Subſtance: And ſo by repeating of theſe Diſſolvings and Diſtillings, there will be at length produced divers ſmall Attoms, which being put into a Glaſs well luted, and kept dry, will have a perpetual Motion.

I cannot ſay any thing from Experience againſt this; but methinks it does not ſeem very probable, becauſe Things that are forced up to ſuch a Vigorouſneſs and Activity as theſe Ingredients ſeem to be by their frequent Sublimatings and Diſtillings, are not likely to be of any Duration; the more any thing is ſtretched beyond its uſual Nature, the leſs does it laſt; Violence and Perpetuity being no Companions. And then beſides, ſuppoſe it true, yet ſuch a Motion could not well be applied to any Uſe, which muſt needs take much from the Delight of it.

Celebrated in an Epigram by *Hugo Grotius*, *l.* 1. *Epiſt. ad Erneſtum de Lamp. Vitæ.*

Amongſt the Chymical Experiments to this purpoſe, may be reckoned up that famous Motion invented by *Cornelius Dreble*, and made for King *James*; wherein was repreſented the conſtant Revolutions of the Sun and Moon, and that without the help either of Springs or Weights. *Marcellus Vranckhein*, ſpeaking of the Means whereby it was performed, he calls it, *Scintillula animæ magneticæ mundi, ſeu Aſtralis & inſenſibilis ſpiritus*; being that grand Secret, for the diſcovery of which, thoſe Dictators of Phyloſophy, *Democritus*, *Pythagoras*, *Plato*, did Travel unto the *Gymnoſophiſts*, and *Indian* Prieſts. The Author himſelf in his Diſcourſe upon it, does not at all reveal the way how it was performed. But there is one *Thomas Tymme*, who was a familiar Acquaintance of his, and did often pry into his Works, (as he profeſſes himſelf) who affirms it to be done thus; *By extracting a fiery Spirit out of the Mineral Matter, joining the ſame with his proper Air, which in-*

Epiſt. ad Jacobum Regem.

cluded

cluded in the Axle Tree (of the first moving Wheel) *being hollow, carrieth the other Wheels, making a continual Rotation, except issue or vent be given in this hollow Axle Tree, whereby the imprisoned Spirit may get forth.*

Philosophical Dialogue. *Confer.* 2. *cap.* 3.

What strange Things may be done by such Extractions, I know not, and therefore dare not condemn this Relation as impossible; but methinks it sounds rather like a Chymical Dream, than a Philosophical Truth. It seems this imprisoned Spirit is now set at Liberty, or else is grown weary, for the Instrument (as I have heard) hath stood still for many Years. It is here considerable that any Force is weakest near the Center of a Wheel; and therefore though such a Spirit might of it self have an Agitation, yet 'tis not easily conceivable how it should have Strength enough to carry the Wheels about with it. And then the Absurdity of the Author's citing this, would make one mistrust his Mistake; he urges it as a strong Argument against *Copernicus*, as if because *Dreble* did thus contrive in an Engine the Revolution of the Heavens, and the Immoveableness of the Earth, therefore it must needs follow that 'tis the Heavens which are moved, and not the Earth. If his Relation were no truer than his Consequence, it had not been worth the Citing.

CHAP. X.

Of Subterraneous Lamps; divers Historical Relations concerning their Duration for many Hundred Years together.

UNto this kind of Chymical Experiments, we may most probably reduce those perpetual Lamps, which for many Hundred Years together have

have continued burning without any new ſupply in the Sepulchres of the Ancients, and might (for ought we know) have remained ſo for ever. All Fire, and eſpecially Flame, being of an active and ſtirring Nature, it cannot therefore ſubſiſt without Motion; whence it may ſeem, that this great Enquiry hath been this way accompliſhed: And therefore it will be worth our Examination to ſearch further into the Particulars that concern this Experiment. Though it be not ſo proper to the chief purpoſe of this Diſcourſe, which concerns *Mechanical Geometry*, yet the Subtilty and Curioſity of it may abundantly requite the Impertinency.

There are ſundry Authors, who Treat of this Subject on the by, and in ſome particular Paſſages, but none that I know of (except *Fortunius Licetus*) that hath writ purpoſely any ſet and large Diſcourſe concerning it: Out of whom I ſhall borrow many of thoſe Relations and Opinions, which may moſt naturally conduce to the preſent Enquiry.

Lib. de reconditis antiquorum lucernis.

For our fuller underſtanding of this, there are theſe Particulars to be explained:

1. ὅτι, or *quod ſit.*
2. διότι { *cur ſit.* / *quomodo ſit.*

1. Firſt then, for the ὅτι, or that there have been ſuch Lamps, it may be evident from ſundry plain and undeniable Teſtimonies: St. *Auſtin* mentions one of them in a Temple dedicated to *Venus*, which was always expoſed to the open Weather, and could never be conſumed or extinguiſhed. To him aſſents the judicious *Zanchy*. *Pancyrollus* mentions a Lamp found in his Time, in the Sepulchre of *Tullia*, *Cicero*'s Daughter, which had continued there for about 1550 Years, but was preſently extinguiſhed upon the admiſſion of new Air. And 'tis commonly related

De civitat. Dei l. 21. c. 6.

De operibus Dei, pars 1. l. 4. c. 12. De deperd. Tit. 35.

of

of *Cedrenus*, that in *Juſtinian*'s Time there was another burning Lamp found in an old Wall at * *Edeſſa*, which had remained ſo for above 500 Years, there being a Crucifix placed by it, whence it ſhould ſeem, that they were in Uſe alſo amongſt ſome Chriſtians.

* Or *Antioch. Licetus de Lucernis, l.1.c.7.*

But more eſpecially remarkable, is that Relation celebrated by ſo many Authors, concerning *Olybius* his Lamp, which had continued burning for 1500 Years. The Story is thus: As a Ruſtick was digging the Ground by *Padua*, he found an Urn or Earthen Pot, in which there was another Urn, and in this leſſer, a Lamp clearly burning; on each ſide of it there were two other Veſſels, each of them full of a pure Liquor; the one of Gold, the other of Silver. *Ego Chymiæ artis, (ſimodo vera poteſt eſſe ars Chymia) jurare auſim elementa & materiam omnium*, (ſaith *Maturantius*, who had the Poſſeſſion of theſe things after they were taken up.) On the bigger of theſe Urns there was this Inſcription:

Plutoni ſacrum munus ne attingite fures.
Ignotum eſt vobis hoc quod in orbe latet,
Namque elementa gravi clauſit digeſta labore
Vaſe ſub hoc modico, Maximus Olybius.
Adſit fœcundo cuſtos ſibi copia cornu,
Ne tanti pretium depereat laticis.

The leſſer Urn was thus inſcribed.

Abite hinc peſſimi fures,
Vos quid vultis, veſtris cum oculis emiſſitiis?
Abite hinc, veſtro cum Mercurio
Petaſato Caduceatoque,
Donum hoc Maximum, Maximus Olybius
Plutoni ſacrum facit.

Whence we may probably conjecture that it was ſome Chymical Secret, by which this was contrived.

Mag. Natural. l. 12. cap. ult.

Baptiſta Porta tells us of another Lamp burning in an old marble Sepulchre, belonging to ſome of the Ancient *Romans*, incloſed in a Glaſs Vial, found in his Time, about the Year 1550, in the Iſle *Neſis*, which had been buried there before our Saviour's coming.

Chron. Martin. Fort. Licet. de lucern. l. 1. c. 11.

In the Tomb of *Pallas*, the *Archadian* who was ſlain by *Turnus* in the *Trojan* War, there was found another burning Lamp, in the Year of our Lord 1401. Whence it ſhould ſeem, that it had continued there for above Two thouſand and Six hundred Years: And being taken out, it did remain burning, notwithſtanding either Wind or Water, with which ſome did ſtrive to quench it; nor could it be extinguiſhed till they had ſpilt the Liquor that was in it.

Not. ad Auguſt. de civit. Dei, l. 21. c. 6.

Ludovicus Vives tells us of another Lamp, that did continue burning for 1050 Years, which was found a little before his Time.

Such a Lamp is likewiſe related to be ſeen in the Sepulchre of *Francis Roſicroſſe*, as is more largely expreſſed in the Confeſſion of that Fraternity.

There is another Relation of a certain Man, who upon occaſion digging ſomewhat deep in the Ground did meet with ſomething like a Door, having a Wall on each Hand of it; from which having cleared the Earth, he forced open this Door, upon this there was diſcovered a fair Vault, and towards the further Side of it, the Statue of a Man in Armour, ſitting by a Table, leaning upon his Left Arm, and holding a Scepter in his Right Hand, with a Lamp burning before him; the Floor of this Vault being ſo contrived, that upon the firſt Step into it, the Statue would erect it ſelf from its leaning Poſture; upon the ſecond Step it did lift up the Scepter to ſtrike, and before a Man could approach near enough to take hold of the Lamp, the Statue did ſtrike and break it to Pieces: Such Care was there taken that

it might not be ſtoln away, or diſcovered.

Our Learned *Cambden* in his Deſcription of *Yorkſhire*, ſpeaking of the Tomb of *Conſtantius Chlorus*, broken up in theſe later Years, mentions ſuch a Lamp to be found within it. *Pag.* 572.

There are ſundry other Relations to this Purpoſe. *Quod ad lucernas attinet, illæ in omnibus fere monumentis inveniuntur*, (ſaith *Gutherius.*) In moſt of the Ancient Monuments there is ſome kind of Lamp, (tho' of the ordinary Sort:) But thoſe Perſons who were of greateſt Note and Wiſdom, did procure ſuch as might laſt without Supply, for ſo many Ages together. *Pancirollus* tells us, that it was uſual for the Nobles amongſt the *Romans*, to take ſpecial Care in their laſt Wills, that they might have a Lamp in their Monuments. And to this Purpoſe they did uſually give Liberty unto ſome of their Slaves on this Condition, that they ſhould be watchful in maintaining and preſerving it. From all which Relations, the firſt particular of this Enquiry, concerning the Being or Exiſtence of ſuch Lamps, may ſufficiently appear. *De jure manium, l. 2. c. 32.* *De perdit. Tit. 62.*

CHAP. XI.

Several Opinions concerning the Nature and Reaſon of theſe perpetual Lamps.

THere are two Opinions to be anſwered, which do utterly overthrow the chief Conſequence from theſe Relations.

1. Some think that theſe Lights ſo often diſcovered in the Ancient Tombs, were not Fire or Flame, but only ſome of thoſe bright Bodies which do uſually ſhine in dark Places.

2. Others grant them to be Fire, but yet think them

them to be then firſt enkindled by the Admiſſion of new Air, when theſe Sepulchres were opened.

1. There are divers Bodies (ſaith *Ariſtotle*) which ſhine in the Dark, as rotten Wood, the Scales of ſome Fiſhes, Stones, the Gloworm, the Eyes of divers Creatures. *Cardan* tells us of a Bird in new *Spain*, called *Cocoyum*, whoſe whole Body is very bright, but his Eyes almoſt equal to the Light of a Candle, by which alone in a dark Night, one may both write and read: By theſe the *Indians* (ſaith he) uſe to eat their feaſting Suppers.

De anima, l. 2. c. 7.

Subtil. l. 9.

It is commonly related and believed, that a Carbuncle does ſhine in the Dark like a burning Coal, from whence it hath its * Name. To which Purpoſe there is a Story in *Ælian* of a Stork, that by a certain Woman was cured of a broken Thigh, in Gratitude to whom, this Fowl afterwards flying by her, did let fall into her Lap a bright Carbuncle, which (ſaith he) would in the Night Time ſhine as clear as a Lamp. But this and the like old Relations are now generally disbelieved and rejected by learned Men: *Doctiſſimorum omnium conſenſu, hujuſmodi gemmæ non inveniuntur*, (ſaith *Boetius de Boot*) a Man very much skilled in, and inquiſitive after ſuch Matters; nor is there any one of Name that does from his own Eye-ſight or Experience, affirm the real Exiſtence of any Gem ſo qualified.

* *Carlo Pyropus. Hiſtoria Anim. l. 8.*

De Lapid. & Gemmis. l. 2. c. 8.

Some have thought that the Light in Ancient Tombs hath been occaſioned from ſome ſuch Bodies as theſe. For if there had been any Poſſibility to preſerve Fire ſo long a Space, 'tis likely then that the *Iſraelites* would have known the Way, who were to keep it perpetually for their Sacrifices.

Vide Licet. de lucern. l. 2.

But to this Opinion it might be replied, that none of theſe *Noctilucæ*, or Night-ſhining Bodies have been obſerved in any of the Ancient Sepulchres, and therefore this is a mere imaginaty Conjecture; and

then

then beſides, ſome of theſe Lamps have been taken out burning, and continued ſo for a conſiderable Space afterwards. As for the ſuppoſed Conveniency of them, for the perpetuating of the Holy Fire amongſt the *Jews*, it may as well be feared leſt theſe ſhould have occaſioned their Idolatry, unto which that Nation was ſo ſtrongly addicted, upon every ſlight Occaſion; nor may it ſeem ſtrange, if the Providence of God ſhould rather permit this Fire ſometimes to go out, that ſo by their earneſt Prayers, being again renewed from Heaven, (as it * ſometimes was) the Peoples Faith might be the better ſtirred up and ſtrengthned by ſuch frequent Miracles.

* Levit. 9. 24. 2 Chron. 7. 1. 1 King. 18. 38.

2. It is the Opinion of *Gutherius*, that theſe Lamps have not continued burning for ſo long a Space, as they are ſuppoſed in the former Relations; but that they were then firſt enflamed by the Admiſſion of new Air, or ſuch other occaſion, when the Sepulchres were opened: As we ſee in thoſe fat Earthy Vapours of divers Sorts, which are oftentimes enkindled into a Flame. And 'tis ſaid, that there are ſome Chymical Ways, whereby Iron may be ſo heated, that being cloſely luted in a Glaſs, it ſhall conſtantly retain the Fire for any Space of Time, though it were for a thouſand Years or more; at the end of which, if the Glaſs be opened, and the freſh Air admitted, the Iron ſhall be as red Hot as if it were newly taken out of the Fire.

De jure Mani. l. 2 c. 32.

But for anſwer to this Opinion, 'tis conſiderable that ſome Urns have had Inſcriptions on them, expreſſing that the Lamps within them were burning, when they were firſt buried. To which may be added the Experience of thoſe which have continued ſo, for a good Space afterwards; whereas the Inflammation of fat and viſcous Vapours does preſently vaniſh. The Lamp which was found in the Iſle *Neſis*, did burn clearly while it was incloſed in the

the Glaſs, but that being broken, was preſently extinguiſhed. As for that Chymical Relation, it may rather ſerve to prove that Fire may continue ſo many Ages, without conſuming any Fewel.

So that notwithſtanding the oppoſite Opinions, yet 'tis more probable that there have been ſuch Lamps as have *remained burning*, without any new Supply, for many hundred Years together; which was the firſt Particular to be explained.

Cur ſint. 2. Concerning the Reaſon why the Ancients were ſo careful in this Particular, there are divers Opinions. Some think it to be an Expreſſion of their Belief, concerning the Soul's Immortality, after its departure out of the Body; a Lamp amongſt the *Egyptians* being the *Hieroglyphick* of Life. And therefore they that could not procure ſuch Lamps, were yet careful to have the Image and Repreſentation of them engraved on their Tombs.

Others conceive them to be by way of Gratitude to thoſe infernal Deities, who took the Charge and Cuſtody of their dead Bodies *remaining* always with them in their Tombs, and were therefore called *Dii manes.*

Others are of Opinion, that theſe Lamps were only intended to make their Sepulchres more pleaſant and lightſome, that they might not ſeem to be impriſoned in a diſmal and uncomfortable Place. True indeed, the dead Body cannot be ſenſible of this Light, no more could it of its want of Burial; yet the ſame Inſtinct which did excite it to the Deſire of one, did alſo occaſion the other.

De Lucernis, l. 3. c. 8. *Licetus* concludes this Ancient Cuſtom to have a double End. 1. *Politick*, for the Diſtinction of ſuch as were nobly born, in whoſe Monuments only they were uſed. 2. *Natural*, to preſerve the Body and Soul from Darkneſs; for it was a common Opinion amongſt them, that the Souls alſo were much converſant about thoſe Places where the Bodies were buried.

CHAP.

CHAP. XII.

he moſt probable Conjecture, how theſe Lamps were framed.

Quomodo ſint.

THE greateſt difficulty of this Enquiry doth conſiſt in this laſt Particular, concerning the anner how, or by what poſſible Means any ſuch erpetual Flame may be contrived.

For the diſcovery of which, there are two things o be more eſpecially conſidered.

1. The Snuff, or Wick, which muſt adminiſter nto the Flame.

2. The Oil, which muſt nouriſh it.

For the *firſt*, it is generally granted that there are ivers Subſtances which will retain Fire without conuming: Such is that Mineral which they call the *alamanders Wooll*, ſaith our Learned * *Bacon. Ipſe xpertus ſum villos Salamandræ non conſumi*, ſaith † *Joahimus Fortius*. And * *Wecker*, from his own knowedge, affirms the ſame of *Plumeallum*, that being formed into the likeneſs of a Wick, will adminiſter o the Flame, and yet not conſume it ſelf. Of this Nature likewiſe was that which the Ancients did call *Linum Vivum*, or *Asbeſtinum*: Of this they were wont to make Garments, that were not deſtroyed, but purified by Fire; and whereas the Spots or Foulneſs of other Cloaths are waſhed out, in theſe they were uſually burnt away. The Bodies of the ancient Kings were wrapped in ſuch Garments, when they were put in the Funeral Pile, that their Aſhes might be therein preſerved, without the mixture of any other. The Materials of them were not from any Herb or Vegetable, as other Textiles, but from a Stone called *Amiantus*; which being bruiſed by a Hammer,

* *Nat. Hiſt. Exper.* 774.
† *Lib. Exper.*
* *De Secretis, l.* 3. *c.* 2.
Or *Linum Carpaſium. Plutarch, de Oracul. defectu.*
Plin. Hiſt. l. 19. *c.* 1.

Hammer, and its earthly Nature ſhaken out, retain certain hairy Subſtances, which may be Spun and Woven, as Hemp or Flax. *Pliny* ſays, that for the Precioufneſs of it, it did almoſt equal the Price of Pearls. *Pancirollus* tells us, that it was very rare and eſteemed precious in ancient Times, but now is ſcarce found or known in any Places, and therefore he reckons it amongſt the things that are loſt. But *L. Vives* affirms, that he hath often ſeen Wicks made of it at *Paris*, and the ſame Matter woven into a Napkin at *Lovaine*, which was cleanſed by being burnt in the Fire.

De perd. Tit. 4.

In Auguſt. de Civit. Dei, l. 21. c. 6.

'Tis probable from theſe various Relations, that there was ſeveral Sorts of it; ſome of a more precious, other of a baſer kind, that was found in *Cyprus*, the Deſerts of *India*, and a certain Province of *Aſia*; this being common in ſome Parts of *Italy*, but is ſo ſhort and brittle, that it cannot be ſpun into a Thread; and therefore is uſeful only for the Wicks of perpetual Lamps, ſaith *Boetius de Boot.* Some of this, or very like it, I have upon Enquiry lately procured and experimented; but whether it be the Stone *Asbeſtus*, or only *Plumeallum*, I cannot certainly affirm; for it ſeems they are both ſo very like, as to be commonly Sold for one another (ſaith the ſame Author.) However, it does truly agree in this common Quality aſcribed unto both, of being Incombuſtible, and not conſumable by Fire: But yet there is this Inconvenience, That it doth contract ſo much Fuliginous Matter from the Earthly Parts of the Oil, (though it was tryed with ſome of the pureſt Oil which is ordinary to be bought) that in a very few Days it did choak and extinguiſh the Flame. There may poſſibly be ſome Chymical way, ſo to purifie and defecate this Oil, that it ſhall not ſpend into a ſootty Matter.

De lapid. & gemmis, l. 2. c. 204.

However, if the Liquor be of a cloſe and Glutinous Conſiſtency, it may burn without any Snuff, as

we ſee in Camphire, and ſome other Bituminous
ɔſtances. And it is probable that moſt of the an-
nt Lamps were of this kind, becauſe the exacteſt
lations (to my Remembrance) do not mention
y that have been found with ſuch Wicks.

But herein will conſiſt the greateſt Difficulty, to
d out what Invention there might be for their Du-
ion: Concerning which there are ſundry Opi-
ons.

St. *Auſtin* ſpeaking of that Lamp in one of the
:athen Temples, thinks that it might either be
ne by Magick, (the Devil thinking thereby to
ɔmote the Worſhip and Eſteem of that Idol to
hich it was Dedicated) or elſe, that the Art of
an might make it of ſome ſuch Material, as the
one *Asbeſtus*, which being once kindled, will
rn without being conſumed. As others (ſaith he)
ve contrived as great a Wonder in appearance,
ɔm the natural Virtue of another Stone, making
Iron Image ſeem to hang in the Air, by reaſon
two Load-Stones, the one being placed in the
eiling, the other in the Floor.

Deciv. Dei, l. 21. c. 6.

Zanch. de Operibus Dei, par. 1. l. 4. c. 12.

Others are of Opinion, that this may be effected
a hollow Veſſel, exactly luted or ſtopped up in all
e Vents of it: And then, if a Lamp be ſuppoſed
burn in it but for the leaſt moment of time, it
uſt continue ſo always, or elſe there would be a
cuum, which Nature is not capable of. If you
k how it ſhall be nouriſhed, it is anſwered, That
e Oil of it being turned into Smoak and Vapours,
ill again be converted into its former Nature; for
herwiſe, if it ſhould remain Rarified in ſo thin a
ubſtance, then there would not be room enough
r that Fume which muſt ſucceed it; and ſo on
e other ſide, there might be ſome danger of the
netration of Bodies, which Nature doth as much
ɔhor. To prevent both which, as it is in the Chy-
ical Circulations, where the ſame Body is often-

times

times turned from Liquor into Vapour, and fro Vapour into Liquor again; ſo in this Experimen the ſame Oil ſhall be turned into Fume, and tha Fume ſhall again convert into Oil. Always provi ded, that this Oil which nouriſhes the Lamp, be ſup poſed of ſo cloſe and tenacious a Subſtance, tha may ſlowly evaporate, and ſo there will be th more Leiſure for Nature to perfect theſe Circulati ons. According to which Contrivance, the Lam within this Veſſel can never fail, being always ſup plied with ſufficient Nouriſhment. That which wa found in the Iſle *Neſis*, incloſed in a Glaſs-Via mentioned by *Baptiſta Porta*, is thought to be mad after ſome ſuch manner as this.

Others conceive it poſſible to extract ſuch an O out of ſome Minerals, which ſhall for a long ſpac ſerve to nouriſh the Flame of a Lamp, with ver little or no Expence of its own Subſtance. T which purpoſe (ſay they) if Gold be diſſolved int an unctuous Humour, or if the radical Moiſture o that Metal were ſeparated, it might be contrived t burn (perhaps for ever, or at leaſt) for many Age together, without being conſumed. For, if Gol it ſelf (as Experience ſhews) be ſo untameable b the Fire, that after many Meltings and violent Heats it does ſcarce diminiſh, 'tis probable then, that be ing diſſolved into an Oily Subſtance, it might fo many hundred Years together continue burning.

Wolphang. Lazius, l 3. *c.* 18. *Camb. Brit. p.* 572.

There is a little Chymical Diſcourſe, to prov that *Urim* and *Thummim* is to be made by Art. Th Author of this Treatiſe affirms that place, *Gen.* 6. 16 where God tells *Noah*, *A Window ſhalt thou make i the Ark*, to be very unfitly rendred in our Tranſla tion, a *Window*; becauſe the original Word צהר ſig nifies properly Splendor, or Light: And then be ſides, the Air being at that time ſo extreamly dark ned with the Clouds of that exeſſive Rain, a Win dow could be but of very little uſe in regard o Light.

ght, unleſs there were ſome other help for it. om whence he conjectures, that both this Splen- r, and ſo likewiſe the *Urim* and *Thummim* were ificial Chymical Preparations of Light, anſwe- ble to theſe ſubterraneous Lamps; or in his own nraſe, it was *the univerſal Spirit fixed in a tranſparent dy.*

It is the Opinion of *Licetus*, (who hath more actly ſearched into the Subtilties of this Enquiry) at Fire does not need any Humour for the Nou- ſhment of it, but only to detain it from flying up- ards: For, being in it ſelf one of the chief Ele- ents (ſaith he out of *Theophraſtus*) it were abſurd think that it could not ſubſiſt without ſomething feed it. As for that Subſtance which is conſumed it, this cannot be ſaid to foment or preſerve the me Fire, but only to generate new. For the bet- r underſtanding of this, we muſt obſerve, that there ay be a threefold proportion betwixt Fire, and the lumour, or Matter of it. Either the Humour does xceed the ſtrength of the Fire, or the Fire does ex- eed the Humour; and according to both theſe, the lame doth preſently vaniſh. Or elſe laſtly, they ay be both equal in their Virtues, (as it is betwixt he Radical Moiſture, and Natural Heat in Living Creatures) and then neither of them can overcome, r deſtroy the other. *De Lucernis, c. 20, 21.*

Thoſe ancient Lamps of ſuch long Duration, were of this later kind: But now, becauſe the Qua- ties of Heat or Cold, Dryneſs or Moiſture in the mbient Air, may alter this Equality of Proportion etwixt them, and make one ſtronger than the o- her; therefore to prevent this, the Ancients did ide theſe Lamps in ſome Caverns of the Earth, or loſe Monuments. And hence is it, that at the pening of theſe, the admiſſion of new Air unto he Lamp does uſually cauſe ſo great an Inequality etwixt the Flame and the Oil, that it is preſently extinguiſhed.

But

But ſtill, the greateſt Difficulty remains how to make any ſuch exact Proportion betwixt an unctuous Humour, and ſuch an active Quality as the heat of Fire; or this Equality being made, it is yet a further Difficulty, how it may be preſerved. To which purpoſe, *Licetus* thinks it poſſible to extract an inflamable Oil from the Stone *Aſbeſtus*, *Amiantus*, or the Metal Gold; which being of the ſame pure and homogeneous Nature with thoſe Bodies, ſhall be ſo proportioned unto the heat of Fire, that it cannot be conſumed by it; but being once inflamed, ſhould continue for many Ages, without any ſenſible Diminution.

If it be in the power of Chymiſtry to perform ſuch ſtrange Effects, as are commonly experimented in that which they call *Aurum Fulminans*, one Scruple of which ſhall give a louder Blow, and be of greater force in Deſcent, than half a Pound of ordinary Gunpowder in Aſcent; why may it not be as feaſible by the ſame Art, to extract ſuch an Oil as is here enquired after? ſince it muſt needs be more difficult to make a Fire, (which of its own Inclination ſhall tend downwards) than to contrive ſuch an unctuous Liquor, wherein Fire ſhall be maintained for many Years without any new ſupply.

Thus have I briefly ſet down the Relations and Opinions of divers Learned Men, concerning theſe perpetual Lamps; of which, though there have been ſo many ſundry kinds, and ſeveral ways to make them, (ſome being able to reſiſt any Violence of Weathers, others being eaſily extinguiſhed by any little alteration of the Air, ſome being incloſed round about within Glaſs, others being open;) yet now they are all of them utterly periſhed amongſt the other Ruins of Time; and thoſe who are moſt verſed in the ſearch after them, have only recovered ſuch dark Conjectures, from which a Man cannot clearly deduce any evident Principle, that may encourage him to a particular Trial.

CHAP.

CHAP. XIII.

oncerning ſeveral Attempts of Contriving a perpetual Motion, by Magnetical Virtues.

THE ſecond way whereby the making of a perpetual Motion hath been attempted, is by lagnetical Virtues; which are not without ſome rong Probabilities of proving effectual to this purɔſe: Eſpecially when we conſider, that the Heaenly Revolutions, (being as the firſt Pattern imited and aimed at in theſe Attempts) are all of em performed by the help of theſe Qualities. This eat Orb of Earth, and all the other Planets, being ıt as ſo many Magnetical Globes, endowed with ch various ahd continual Motions, as may be moſt greeable to the Purpoſes for which they were inded. And therefore moſt of the Authors, who eat concerning this Invention, do agree, that the kelieſt way to effect it, is by theſe kind of Qualiɛs.

Gilbert de Magnet. Cabæus Philoſ. Magnet. l. 4. c. 20.

It was the Opinion of *Pet. Peregrinus*, and there is Example pretended for it in *Bettinus*, (*Apiar.* 9. *ogym.* 5. *pro.* 11.) that a Magnetical Globe, or erella, being rightly placed upon its Poles, would it ſelf have a conſtant Rotation, like the Diurl Motion of the Earth: But this is commonly exɔded, as being againſt all Experience.

Athanaſ. Kircher, de Arte Magnet. l. 1. par. 2, prop. 13. Item l. 2. p. 4.

Others think it poſſible, ſo to contrive ſeveral eces of Steel and a Load-Stone, that by their ntinual Attraction, and Expulſion of one another, ey may cauſe a perpetual Revolution of a Wheel. f this Opinion were [a] *Taiſner*, [b] *Pet. Peregrinus*, d [c] *Cardan*, out of *Antonius de Fantis*. But D. *Gilt*, who was more eſpecially verſed in Magnetical xperiments, concludes it to be a vain and ground-

[a] *Tract. de motu continuo.*
[b] *De Rota perpetui motus. par. 2. c. 3.*
[c] *De Variet. rerum, l. 9. c. 48. De Magnet. l. 2. c. 35.*

But
ſs Fancy.

But amongſt all theſe kind of Inventions, that is moſt likely, wherein a Load-Stone is ſo diſpoſed, that it ſhall draw unto it on a reclined Plane, a Bullet of Steel, which Steel as it aſcends near to the Load-ſtone, may be contrived to fall down thro' ſome Hole in the Plane, and ſo to return unto the Place from whence at firſt it began to move; and being there, the Loadſtone will again attract it upwards, till coming to this Hole, it will fall down again; and ſo the Motion ſhall be perpetual, as may be more eaſily conceivable by this Figure.



Suppoſe the Load-Stone to be repreſented at *A B*, which, though it have not ſtrength enough to attract the Bullet C directly from the Ground, yet may do it by the help of the Plane *EF*. Now, when the Bullet is come to the top of this Plane, its own Gravity (which is ſuppoſed to exceed the ſtrength

of

the Loadſtone) will make it fall into that Hole *E*; and the force it receives in this fall, will car- it with ſuch a violence unto the other end of this ch, that it will open the Paſſage which is there de for it, and by its return will again ſhut it; ſo t the Bullet, (as at the firſt) is in the ſame Place ence it was attracted, and conſequently muſt ve perpetually.

But however this Invention may ſeem to be of h ſtrong probability, yet there are ſundry Parti- ars which may prove it inſufficient: For,

1. This Bullet of Steel muſt firſt be touched, and ve its ſeveral Poles, or elſe there can be little or Attraction of it. Suppoſe *C* in the Steel to be ſwerable unto *A* in the Stone, and to *B*; in the traction, *C D* muſt always be directed anſwerable *A B*, and ſo the Motion will be more difficult, by ſon there can be no Rotation, or turning round the Bullet, but it muſt ſlide up with the Line *D*, anſwerable to the Axis *A B*.

2. In its fall from *E* to *G*, which is *motus elemen- is*, and proceeds from its Gravity, there muſt eds be a Rotation of it, and ſo 'tis odds but it ppens wrong in the riſe, the Poles in the Bullet ing not in the ſame Direction to thoſe in the Mag- t: And if in this Reflux, it ſhould ſo fall out, at *D* ſhould be directed towards *B*, there ſhould be her a Flight than an Attraction, ſince thoſe two ds do *repel*, and not draw one another.

3. If the Loadſtone *A B* have ſo much ſtrength, at it can attract the Bullet in *F* when it is not turn- round, but does only ſlide upon the Plane, where- its own Gravity would rowl it downwards; then is evident, the Sphere of its Activity and Strength ould be ſo increaſed when it approaches much arer, that it would not need the aſſiſtance of the ane, but would draw it immediately to it ſelf thout that help; and ſo the Bullet would not fall

down through the Hole, but aſcend to the Stone, and conſequently ceaſe its Motion: For, if the Loadſtone be of force enough to draw the Bullet on the Plane, at the diſtance *FB*, then muſt the ſtrength of it be ſufficient to attract it immediately unto it ſelf, when it is ſo much nearer as *EB*. And if the Gravity of the Bullet be ſuppoſed ſo much to exceed the ſtrength of the Magnet, that it cannot draw it directly when it is ſo near, then will it not be able to attract the Bullet up the Plane, when it is ſo much further off.

So that none of all theſe Magnetical Experiments, which have been as yet diſcovered, are ſufficient for the effecting of a perpetual Motion, though theſe kind of Qualities ſeem moſt conducible unto it, and perhaps hereafter it may be contrived from them.

CHAP. XIV.

The ſeeming Probability of effecting a continual Motion by ſolid Weights, in a hollow Wheel or Sphere.

THE third way whereby the making of a perpetual Motion hath been attempted, is by the natural Affection of Gravity; when the Heavineſs of ſeveral Bodies is ſo contrived, that the ſame Motion which they give in their Deſcent, may be able to carry them up again.

But, (againſt the Poſſibility of any ſuch Invention) it is thus objected by *Cardan*. All Sublunary Bodies have a direct Motion either of Aſcent, or Deſcent; which, becauſe it does refer to ſome Term, therefore cannot be perpetual, but muſt needs ceaſe, when it is arrived at the Place unto which it naturally tends.

Subtil. l. 17. De Var. Rerum, l. 9. c. 48.

I an

I anſwer, Though this may prove that there is no Natural Motion of any particular heavy Body, which is perpetual, yet it doth not hinder, but that it is poſſible from them to contrive ſuch an artificial Revolution, as ſhall conſtantly be the cauſe of it ſelf.

Thoſe Bodies which may be ſerviceable to this Purpoſe, are diſtinguiſhable into two kinds.

1. Solid and Conſiſtent, as Weights of Metal, or the like.

2. Fluid, or Sliding; as Water, Sand, *&c.*

Both theſe ways have been attempted by many, though with very little or no ſucceſs. Other Mens Conjectures in this kind you may ſee ſet down by divers Authors. It would be too tedious to repeat them over, or ſet forth their Draughts. I ſhall only mention two new ones, which (if I am not over-partial) ſeem altogether as probable as any of theſe kinds that have been yet invented; and till Experience had diſcovered their Defect and Inſufficiency, did certainly conclude them to be Infallible.

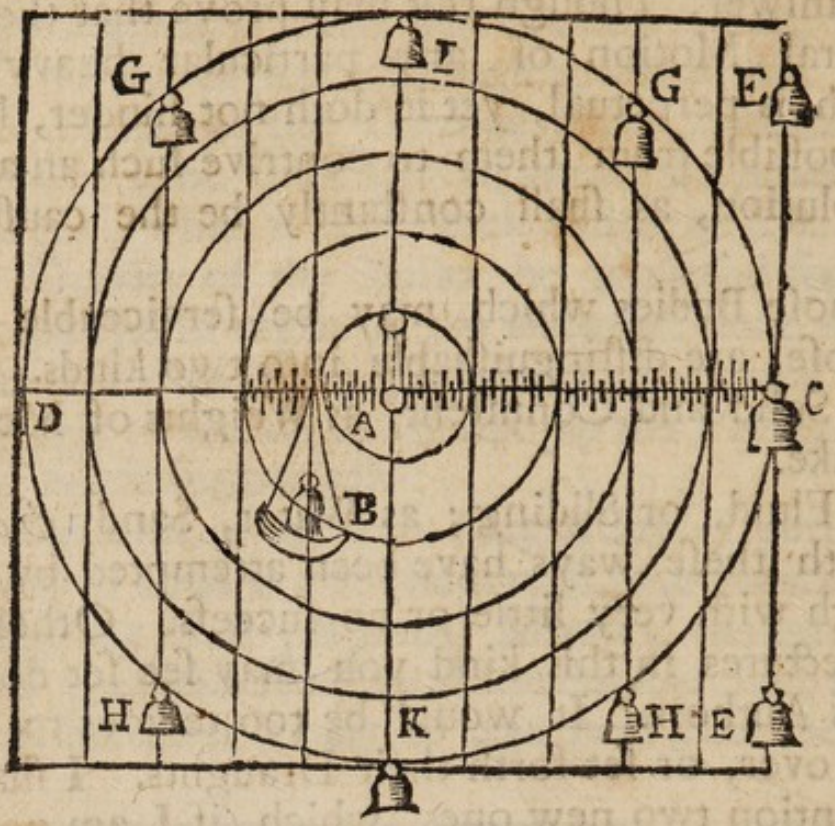
D. Flud. Tract. 2. pars 7. l. 2. c. 4. & 7.

The firſt of theſe Contrivances was by ſolid Weights being placed in ſome hollow Wheel or Sphere, unto which they ſhould give a perpetual Revolution: For (as the Philoſopher hath largely proved) only a Circular Motion can properly be Perpetual.

Ariſt. Phyſ. l. 8. c. 12.

But for the better conceiving of this Invention, it is requiſite that we rightly underſtand ſome Principles in *Trochilicks*, or the Art of Wheel-Inſtruments: As chiefly, the Relation betwixt the Parts of a Wheel, and thoſe of a Ballance; the ſeveral Proportions in the Semidiameter of a Wheel, being anſwerable to the Sides in a Ballance, where the Weight is multiplied according to its diſtance from the Center.

Ariſt. Mechan. c. 2. De ratione libræ ad circulum.



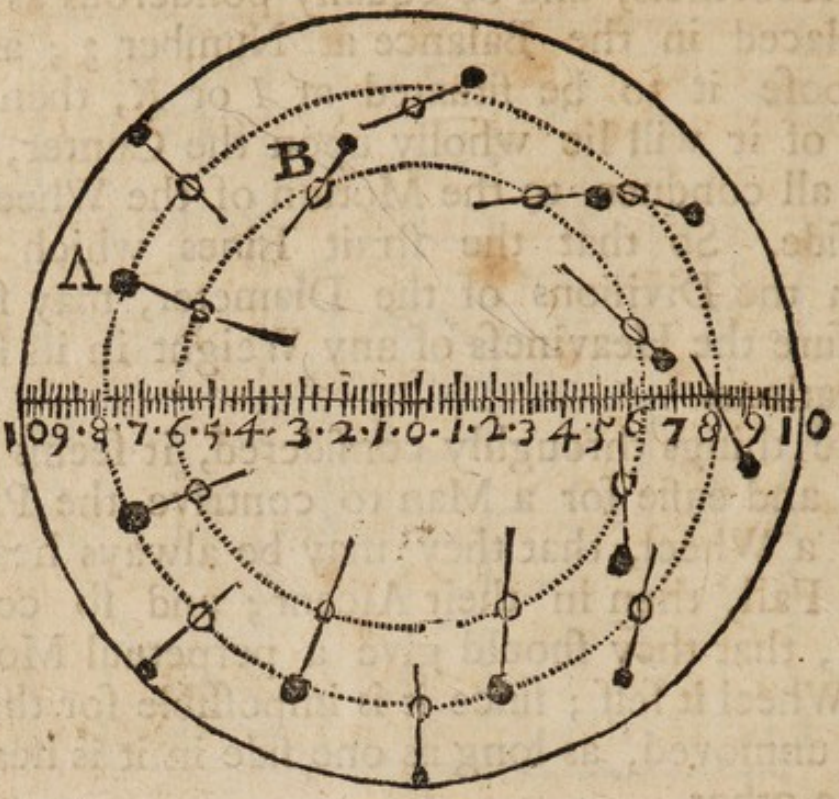
Thus, ſuppoſe the Center to be at *A*, and the Diameter of the Wheel *D C* to be divided into equal Parts (as is here expreſſed) it is evident, according to the former Ground, that one Pound at *C* will equiponderate to Five Pound at *B*, becauſe there is ſuch a proportion betwixt their ſeveral Diſtances from the Center. And it is not material, whether or no theſe ſeveral Weights be placed Horizontally; for though *B* do hang lower than *C*, yet this does not at all concern the Heavineſs; or though the Plummet *C* were placed much higher than it is at *E*, or lower at *F*, yet would it ſtill retain the ſame Weight which it had at *C*; becauſe theſe Plummets (as in the Nature of all heavy Bodies) do tend downwards by a ſtrait Line: So that their ſeveral Gravities are to be meaſured by that part of the Horizontal Semidiameter, which is directly either below or above them. Thus when the Plummet *C* ſhall be moved either to *G* or *H*, it will loſe $\frac{1}{3}$ of its

for-

mer Heavineſs, and be equally ponderous as if it re placed in the Balance at Number 3; and if ſuppoſe it to be ſituated at *I* or *K*, then the ight of it will lie wholly upon the Center, and t at all conduce to the Motion of the Wheel on ner ſide. So that the ſtrait Lines which paſs ough the Diviſions of the Diameter, may ſerve meaſure the Heavineſs of any Weight in its ſeve- Situations.

Theſe things throughly conſidered, it ſeems very ſſible and eaſie for a Man to contrive the Plum- ts of a Wheel, that they may be always heavier their Fall, than in their Aſcent; and ſo conſe- ently, that they ſhould give a perpetuul Motion the Wheel it ſelf; ſince it is impoſſible for that to main unmoved, as long as one ſide in it is heavier an the other.

For the performance of this, the Weights muſt ſo ordered, 1. That in their Deſcent they may ll from the Center, and in their Aſcent may riſe arer to it. 2. That the Fall of each Plummet ay begin the Motion of that which ſhould ſucceed As in this following Diagram.



Where there are 16 Plummets, 8 in the inward Circle, and as many in the outward, (the inequality being to ariſe from their Situation, it is therefore moſt convenient that the Number of them be even.) The 8 inward Plummets are ſuppoſed to be in themſelves ſo much heavier than the other, that in the Wheel they may be of equal Weight with thoſe above them, and then the Fall of theſe will be of ſufficient Force to bring down the other. For Example, if the outward be each of them Four Ounces, then the inward muſt be Five; becauſe the outward is diſtant from the Center Five of thoſe Parts, whereof the inward is but Four. Each Pair of theſe Weights ſhould be joined together by a little String or Chain, which muſt be faſtned about the middle, betwixt the Bullet and the Center of that Plummet which is to fall firſt, and at the Top of the other.

When theſe Bullets in their Deſcent are at their fartheſt Diſtance from the Center of the Wheel, then

ſhall

all they be ſtopped, and reſt on the Pins placed to at Purpoſe; and ſo in their riſing, there muſt be her Pins to keep them in a convenient Poſture and iſtance from the Center, leſt approaching too near to it, they thereby become unfit to fall, when ey ſhall come to the Top of the deſcending Side.

This may be otherwiſe contrived with ſome dif-ent Circumſtances, but they will all redound to e ſame Effect. By ſuch an Engine it ſeems very obable, that a Man may produce a perpetual Mo-on. The Diſtance of the Plummets from the Cen-r increaſing their Weight on one Side, and their ing tied to one another, cauſing a conſtant Suc-ſſion in their falling,

But now, upon Experience I have found this to fallacious, and the Reaſon may ſufficiently appear a Calculation of the Heavineſs of each Plummet, cording to its ſeveral Situation; which may eaſi-be done by thoſe Perpendiculars that cut the Dia-eter, (as was before explained, and is here expreſſed 5 of thePlummets on the deſcending Side.) From ch aCalculation it will be evident,that both theSides f this Wheel will equiponderate; and ſo conſequent-that the ſuppoſed Inequality whence the Motion ould proceed, is but Imaginary and Groundleſs. On the deſcending Side, the Heavineſs of each lummet may be meaſured according to theſe Num-ers, (ſuppoſing the Diameter of the Wheel to be ivided into Twenty Parts, and each of thoſe ſub-ivided into Four.)

The outward Plummets.

7	0
10	0
7	0

The Sum 24.

The inward Plummets.

1	0
7	2
7	2
3	0

The Sum 19.

On the aſcending Side, the Weights are to be reckoned according to theſe Degrees.

The outward.

1	3
7	2
9	0
5	3
0	0

The Sum 24.

The inward.

4	1
7	0
5	2
2	1

The Sum 19.

The Sum of which laſt Numbers is equal with the former, and therefore both the Sides of ſuch a Wheel, in this Situation will equiponderate.

If it be objected, that the Plummet *A* ſhould be contrived to pull down the other at *B*, and then the deſcending Side will be heavier than the other.

For anſwer to this, it is conſiderable,

1. That theſe Bullets towards the Top of the Wheel, cannot deſcend till they come to a certain kind of Inclination.

2. That any lower Bullet hanging upon the other above it, to pull it down, muſt be conceived, as if the Weight of it were in that Point where its String touches the upper; at which Point this Bullet will be of leſs Heavineſs in reſpect of the Wheel, than if it did reſt in its own Place: So that both the Sides of it, in any kind of Situation may equiponderate.

CHAP.

CHAP. XV.

compoſing a perpetual Motion by fluid Weights. Concerning Archimedes *his Water-Screw. The great Probability of accompliſhing this Enquiry by the Help of that; with the Falliblenеſs of it upon Experiment.*

THat which I ſhall mention as the laſt Way, for the Trial of this Experiment, is by contriving in ſome Water-Inſtrument; which may ſeem altogether as probable and eaſie as any of the reſt; becauſe that Element by reaſon of its fluid and ſubNature (whereby of its own accord it ſearches t the lower and more narrow Paſſages) may be oſt pliable to the Mind of the Artificer. Now the ual Means for the Aſcent of Water, is either by *ckers* or *Forces*, or ſomething equivalent thereunto: either of which may be conveniently applied unſuch a Work as this, becauſe there is required uneach of them ſo much or more Strength, as may anſwerable to the full Weight of the Water that to be drawn up; and then beſides, they move r the moſt part by Fits and Snatches, ſo that it is ot eaſily conceivable, how they ſhould conduce nto ſuch a Motion, which by reaſon of its Perpeity muſt be regular and equal.

But amongſt all other ways to this Purpoſe, that nvention of *Archimedes* is incomparably the beſt, hich is uſually called *Cochlea*, or the *Water-ſcrew*; eing framed by the helical Revolution of a Cavity out a Cylinder. We have not any Diſcourſe from he Author himſelf concerning it, nor is it certain hether he ever writ any thing to this Purpoſe. But he did, yet as the Injury of Time hath depried us of many other his excellent Works, ſo likeiſe of this amongſt the Reſt.

Athanaſ.

Athenæus ſpeaking of that great Ship built by *Hiero*, in the framing of which, there were Three hundred Carpenters employed for a Year together, beſides many other Hirelings for Carriages, and ſuch ſervile Works; mentions this Inſtrument as being inſtead of a Pump for that vaſt Ship; by the Help of which, one Man might eaſily and ſpeedily drain out the Water, though it were very deep.

Deipnoſop. l. 5.

Diodorus Siculus ſpeaking of this Engine, tells us, that *Archimedes* invented it when he was in *Egypt*, and that it was uſed in that Countrey, for the draining of thoſe Pits and lower Grounds, whence the Waters of *Nilus* could not return. Φιλοτέχνως δ' ὄντος τοῦ ὀργάνου καθ' ὑπερβολήν, (ſaith the ſame Author.) It being an Engine ſo Ingenious and Artificial, as cannot be ſufficiently expreſſed or commended. And ſo (it ſhould ſeem) the Smith in *Milan* conceived it to be, who having without any Teaching or Information found it out, and therefore thinking himſelf to be the firſt Inventor, fell mad with the meer Joy of it.

Biblioth. l. 1.

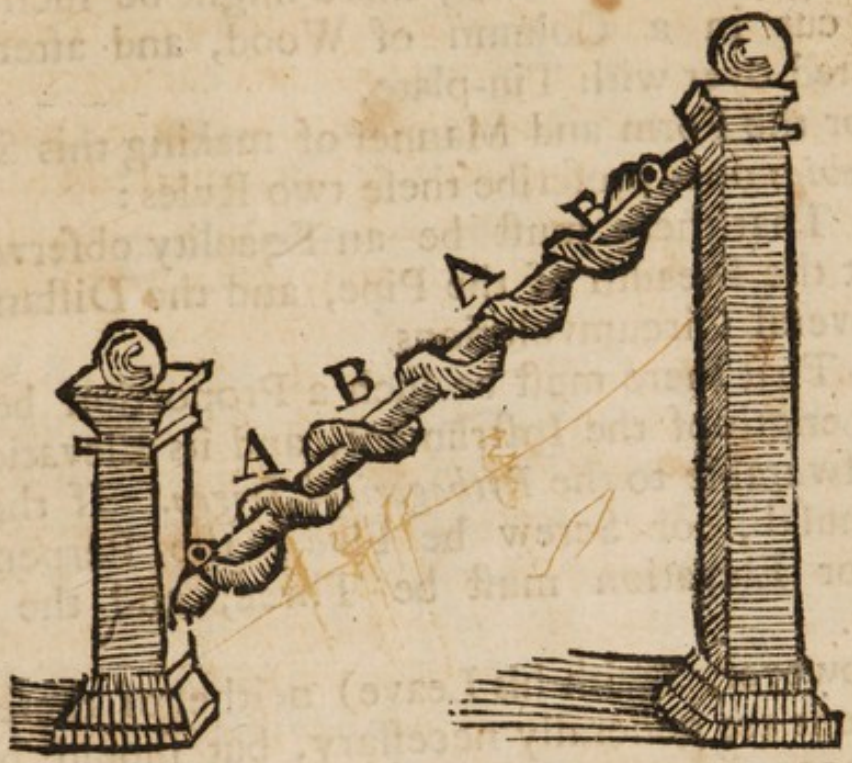
Cardan. Subtil. l. 1. De ſapient. l. 5.

The Nature and Manner of making this, is more largely handled by *Vitruvius*.

Architect. l. 10. c. 11.

The Figure of it is after this Manner.

Where



Where you ſee there is a Cylinder *AA*, and a iral Cavity or Pipe twining about it, according equal Revolutions *BB*. The Axis and Centers of Motions are at the Points *C D*; upon which being rned, it will ſo happen, that the ſame part of the ipe which was now lowermoſt, will preſently be- me higher, ſo that the Water does aſcend by de- ending; aſcending in compariſon to the whole ſtrument, and deſcending in reſpect of its ſeveral arts. This being one of the ſtrangeſt Wonders a- ongſt thoſe many wherein theſe Mathematical rts do abound, that a heavy Body ſhould riſe by lling down, and the farther it paſſes by his own atural Motion of Deſcent, by ſo much higher ſtill all it aſcend; which though it ſeem ſo evidently contradict all Reaſon and Philoſophy, yet in his Inſtrument it may be manifeſted both by De- onſtration and Senſe.

This Pipe or Cavity, for the Matter of it, cannot aſily be made of Metal, by reaſon of its often turn-

turnings; but for Trial, there might be such a Cavity cut in a Column of Wood, and afterwards covered over with Tin-plate.

For the Form and Manner of making this Screw, *Vitruvius* does prescribe these two Rules:

1. That there must be an Equality observed betwixt the Breadth of the Pipe, and the Distance of its several Circumvolutions.

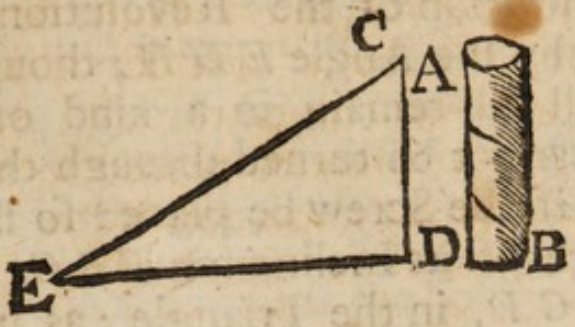
2. That there must be such a Proportion betwixt the Length of the Instrument, and its Elevation, as is answerable to the *Pythagorical Trigon.* If the Hypotenusal, or Screw be Five, the Perpendicular or Elevation must be Three, and the Basis Four.

David Rivalt. Com. in Archim. opera exter.

However, (with his Leave) neither of these Proportions are generally necessary, but should be varied according to other Circumstances. As for the Breadth of the Pipe in respect of its Revolutions, it is left at Liberty, and may be contrived according to the Quantity of Water which it should contain. The chief thing to be considered, is the Obliquity or Closeness of these Circumvolutions. For the nearer they are unto one another, the higher may the Instrument be erected; there being no other guide for its true Elevation but this.

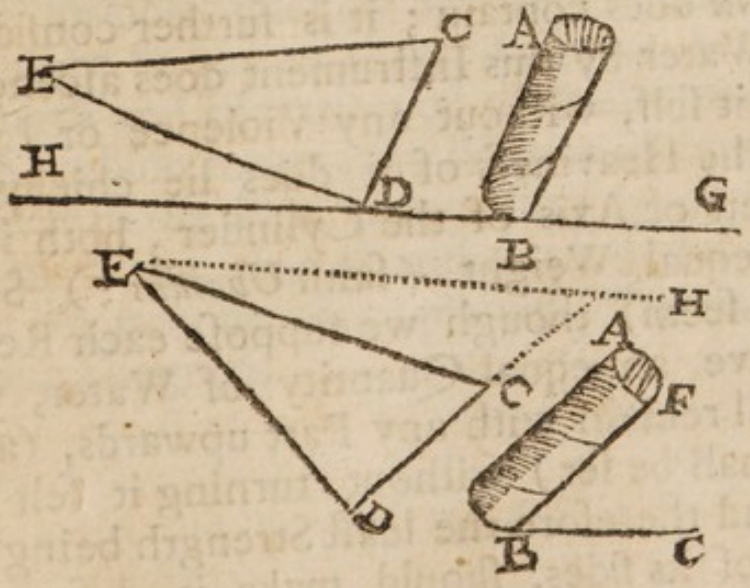
And because the right understanding of this particular is one of the principal Matters that concerns the use of this Engine, therefore I shall endeavour with Brevity and Perspicuity to explain it. The first thing to be enquired after, is, what kind of Inclination these Helical Revolutions of the Cylinder have unto the Horizon; which may be thus found out.

Let



et *A B* repreſent a Cylinder with two perfect volutions in it, unto which Cylinder the Perpenlar Line *C D* is equal : The Baſis *D E* being ſuped to be double unto the Compaſs or Circumfece of the Cylinder. Now it is certain, that the gle *C E D*, is the ſame with that by which the volutions on the Cylinder are framed, and that Line *E C*, in compariſon to the Baſis *E D*, does w the Inclination of theſe Revolutions unto the rizon. The Grounds and Demonſtration of this, more fully ſet down by *Guidus Ubaldus*, in his chanicks, and that other Treatiſe *De Cochlea*, ich he writ purpoſely for the Explication of Inſtrument, where the Subtilties of it are largend excellently handled.

Now if this Screw which was before Perpendicube ſuppoſed to decline unto the Horizon by Angle *F B G*, as in this ſecond Figure ;



then

then the Inclination of the Revolutions in it will be increaſed by the Angle *E D H*; though theſe Revolutions will ſtill remain in a kind of Aſcent, ſo that Water cannot be turned through them.

But now, if the Screw be placed ſo far declining that the Angle of its Inclination *F B G*, be leſs than the Angle *E C D*, in the Triangle; as in this other Diagram under the former; then the Revolution of it will deſcend to the Horizon, as does the Line *E C*; and in ſuch a Poſture, if the Screw be turned round, Water will aſcend through its Cavity. Whence it is eaſie to conceive the certain Declination, wherein any Screw muſt be placed for its own Conveyance of Water upwards. Any Point betwixt *H* and *D* being in deſcent, but yet the more the Screw declines downwards towards *D*, by ſo much the more Water will be carried up by it.

See a further explication of this in *Ubaldus de Cochlea, l. 2. prop. 25.*

If you would know the juſt Quantity of Water which every Revolution does contain and carry, according to any Inclination of the Cylinder; this may be eaſily found, by aſcribing on it an *Ellipſis*, parallel to the Horizon; which *Ellipſis* will ſhew how much of the Revolution is empty, and how much full.

The true Inclination of the Screw being found, together with the certain Quantity of Water which every *Helix* does contain; it is further conſiderable, that the Water by this Inſtrument does aſcend naturally of it ſelf, without any Violence or Labour; and that the Heavineſs of it does lie chiefly upon the Centers or Axis of the Cylinder, both its ſides being of equal Weight (ſaith *Ubaldus*:) So that (it ſhould ſeem) though we ſuppoſe each Revolution to have an equal Quantity of Water, yet the Screw will remain with any Part upwards, (according as it ſhall be ſet) without turning it ſelf either way. And therefore the leaſt Strength being added to either of its ſides, ſhould make it deſcend, ac-

Ibid. 3. prop. 4.

cording

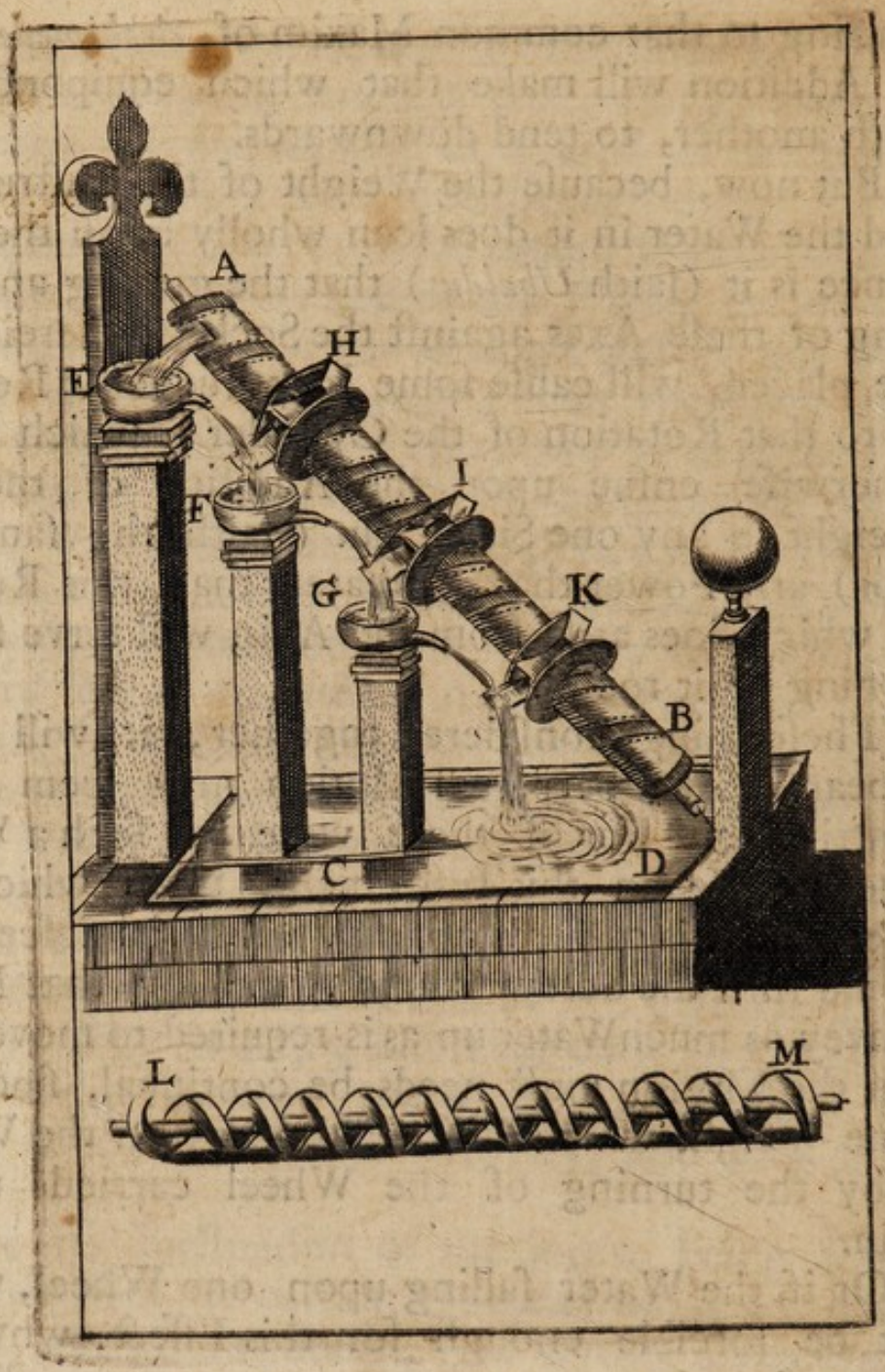
rding to that common Maxim of *Archimedes*; a- *De Æquipond. Suppoſ.* 3.
Addition will make that which equiponderates ith another, to tend downwards.

But now, becauſe the Weight of this Inſtrument, id the Water in it does lean wholly upon the Axis, ence is it (ſaith *Ubaldus*) that the grating and rubng of theſe Axes againſt the Sockets wherein they e placed, will cauſe ſome Ineptitude and Reſiſten- to that Rotation of the Cylinder; which would herwiſe enſue upon the Addition of the leaſt eight to any one Side; but (ſaith the ſame Auor) any Power that is greater than this Reſiſten- which does ariſe from the Axis, will ſerve for the rning of it round.

Theſe things conſidered together, it will hence ppear, how a perpetual Motion may ſeem eaſily ntrivable. For if there were but ſuch a Waterheel made on this Inſtrument, upon which the ream that is carried up may fall in its deſcent, it ould turn the Screw round, and by that Means nvey as much Water up as is required to move it; ſo at the Motion muſt needs be continual, ſince the me Weight which in its Fall does turn the Wheel, by the turning of the Wheel carried up ain.

Or if the Water falling upon one Wheel, would t be forcible enough for this Effect, why then ere might be two or three, or more, according as e Length and Elevation of the Inſtrument will adit: By which means, the Weight of it may be ſo ultiplied in the Fall, that it ſhall be equivalent to vice or thrice that quantity of Water which aſnds. As may be more plainly diſcerned by this llowing Diagram.

Where



Where the Figure *L M*, at the Bottom, does repreſent a wooden Cylinder with helical Cavities cut in it; which at *A B*, is ſuppoſed to be covered over with Tin-plates, and three Water-wheels upon it *H I K*. The lower Ciſtern which contains the Water being *C D*. Now this Cylinder being turned round, all the Water which from the Ciſtern aſcends through it, will fall into the Veſſel at *E*, and from that Veſſel being conveyed upon the Water-wheel *H*, ſhall conſequently give a circular Motion to the whole

hole Screw : Or if this alone ſhould be too weak r the turning of it, then the ſame Water which lls from the Wheel *H*, being received into the o- er Veſſel *F*, may from thence again deſcend on e Wheel *I* ; by which means the force of it will : doubled. And if this be yet inſufficient, then ay the Water which falls on the ſecond Wheel *I*, : received into the other Veſſel *G*, and from ience again deſcend on the third Wheel at *K* : And) for as many other Wheels as the Inſtrument is ca- able of. So that beſides the greater Diſtance of ieſe three Streams from the Center or Axis, by hich they are made ſo much heavier, and beſides, iat the Fall of this outward Water is forcible and iolent, whereas the Aſcent of that within is natu- l ; beſides all this, there is thrice as much Water) turn the Screw, as is carried up by it.

There is another like contrivance to this purpoſe in *Pet. Bettin. Apier.* 4. *Pogym.* 1. *Prop.* 10. but with much leſs advantage than 'tis here propoſed.

But on the other ſide, if all the Water falling pon one Wheel, would be able to turn it round, ien half of it would ſerve with two Wheels ; and ie reſt may be ſo diſpoſed of in the Fall, as to erve unto ſome other uſeful delightful Ends.

When I firſt thought of this Invention, I could carce forbear with *Archimedes* to cry out εὕρηκα, εὕρηκα ; ſeeming ſo infallible a way for the effecting of a erpetual Motion, that nothing could be ſo much s probably objected againſt it : But upon Trial and Experience I find it altogether inſufficient for any uch Purpoſe, and that for theſe two Reaſons :

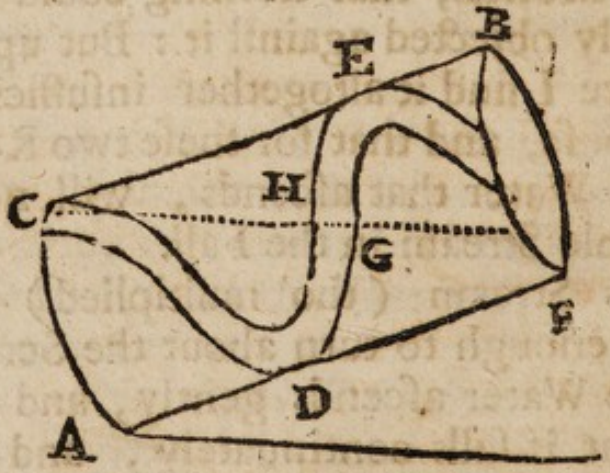
1. The Water that aſcends, will not make any onſiderable Stream in the Fall.

2. This Stream (tho' multiplied) will not be f Force enough to turn about the Screw.

1. The Water aſcends gently, and by Intermiſ- ions ; but it falls continuately, and with Force ; ach of the three Veſſels being ſuppoſed full at the irſt, that ſo the Weight of the Water in them night add the greater Strength and Swiftneſs to the

Streams, that deſcend from them. Now this Swiftneſs of Motion will cauſe ſo great a Difference betwixt them, that one of theſe little Streams may ſpend more Water in the Fall, than a Stream ſix times bigger in the Aſcent, tho' we ſhould ſuppoſe both of them to be continuate: How much more then, when as the aſcending Water is vented by Fits and Intermiſſions; every Circumvolution voiding only ſo much as is contained in one *Helix*? And in this particular, one that is not verſed in theſe kind of Experiments, may be eaſily deceived.

But *Secondly*, tho' there were ſo great a Diſproportion, yet notwithſtanding, the Force of theſe outward Streams might well enough ſerve for the turning of the Screw; if it were ſo, that both its ſides would equiponderate the Water being in them (as *Ubaldus* hath affirmed.) But now, upon farther Examination, we ſhall find this Aſſertion of his to be utterly againſt both Reaſon and Experience. And herein does conſiſt the chief Miſtake of this Contrivance: For the aſcending ſide of the Screw is made by the Water contained in it, ſo much heavier than the deſcending ſide, that theſe outward Streams thus applied, will not be of force enough to make them equiponderate, much leſs to move the whole; as may be more eaſily diſcern'd by this Fig.



Where *A B* repreſents a Screw cover'd over, *C D E* one *Helix*, or Revolution of it, *C D* the Aſcending

nding ſide, *E D* the Deſcending ſide, the Point the middle. The Horizontal Line *C F*, ſhewing ow much of the *Helix* is filled with Water, *viz.* the Aſcending ſide, from *C* the beginning of the *elix*, to *D* the middle of it; and on the Deſcend-g ſide, from *D* the middle, to the Point *G*, here the Horizontal does cut the *Helix*. Now it evident, that this latter part *D G*, is nothing near much, and conſequently not ſo heavy as the ther *D C*. And thus is it in all the other Revolu-ons; which, as they are either more or larger, will the Difficulty of this Motion be increaſed. Vhence it will appear, that the outward Streams hich deſcend, muſt be of ſo much Force, as to ountervail all that Weight whereby the Aſcend-ng ſide in every one of theſe Revolutions does ex-eed the other. And tho' this may be effected by aking the Water-wheels larger, yet then the Mo-on will be ſo ſlow, that the Screw will not be able ſupply the outward Streams.

There is another Contrivance to this purpoſe, entioned by *Kircher de Magnete*, *l.* 2. *p.* 4. depend-ng upon the Heat of the Sun, and the Force of Vinds; but it is liable to ſuch abundance of Excep-ons, that it is ſcarce worth the mentioning, and oes by no means deſerve the Confidence of any ngenious Artiſt.

Thus have I briefly explained the Probabilities nd Defects of thoſe ſubtle Contrivances, whereby he making of a perpetual Motion hath been at-empted. I would be loth to diſcourage the En-uiry of any ingenious Artificer, by denying the oſſibility of effecting it with any of theſe Me-hanical Helps: But yet (I conceive) if thoſe Prin-iples which concern the Slowneſs of the Power, in ompariſon to the Greatneſs of the Weight, were ightly underſtood, and throughly conſidered, they would make this Experiment to ſeem (if not al-

Treated of before, *l.* 1. *c.*

toge-

together impoſſible, yet) much more difficult than otherwiſe perhaps it will appear. However, the Enquiring after it cannot but deſerve our Endeavours, as being one of the moſt noble amongſt all theſe Mechanical Subtilties. And (as it is in the Fable of him who dug the Vineyard for a hid Treaſure, tho' he did not find the Money, yet he thereby made the Ground more fruitful; ſo) tho' we do not attain to the effecting of this particular, yet our ſearching after it may diſcover ſo many other excellent Subtilties, as ſhall abundantly recompence the Labour of our Enquiry.

And then beſides, it may be another Encouragement, to conſider the Pleaſure of ſuch Speculations, which do raviſh and ſublime the Thoughts with more clear Angelical Contentments. *Archimedes* was generally ſo taken up in the Delight of theſe Mathematical Studies of this familiar *Siren*, (as *Plutarch* ſtiles them) that he forgot both his Meat and Drink, and other Neceſſities of Nature; nay, that he neglected the ſaving of his Life, when that rude Soldier, in the Pride and Haſte of Victory, would not give him leiſure to finiſh his Demonſtration. What a Raviſhment was that, when having found out the way to meaſure *Hiero*'s Crown, he leaped out of the Bath, and (as if he were ſuddenly poſſeſs'd) ran naked up and down, crying, εὕρηκα, εὕρηκα! It is ſtoried of *Thales*, that in his Joy and Gratitude for one of theſe Mathematical Inventions, he went preſently to the Temple, and there offer'd up a ſolemn Sacrifice. And *Pythagoras*, upon the like Occaſion, is related to have ſacrificed a Hundred Oxen. The Juſtice of Providence having ſo contriv'd it, that the Pleaſure which there is in the Succeſs of ſuch Inventions, ſhould be proportioned to the great Difficulty and Labour of their Enquiry.

δικαίας καὶ συνοίκου σειρῆνος. *Plutarch. Marcell. Joan. Tzetzes, Chil. 2. Hiſt. 35. Valer. Maxim. l. 8. c. 7.*

FINIS.

AN ABSTRACT OF Dr. *WILKINS*'s ESSAY Towards a Real Character, AND A Philosophical Language.

Which was Printed by Order of the *Royal Society*, 1668.

IT appears by the Author's Dedication to the President, Council and Fellows of the *Royal Society*, that they had several Times requir'd his Papers of him relating to this Subject, and that in obedience to their Orders, he had reduced them into Method. He tells them, he was not so vain as to think he had finish'd this great Undertaking with all the Advantages of which it was capable: Nor was he so diffident of his Essay, but that he thought it sufficient for what it pretended to, *viz.* the distinct Expression of all Things and Notions that fall under Discourse. He was sensible of sundry Defects in several parts of the Book, and therefore desired they

would appoint ſome of their Number to conſider the whole, and to offer their Obſervations as to what they thought fit to be amended. Accordingly ſeveral of the Society, as appears by the Philoſophical Tranſactions of *Monday*, *May*, 18. 1668. were appointed to anſwer his Deſire, for the furthering and facilitating the Practice of what he aim'd at. But what Progreſs they made in it does not appear. Our Author was ſenſible that his Deſign might lie neglected as other good Deſigns had done; and the only Expedient he could think of to prevent it, was, that it might be ſent abroad with the Approbation of the Royal Society, which might provoke at leaſt the Learned part of the World to take notice of, and encourage it, according as they ſhould think it deſerv'd.

The Advantages propoſed by this Philoſophical Language were, The facilitating of mutual Commerce among the ſeveral Nations of the World; the improving of Natural Knowledge; and the Propagation of Religion: Our Author was alſo of Opinion, that it might contribute much to the clearing of ſome Modern Differences in Religion, by unmasking many wild Errors that ſhelter themſelves under the Diſguiſe of Affected Phraſes; which being philoſophically unfolded, and rendred according to the Genuine and Natural Importance of Words, would appear to be Inconſiſtencies and Contradictions; and ſeveral of thoſe pretended Myſterious Profound Notions, expreſs'd in Big Swelling Words, by which Men ſet up for Reputation, being this way examin'd, would either appear to be Nonſenſe, or very jejune. But whatever might be the iſſue of this Attempt, as to the eſtabliſhing of a Real Character, and bringing it into common Uſe among ſeveral Nations of the World, of which our Author had but very ſlender Expectations, yet of this he was confident, that the reducing of all Things and Notions to ſuch kind of

Tables

Tables as he propoſed, were it as compleatly done as it might be, would prove the ſhorteſt and plaineſt Way for the attainment of Real Knowledge, that had yet been offer'd to the World. To which he added, That he thought his Tables, as now they are, were a much better and readier Courſe for training up Men in the knowledge of Things, than any other Way that he knew of. And inded ſince his Deſign of the Real Character is wholly neglected, that ſeems now to be the principal uſe of the Book, and alone makes it truly valuable.

In his Preface to the Reader he gives an Account how he came to engage in this Work, *viz.* That by his Converſe with Dr. *Seth Ward*, then Biſhop of *Salisbury*, upon the various *Deſiderata*, propoſed by Learned Men to be ſtill wanting to the Advancement of ſeveral parts of Learning, he found this of an *Univerſal Character*, to be one of the principal and moſt feaſible, if regularly proſecuted; but moſt of thoſe who had attempted any thing like it, miſtook their Foundation, by propoſing a Character according to ſome particular Language, without reference to the Nature of Things, and that Common Notion of them wherein Mankind agrees: This Suggeſtion gave him the firſt diſtinct Apprehenſion of the proper Courſe to be taken for advancing ſuch a Deſign.

He ſays it was a conſiderable time after this before he attempted it; and the firſt Occaſion of it was; his deſire to aſſiſt another Perſon in framing a Real Character from the Natural Notion of Things. In order to promote that Perſon's Deſign, he drew up the Tables of Subſtances, or the Species of Natural Bodies, reduced under their ſeveral Heads, much the ſame as they are publiſh'd in this Eſſay. But the Perſon thinking this Method of too great a compaſs, and conceiving that he could provide for all the chief Radicals in a much ſhorter and eaſier Way, he did not make uſe of the Doctor's Tables. Our Author how-

however being convinc'd that this was the only way to effect ſuch a Work, and being unwilling to loſe ſo much Pains, he went on with the other Tables of Accidents, and then attempted the reduction of all other Words in the Dictionary to theſe Tables, either as they were ſynonimous to them, or to be defin'd by 'em; which was a true way to try the Fulneſs of thoſe Tables, and likewiſe a Help to Learners, who without ſuch a Direction, might not perhaps be able at firſt to find out the true Place and Notion of many Words.

For the farther compleating of this Work, out Author found it neceſſary to frame ſuch a Natural Grammar, as might be ſuited to the Philoſophy of Speech, abſtracting from many unneceſſary Rules belonging to inſtituted Languages.

He takes notice of the Aſſiſtance he receive'd from his Learned Friends in ſeveral Faculties; particularly from Mr. *Francis Willoughby*, as to the ſeveral Species of Animals; from Mr. *John Ray*, as to the Tables of Plants; and for the other principal Difficulties from Dr. *William Lloyd*, than whom he knew none fitter, becauſe of his Accurate Judgment in Philology and Philoſophy; and to him particularly he ow'd the ſuiting the Tables to the Dictionary, and the drawing up of the Dictionary it ſelf, which he doubts not will be found the moſt perfect ever yet made for the *Engliſh* Tongue.

'Tis obſervable however, that though he mentions others of his Friends by Name, from whom he had any Light or Help towards this Deſign, he does not at all name Mr. *George Dalgarno*, a *Scotch* Gentleman, born at *Aberdeen*, and bred in the Univerſity there, who printed a Book upon the ſame Subject, and with the ſame View, before him. This is the more remarkable, becauſe Dr. *Wilkins*'s own Name is printed in the Margin of King *Charles* the IId's Letter, prefix'd to Mr. *Dalgarno*'s Book, as one of thoſe who inform'd

orm'd his Majeſty of Mr. *Dalagarno*'s Deſign; and approv'd it as a thing that might be of ſingular uſe to facilitate an Intercourſe between People of different Languages, and conſequently a proper and effectual Means for advancing all the Parts of Real and Uſeful Knowledge, civilizing Barbarous Nations, propagating the Goſpel,aud increaſing Traffick and Commerce ; which prevail'd with his Majeſty to grant his ſaid Letters of Recommendation to as many of his Subjects, eſpecially the Clergy, as were truly apprehenſive and ſenſible of the defectiveneſs of Art, chiefly in this Particular of Language, what a great loſs Mankind is at thereby, how acceptable it would be before God, and praiſe-worthy among Men, to encourage and advance thoſe Ways of Learning, wherein the general Good of Mankind is intended; that ſuch Perſons would, as their Affections ſhall incline them, and their Places enable them, put their helping Hands to the bringing forth this (as yet) Infant Deſign, now ſticking in the Birth.

Theſe are the Words of his Majeſty's Letters, wherein he was pleaſed to declare he would give ſome Token of his Royal Favour for the helping forward that ſo laudable and hopeful Enterprize.

There is no Conjecture to be made why the Biſhop ſhould have forborn to name this Gentleman, but what is to be collected from his own Epiſtle, and from Mr. *Dalgarno*'s Book. In the former it appears that the Biſhop had form'd his Tables for the aſſiſtance of another Perſon in ſo worthy an Undertaking ; but that Perſon did not think fit to make uſe of thoſe Tables. And by Mr. *Dalgarno*'s Book, it is evident that he was in his Judgment againſt thoſe Tables, as being too tedious and difficult, and ſuch as Philoſophers were not agreed in , and by conſequence other Men of different Languages and Nations,could not have the ſame Idea's about them ; by which it is

probable he gave the Biſhop ſome Diſguſt, which might be the occaſion why he did not mention his Name.

The Title of Mr. *Dalgarno*'s Book is, *Ars Signorum, vulgo Character Univerſalis & Lingua Philoſophica. Qua poterunt, homines diverſiſſimorum Idiomatum, Spatio duarum ſeptimanarum, omnia Animi ſui ſenſa (in rebus familiaribus) non minus intelligibiliter, ſive ſcribendo, ſive loquendo, mutuo communicare, quam linguis propriis vernaculis. Præterea, hinc etiam poterunt Juvenes Philoſophiæ, Principia & veram Logicæ praxin, citius & facilius multo imbibere, quam ex vulgaribus Philoſophorum Scriptis.*

This is enough to ſhew that Mr. *Dalgarno*'s Deſign, tho' he differ'd in the Method, was the ſame, in the main, with the Biſhop's, to which we now return. He divides his Book into four Parts; the firſt contains the *Prolegomena*, and is divided into Five Chapters. The Firſt Chapter hath Four Sections: The Firſt contains the Introduction; the Second, the Original of Languages; wherein he delivers his Opinion, That the firſt Language was concreated with our Firſt Parents. The Riſe of the Confuſion of Languages is well enough known, but what number of Languages ſprung up at that Confuſion, is not certain; the moſt receiv'd Conjecture is, that they were 70, or 72, tho' there be ſtrong Probabilities to prove that there were not ſo many, and that the firſt Diſperſion did not divide Mankind into ſo many Colonies. But the Languages now us'd in the World, do far exceed this Number. *Pliny* and *Strabo* make mention of 300 Nations of different Languages, from whence People reſorted to *Dioſcuria*, a great Mart-Town in *Colchos*; which conſidering the narrow compaſs of Traffick, before the Invention of the Magnetick Needle, muſt needs be but a ſmall proportion, in compariſon to the reſt of the World. Some *American* Hiſtories ſay, That in every 80 Miles of that Coun-

Country, the Inhabitants ſpeak a different Language. *Joſeph Scaliger* reckons Eleven Mother Tongues in *Europe*, which have no dependance on one another; but they are ſo well known, that we need not inſiſt upon them. Beſides this difference of Languages in their firſt Derivation, every particular Tongue has its ſeveral Dialects in one and the ſame Nation. The *Hebrew* is by many Learned Men ſuppos'd to be the firſt Mother Tongue of thoſe now known in the World. When the *Jews* were Captives at *Babylon*, their Language was mix'd with the *Caldean*; and after the Captivity, the Pure *Hebrew* ceas'd to be Vulgar, and remain'd only amongſt Learned Men; as we find by *Nehemiah*, 8. 7, 8. And the Pure *Hebrew* now in being is only that of the Old Teſtament; which tho' ſufficient to expreſs what is there intended, is not ſo for Converſation, and therefore is gueſs'd not to be the ſame which was concreated with our Firſt Parents, and ſpoken in Paradiſe.

The Second Chapter conſiſts of Four Sections. The Firſt concerns the various Changes to which all Vulgar Tongues are obnoxious. The Second gives Proofs of ſuch Changes in the *Engliſh* Tongue in the Lord's Prayer, from the Year of *Chriſt* 700, to 1537. The Third Section determines in the Affirmative, that ſeveral of the Ancient Languages are loſt, ſince 'tis evident from the Inſtance of our own, that in ſome few hundreds of Years, a Language may be ſo chang'd, as to be ſcarce intelligible. The Fourth Section accounts for the Riſe and Occaſion of New Languages; which he ſays proceeds from Commerce, and Mixture of People by Conqueſts, Marriage of Princes, or otherwiſe; and inſtances in that call'd the *Malayan* Tongue, the neweſt in the World, and as common among the Natives of the *Eaſt Indies*, as *Latin* and *French* in *Europe*. It was invented or occaſion'd by a Concourſe of Fiſhermen from *Pegu*, *Siam*, *Bengala*, and other Nations at *Malacca*, where they built

the Town of that Name, and agreed upon a distinct Language made up of the easiest Words belonging to each Nation.

The Third Chapter consists of 4 Sections. The First treats of the Original of Letters and Writing. Our Author tells us, it is most generally agreed, That *Adam* in process of time, upon his Experience of the great necessity of Letters, did first invent the ancient *Hebrew* Character; but he rejects those particular Alphabets which are by some ascrib'd to *Adam*, *Enoch*, and *Noah*; and adds, that it has been abundantly cleared by Learned Men, that the ancient *Hebrew* Character has the Priority before any now known. And 'tis none of the least Arguments for the Truth and Divine Authority of the Holy Scriptures, to consider the general Concurrence of all manner of Evidence for the Antiquity of the *Hebrew*, and the Derivation of all other Letters from it. In the Second Section he gives us the Opinion of many of the Ancients, to confirm the Derivation of other Letters and Languages from the *Hebrew*. In the Third, he shews us that the Use of Letters is less ancient, and the Kinds of them less numerous than the Languages themselves. He proves this by several Instances, that many Nations do not yet understand the Use of Letters, and that tho' the *German* and *French* Tongues be ancient, it is not much above 400 Years since Books began to be writ in those Languages: And the reason why Letters are less numerous than Languages, is, That several Nations borrow'd the Use of Letters from their Neighbours, and adapted them to their own Languages. In the Fourth Section, he gives us an Account of the Hieroglyphicks of the Ancients, which was a meer Shift they were put to for want of Letters, and was a slight and imperfect Invention, suitable to those first and ruder Ages. He treats also of the secret and occult ways of Writing, taught by the Abbot *Trithemius*,

mius, for which he was falſly accuſed of Magick. He gives us ſome Hints about Letters or Marks uſed by the Ancients for Brevity ſake; of which Nature is Short-Hand, ſo common in *England*. In the Fifth Section, he gives an Account of ſome ancient Attempts towards a Real Character, to ſignify Things and Notions. And in the Sixth informs us, that no Alphabet now in being, was invented at once, or by Rules of Art; but all of 'em, except the *Hebrew*, were taken up by Imitation.

The Fourth Chapter conſiſts of Six Sections. The Firſt treats of the Defects in the Common Alphabets, as to their true Order, which is inartificial and confus'd, the Vowels and Conſonants being huddled together without any Diſtinction; whereas the Vowels and Conſonants ſhould be reduc'd into Claſſes, according to their ſeveral kinds. In the Second Section, he takes notice of the Redundancy and Deficiency of the *Hebrew* Alphabet, and likewiſe of the *Greek* and *Latin*. In the Third Section, he ſhews that they are very uncertain as to their Powers and Signification; of which he gives ſeveral Inſtances in our own Language. In the Fourth Section, he takes notice that the Names of the Letters in moſt Alphabets are very improperly expreſſed by Words of ſeveral Syllables. In this reſpect, the *Roman* and *Engliſh* Alphabet are more convenient than the reſt, though not without ſome Defects of the ſame Nature. In the Fifth Section, he ſays their Figures do not correſpond ſufficiently with their Natures and Powers, and obſerves that the manner of Writing the Oriental Tongues from Right to Left, is as unnatural as to write with Light on the wrong ſide. In the Sixth Section, he takes notice of the Defects of Words as well as Letters; ſome of them being Equivocal, others Synonimous, beſides the Irregularities in Grammar, and the difference betwixt writing and pronouncing Words. On this Occaſion, he takes notice

tice of the Endeavours of Sir *Thomas Smith*, and others, to rectify our *Engliſh* Orthography, tho' we ſtill obſtinately retain the Errors of our Anceſtors.

The Fifth Chapter has Three Sections. The Firſt maintains, That neither Letters nor Languages have been regularly Eſtabliſhed by Rules of Art: Nor cou'd it be otherwiſe, becauſe Grammar (by which they ſhould be regulated) is of a much later Invention than the Languages themſelves; as is evident from the *Hebrew*; which, tho' the oldeſt of all, was not reduc'd into Order of Grammar till the Year 1040. In the Second, he treats of the Natural Ground and Principle of the ſeveral Ways of Communication among Men; where he tells us, That as they generally agree in the ſame Principle of Reaſon, they likewiſe agree in the ſame Internal Notion or Apprehenſion of Things; and thoſe Internal Notions they communicate to the Ear by Sounds, and particularly by Words, and to the Eye they communicate them by Motion and Figure, *&c.* and more particularly by Writing: So that if Men ſhould generally agree upon the ſame way of Expreſſion as they agree in the ſame Notion, we ſhould then be free from that Curſe of the Confuſion of Tongues, and all the unhappy Conſequences of it. This is only to be done by ſome one Language and Character to be univerſally practiſed, and enjoined by Authority; which cannot be expected without an *Univerſal Monarchy*; and perhaps not then: Or elſe by ſome Method which (without ſuch Authority) might engage Men to learn it, becauſe of its Facility and Uſefulneſs, which was the Deſign of this *Eſſay*. The Third Section informs us, That in order to this, the firſt thing to be conſider'd, was a juſt Enumeration and Deſcription of ſuch things as were to have Marks or Names aſſigned them, and to be ſo contrived, as to be full and adequate without Redundancy or Defect as to their Number, and regular as to their Place and Order.

der. And, if every Thing and Notion had a diſtinct Mark, with ſome Proviſion to expreſs Grammatical Derivations and Inflections, it would anſwer one great End of a Real Character, to ſignify Things and not Words. And if ſeveral diſtinct Words were aſſigned for the Names of ſuch Things, with fixed Rules for ſuch Grammatical Derivations and Inflections as are natural and neceſſary, it would make a more eaſie and convenient Language than any yet in being.

Then if theſe Marks or Notes could be ſo contriv'd, as to have ſuch a dependance upon, and relation to one another, as might ſuit the Nature of the Things and Notions they repreſent; and likewiſe, if the Names of Things could be ſo ordered, as to contain ſuch an Affinity or Oppoſition in their Letters and Sounds, as might ſome way anſwer the Nature of the Things they ſignify, it would be a further Advantage, by which, beſides helping the Memory by Natural Method, the Underſtanding would be improv'd; and by learning the Characters and Names of Things, we ſhould likewiſe learn their Natures.

Thus our Author concludes the Firſt Part, and comes to the Second; which contains a regular Enumeration and Deſcription of all thoſe Things and Notions to which Names are to be aſſigned, and forms a Syſtem of Univerſal Philoſophy. This Part is divided into Twelve Chapters. The Firſt contains Six Sections. The Firſt Section has a Scheme of Genus's, or more common Heads of Things belonging to this Deſign. Then he ſhews how each of them may be ſubdivided by its peculiar Differences, which for the better Convenience of the Deſign, he determines for moſt part to the Number of Six, except in the Numerous Tribes of Herbs, Trees, Exanguious Animals, Fiſhes and Birds, which cannot be comprehended in ſo narrow a Compaſs. Then he

he enumerates the ſeveral Species belonging to each of thoſe Differences, in ſuch an Order and Dependance, as may contribute to define them, and determine their primary Significations. Theſe Species he commonly joins together in Pairs, for helping the Memory; and ſo likewiſe are ſome of the Genus's and Differences; thoſe things which naturally have Oppoſites, are join'd with them, according to ſuch Oppoſition, whether ſingle or double; and thoſe things that have no Oppoſites, are commonly join'd together with reſpect to ſome Affinity which they have to one another, tho' ſometimes thoſe Affinities are leſs proper and more remote; there being ſeveral things ſhifted into thoſe Places, becauſe the Author did not know how to provide for them better. The Second Section relates to the more general Notions of Things, and the difficulty of Eſtabliſhing thoſe Notions aright. The Third treats of Tranſcendentals General. The Fourth of Tranſcendental Relations mix'd. The Fifth of Tranſcendental Relations of Action; and the Sixth of the ſeveral Notions belonging to Grammar or Logick. But theſe Things being digeſted into Tables, we muſt refer the Reader to the Book it ſelf, for a diſtinct Idea of them.

The Second Chapter conſiſts of Two Sections. The Firſt is concerning God; and the Second concerning the ſeveral Things and Notions reducible under that Collective *Genus* of the World: Which is alſo digeſted into Tables.

The Third Chapter conſiſts of Three Sections. The Firſt is of Elements and Meteors; the Second of Stones; and the Third of Metals: Digeſted alſo into Tables.

The Fourth Chapter has Seven Sections. The Firſt of Plants; the Second concerning a more general Diſtribution of 'em; the Third, Fourth, and Fifth, treat of Herbs; conſider'd according to their Leaves, Flowers, and Seed-Veſſels. The Sixth treats

of

of Shrubs; and the Seventh of Trees. All of 'em likewiſe in Tables.

The Fifth Chapter has Six Sections. The Firſt concerns Animals, and the general Diſtribution of 'em; the Second is of Exanguious Animals; the Third of Fiſh; the Fourth of Birds; the Fifth of Beaſts; and the Sixth has a Digreſſion concerning *Noah*'s Ark: Wherein he maintains the Truth and Authority of the Scripture, againſt the Objections of Atheiſts and Hereticks, That a Veſſel of ſuch Dimenſions could not contain ſo vaſt a Multitude of Animals, with a whole Year's Proviſion for 'em.

The Sixth Chapter relates to the Parts of Animate Bodies; Firſt, peculiar; Secondly, general: And theſe are alſo digeſted into Tables.

The Seventh Chapter relates to the Predicament of Quantity. 1. Of Magnitude. 2. Of Space. 3. Of Meaſure. All digeſted into Tables.

The Eighth Chapter relates to Quality, and its ſeveral *Genus's*. 1. Of Natural Power. 2. Of Habit. 3. Of Manners. 4. Of ſenſible Quality. 5. Of Diſeaſes. With the various Differences and Species under each.

The Ninth Chapter treats of Action, and its ſeveral *Genus's*. 1. Spiritual. 2. Corporeal. 3. Motion. 4. Operation.

The Tenth Chapter concerns more private Relation. 1. Of Family Relation; with the ſeveral kinds of Things belonging to thoſe in that Capacity, either as Poſſeſſions, or Proviſions.

The Eleventh Chapter concerns Publick Relations; as Civil, Judiciary, Naval, Military, and Eccleſiaſtical.

The Twelfth Chapter explains the Deſign of the foregoing Tables; gives particular Inſtances of the 6 principal *Genus's* of it; has ſome Notes concerning Oppoſites and *Synonyma's*; and an Account of ſuch Things as ought not to be provided for in thoſe Tables.

The

The Third Part contains a Philoſophical Grammar; and is divided into Fourteen Chapters.

The Firſt Chapter concerns the ſeveral Kinds and Parts of Grammar. 2. Of Etymology; and the more General Scheme of Integrals and Particles. 3. Of Nouns in general. 4. Of Subſtantives common, denoting either Things, Actions, or Perſons. 5. Rules concerning Nouns of Action. 6. Of Subſtantives Abſtracts. 7. Of Adjectives, according to the true Philoſophical Notion of them. 8. The true Notion of a Verb. 9. Of derived Adverbs. 10. A General Scheme of the forementioned Derivations.

The Second Chapter concerns Particles in general. 2. Of the *Copula*. 3. Of Pronouns more generally. 4. More particularly. 5. Of Interjections more generally. 6. More particularly.

The Third Chapter treats of Prepoſitions in general. 2. The particular Kinds of them enumerated. 3. An Explication of the Four laſt Combinations of them, relating to Place or Time.

The Fourth Chapter concerns Adverbs in general. 2. The particular Kinds of them. 3. Conjunctions.

The Fifth Chapter treats of Articles. 2. Of Moods. 3. Of Tenſes. 4. The moſt diſtinct way of expreſſing the Differences of Time.

The Sixth Chapter concerns Tranſcendental Particles, and the End and Uſe of them. 2. The uſual ways for enlarging the Senſe of Words in inſtituted Languages. 3. The General Heads of Tranſcendental Particles.

The Seventh Chapter has Inſtances of the great Uſefulneſs of thoſe Tranſcendental Particles; with Directions how they are to be applied.

The Eighth Chapter treats of the Accidental Differences of Words. 1. Inflexion. 2. Derivation. 3. Compoſition.

The Ninth Chapter is of the Second Part of Grammar, called *Syntaxis*. The

The Tenth Chapter is of Orthography ; and contains Three Sections. The Firſt concerning Letters; and the Authors who have treated of this Subject: Of whom Dr. *Wallis* ſeems with the greateſt Accurateneſs and Subtilty to have conſider'd the Philoſophy of Articulate Sounds. The Second contains a brief Table of all ſuch Kinds of ſimple Sounds, as can be framed with the Mouths of Men. The Third contains a further Explanation of this Table, as to the Organs of Speech, and as to the Letters framed by thoſe Organs.

The Eleventh treats of Vowels. The Twelfth of Conſonants. The Thirteenth of Compound Vowels and Conſonants. The Fourteenth treats of the Accidents of Letters: 1. Their Names. 2. Their Order. 3. Affinities and Oppoſitions. 4. Their Figures; with a Twofold Inſtance of a more regular Character for the Letters: The latter of which may be eſteemed Natural. 5. Of Pronunciation. 6. The ſeveral Letters diſus'd by ſeveral Nations.

The Fourth Part contains a Real Character and Philoſophical Language. This conſiſts of Six Chapters: The 1ſt. treats of a Propoſal of one kind of RealCharacter amongſt many others which might be offer'd both for the Integrals, whether *Genus*'s, Differences, or Species, together with the Derivations and Inflexions belonging to them; as likewiſe for all the ſeveral kinds of Particles. Here our Author acquaints us, That it were exceeding deſirable that the Names of Things might conſiſt of ſuch Sounds as ſhould bear in them ſome Analogy to their Natures, and the Figure or Character of theſe Names ſhould bear ſome proper reſemblance to thoſe Sounds; but he does not underſtand how this Character can be adjuſted any otherwiſe than by Inſtitution: And in the framing of thoſe Characters, he ſays, ſpecial Regard muſt be had to theſe Four Properties. 1. That the Figure be plain and eaſy, ſo as it may be made by

by one or at moſt by Two ſtrokes of the Pen. 2. That they be ſufficiently diſtinguiſhed from one another. 3. Graceful to the Eye. 4. Methodical. But we muſt refer to the Book it ſelf for our Author's Specimen.

The Second Chapter contains an inſtance of this Real Character in the Lord's Prayer and Creed.

The Third ſhews how this Character may be made Affable in a diſtinct Language, and what kind of Letters or Syllables may be conveniently aſſign'd to each Character.

The Fourth has a Compariſon of the Lord's Prayer and Creed in this Language, with 50 other Languages as to the Facility and Euphony of it. The Fifth contains Directions for the more eaſy learning this Character and Language; with a brief Table containing the Radicals both Integrals and Particles, together with the Character and Language by which each of 'em are to be expreſs'd.

The Sixth is a Compariſon betwixt this Natural Philoſophical Grammar, and that of other Inſtituted Languages, particularly the *Latin*, in reſpect of the Multitude of unneceſſary Rules, and of Anomaliſms. It treats alſo concerning the *Chinese* Character; the ſeveral Attempts and Propoſals made by others towards a new kind of Character and Language, and the Advantage in reſpect of Facility which this Philoſophical Language has above the *Latin*. In the laſt place comes an Alphabetical Dictionary wherein all *Engliſh* Words according to their various Significations, are either referr'd to their Places in the Philoſophical Tables, or explained by ſuch Words as are in thoſe Tables.

F I N I S.

