

Mechanick Exercises :
OR THE
Doctrine
OF
Handy-Works.

By **Joseph Moxon**, Fellow of the
Royal Society, and Hydrographer to the late
King Charles.

The Third Edition
1703

A Digital Reprint, in Facsimile



The Toolemera Press
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International Standard Book Number : 978-0-615-28981-6



Published by Gary Roberts
The Toolemera Press
Dedham, MA 02026

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Manufactured in the United States of America

The Toolemera Press edition

Joseph Moxon's
Mechanick Exercises: Or,
The Doctrine Of Handy-Works

The Philosophical Transactions of the Royal Society
Review: An Account of Three Books
Philosophical Transactions
1677-1678: Vol. 12, pp. 963-968

Mechanick Exercifes: Or, the Doctrine of Handy-Works. Began Jan. 1. Profecuted in two other Effays, February 1, and March 1, 1677. And intended to be continued monthly. by Jofeph Moxon, Hydrographer to the King.

The Author Undertaking, to fet down what is already known, being good; and not unlikely to give occaffion to others to confider of further Improvements in thefe Matters: it may not be thought improper; that the fame, once for all, be here reprefented.

The Author, as he faith in his Preface, having for many years been converfant in Handy-Works, efppecially Smithery, Founding, Drawing, Joynerly, Turning, Engraving, Printing of Book and Pictures, making of Globes, Maps, Mathematical Inftruments; and being willing publickly to communicate his knowledg herein; hath in his firft Effay begun with Smithery, as comprehending with the Black-Smiths Trade, all other handy-crafts, ufing either forge or file, from the Anchor-Smith to the Watch-Maker: Which will be an Introduction to moft other handycrafts, as having a dependance upon this. And firft, he gives Account of the feveral Parts, Kinds and Ufes of the Smiths Forge, Anvil, Tongues, Hammer and Sledg, Vice, Hand-Vice, Pliers, Drill and Drill-Bow, Skrew-Plate and its Taps. Then of Forging and the feveral Heats to be given: Of brazing and foldering. The feveral forts of

Iron and their proper Uses. And lastly, of Filing and the severall sorts of Files.

In the second Effay, of the making of Hinges, Locks and Keys: The manner of Riveting, making of Screws and Nuts. And particularly, of cutting Wormes upon great Screws.

In the Third Effay, of the making of Jacks, Bullet-molds, Twisting of Iron, Case-Hardening. Some Tools not before describ'd. The severall sorts of Steel; the manner of softening, hardning and tempering the same.

London

Printed for John Martyn, Printer to the Royal Society. 1678



The original for this digital facsimile of the 1703 edition is from my personal library. The binding is of an early 18th Century style and shows no signs of having been repaired or rebound. With the exception of a handful of plates which were loose and damp stained, this book is as intact as the day it was bound. Those plates that were too damaged for legible imaging have been reproduced from a very early 20th Century reprint of the 1703 edition.

The book as purchased showed considerable damp wrinkling and creasing throughout. Basic conservation entailed:

- Freezing the entire volume for one month in a vacuum sealed bag to prevent mold or mildew formation
- Vacuuming loose dust and dirt with a cloth covered vacuum nozzle
- Erasing modern smudges and dirt with a soft vinyl eraser
- Pressing open creased page corners through humidification and clamps

- Correcting page wrinkling by setting the entire volume in a book press for one month under very mild humidification

The covers and title page have been reproduced in full color. The body of the book has been reproduced in grayscale in order to improve contrast and legibility. Manual adjustment of contrast, brightness and level settings reduced the visual interference from creases, damp staining, finger prints and surface irregularities. Each page was cropped slightly to reduce edge fringing. The final PDF, with the exception of grayscale instead of color imaging, is as close as possible to the original.



Reading 17th Century Literature

Reading early English literature is always a challenge. Not only can spellings change within a single page, grammar and usage can change seemingly without reason. Most troublesome to the modern reader is the use of the long ‘*ʒ*’ or ‘*f*’. The ‘*f*’ is a remnant of a Roman cursive ‘*ʒ*’. Here are some examples of what you may come across while reading early text:

c t	ct	ff	ff	ffi	ff
ffl	ff	fi	fi	fl	fl
long s	f	sh	fh	si	fi
sl	fl	ss	ff	st	ft

Notes on Mechanick Exercises: Or, The Doctrine Of Handy-Works

Mechanick Exercises: Or the Doctrine of Handy-Works, was the first book published in England as a serial. Serialization of books was practiced in other countries as a means to make texts available to the less affluent as well as to entice readers to continue to purchase installments. Publishing was a chancy business. With the exception of books backed by a religious institution, most publishers had to raise funds on their own, or print on speculation.

The individual chapters of *Mechanick Exercises* were priced at 6 to 10 pence each, not a small sum, but yet affordable by the Mechanick, a term used to describe someone who made their living through their trade. The full set included chapters on smithing, joinery, carpentry, turning, bricklaying and the making of sundials. Twenty-six engraved plates provided a visual reference that continues to be referred to today when we speak of traditional tools and trades. The content was written in such a way as to introduce tradesmen to both the basics of various crafts as well as to provide direction in advanced techniques.

By 1703, *Mechanick Exercises* appears to have been published as a single volume. It is difficult to say with certainty whether volumes bearing this date were offered as intact sets or if the buyers purchased individual sections for binding. It was a common practice of the 17th and 18th Century publisher to produce a book as an unbound set of signatures (a signature is one set of folded pages. Signatures were sewn together to make up the completed book). Buyers, be they booksellers or private customers, could then choose the type of binding best suited to their means and preferences.

Written by a tradesman, for tradesmen, *Mechanick Exercises: Or, the Doctrine of Handy-Works*, remains one of the most important English language works on craft. The typical book

of building and architecture of the period was written by architects or authors who may or may not ever have set hand to tool. Joseph Moxon wrote of what he knew from his personal experiences. Although we do not know with any certainty if he actually practiced all of the trades of which he wrote, it is clear that his training in the crafts of printing and scientific instrument making lent practical insight in the writing of *Mechanick Exercises*.

A brief biography of Joseph Moxon

Joseph Moxon (August 8, 1627 - February 15, 1691) is best known today for his two works: *Mechanick Exercises: Or, The Doctrine of Handy-Works* and for *Mechanick Exercises On The Whole Art Of Printing*. In his day, Moxon was famed for his skills as a maker of terrestrial and celestial globes, mathematical instruments, maps and charts. Through considerable personal effort, Moxon was appointed Hydrographer to the King. He was also the first tradesman to be accepted to the Royal Society. There are at least 60 titles to which he has been associated as a printer, publisher, translator or author. This was a considerable sum of accomplishments for a 17th Century tradesman.

Born to James Moxon, a printer who held to Puritan beliefs, Joseph traveled with his father to Holland where they were engaged in the printing of the then outlawed Puritan Bibles in English, primarily for the London trade. The supposition is that they left England as a direct result of the prevailing religious climate. Following the end of the First English Civil War (1651), Joseph and his father returned to England. Although Joseph and his elder brother James continued to print Puritan bibles in London, Joseph eventually left the family printing business.

In his preface to *Mathematicks made Easie* (1679), Moxon says it was “*about thirty years ago when I firft began to apply myself to Mathematical Learning.*” From this we assume that Moxon began his studies of mathematics in 1649, at the age of 23. It is not known under whom he studied, but it is clear that he did learn the complex mathematics and constructive skills necessary in the making of globes, spheres, maps and mathematical instruments. From 1653 on, this work comprised the bulk of his personal enterprise. While engaged in the making and selling of scientific instruments, Moxon published various titles in the mathematical sciences, of both his authorship as well as of others. His broad interests led to

a series of titles on astronomy and geography, significant developing sciences of the seventeenth century.

Two instances stand out in the life of Joseph Moxon. He sought admittance to the ranks of the Royal Society as well as the position of Hydrographer to the King (the maker of maps and globes of the bodies of water of the world). These goals far exceeded the social and political reaches of the average skilled tradesman. Moxon was, however, possessed of considerable personal ambition. As Hydrographer, his business in globes and maps could only prosper and expand. Yet in the eyes of the scientific community of his day he was a tradesman. In the pursuit of his trades as a publisher, printer and maker of globes, Moxon was relegated to a fairly low position in the hierarchy of the scientific community. The demarkation between those who worked with their hands and those who were scientists was rarely crossed.

Moxon moved within a fairly rarified circle of friends as a direct result of his expertise in mathematics. An early supporter of Moxon's publishing endeavors was Robert Hooke. Hooke is known as the father of microscopy, for coining the word "cell" to describe the basic unit of life, for Hooke's Law of Elasticity, and for his works in astronomy, evolution and architecture. It is apparent from Hooke's personal records that he met frequently with Moxon to review new publications. Hooke notes that, on December 31, 1677, he "*Calld on Moxon, he read me his firft monthly exercife of fmithery...*" to which reference is made to the *Mechanick Exercises: Or the Doctrine of Handy-Works*. Hooke purchased the first installment of the *Mechanick Exercises* for 6d (6 pence) on January 2, 1678. Moxon's production of scientific instruments and the regular publication of tabular reference material further served to bring him into contact with the scientific community. His application to be appointed Hydrographer to the King was signed by no less than fourteen members of the Royal Society.

His next goal was to be appointed to the Royal Society, the preeminent scientific society in England. Admission to the Royal Society was the ultimate in personal recognition for any man of learning and ambition. Membership in this august body of scholars was typically restricted to those of proper birth and connection. Tradesmen and merchants had never before been admitted to the Royal Society. Despite the opposition from many members of the Society, Moxon persevered and was eventually admitted. He holds the distinction as the first tradesman to join the Royal Society.

Another goal was to be appointed Printer to the Society. Presumably, Moxon saw this appointment as an opportunity to further expand his printing and publishing trade. Little did he realize that, buried in the bylaws of the Society, the Printer was rated lower than the Society Clerk. Fortunately, Moxon lost out on the appointment. Unfortunately, Moxon took the rebuff very hard and ceased to attend Royal Society meetings.

Moxon retained his position as Hydrographer to the King until his death. He is buried in St. Paul's Cathedral, London.



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Mechanick Exercises :
OR THE
DOCTRINE
OF
HANDY-WORKS.

Applied to the Arts of {
Smithing
Joinery
Carpentry
Turning
Blacklavery.

To which is added

Mechanick Dyalling: Shewing how to draw a true Sun-Dyal on any given Plane, however Scituated; only with the help of a straight Ruler and a pair of Compasses, and without any *Arithmetical Calculation*.

The Third Edition.

By JOSEPH MOXON, *Fellow of the Royal Society, and Hydrographer to the late King Charles.*

L O N D O N :

Printed for *Dan. Midwinter and Tho. Leigh*, at the *Rose and Crown* in *St. Paul's-Church-Yard*. 1703.

Moxon's Handy Works

Drachiv.

PREFACE.

I See no more Reason, why the Sordidness of some Workmen, should be the cause of contempt upon Manual Operations, than that the excellent Invention of a Mill should be dispis'd, because a blind Horse draws in it. And tho' the Mechanicks be, by some, accounted Ignoble and Scandalous? yet it is very well known, that many Gentlemen in this Nation, of good Rank and high Quality, are conversant in Handy-Works: And other Nations exceed us in numbers of such. How pleasant and healthey this their Diversion is, their Minds and Bodies find; and how Harmless and Honest, all sober men may judge?

That Geometry, Astronomy, Perspective, Musick, Navigation, Architecture, &c. are excellent Sciences, all that know but their very Names will confess: Yet to what purpose would Geometry serve, were it not to contrive Rules for Handy-Works? Or how could Astronomy be known to any perfection, but by Instruments made by Hand?

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Epilog

Mr Howard in book binding

MECHANICK EXERCISES:

OR,

The Doctrine of *Handy-Works*.

Of SMITHING in General.

Definition.

SMITHING is an *Art-Manual*, by which an irregular Lump (or several Lumps) of Iron, is wrought into an intended Shape.

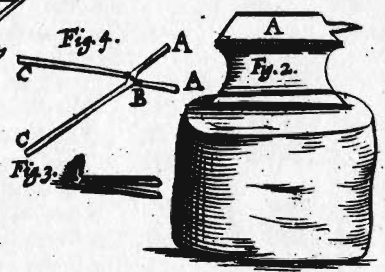
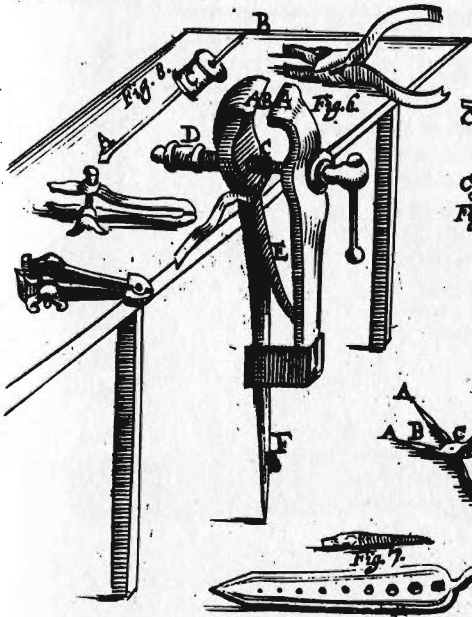
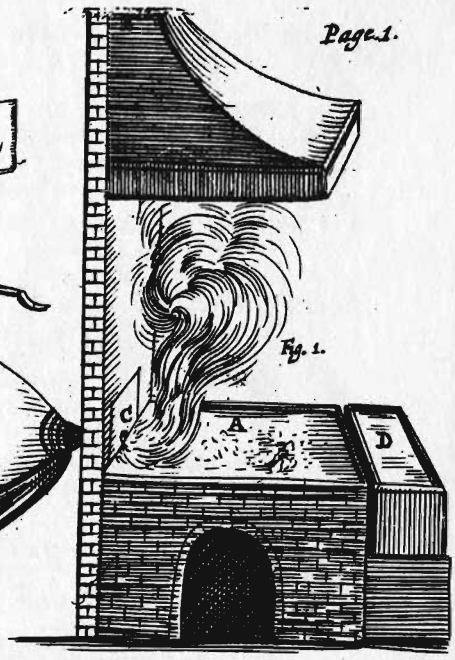
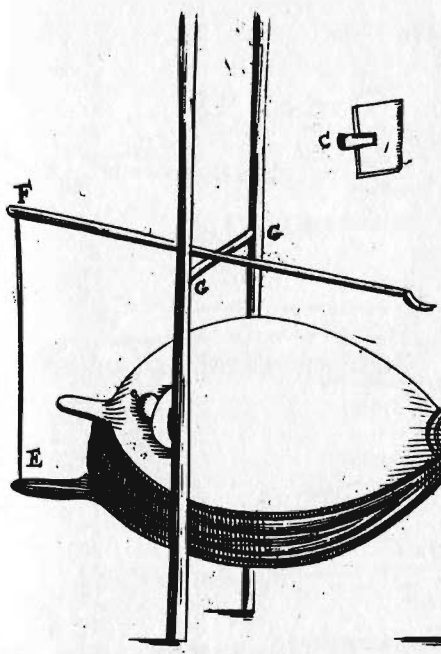
This Definition, needs no Explanation; therefore I shall proceed to give you an Account of the Tools a Smith uses; not but that (they being so common) I suppose you do already know them; but partly because they may require some precaution in setting them up fittest to your use; and partly because it behoves you to know the Names, Smiths call the several parts of them by; that when I name them in Smith's Language (as I shall oft have occasion to do in these *Exercises*) you may the easier understand them, as you read them.

Of setting up a Smith's Forge.

THE *Hearth*, or Fire-place of the *Forge* marked A. (in Plate 1.) is to be built up from your floor with Brick about two foot and an half, or sometimes two foot nine Inches high, according to the purpose you design your *Forge* for; for if your *Forge* be intended for heavy work, your *Hearth* must lie lower than it need be for light work;

A

work;



MECHANICK EXERCISES;

O R,

The Doctrine of *Handy-Works*

The Art of JOINERY.

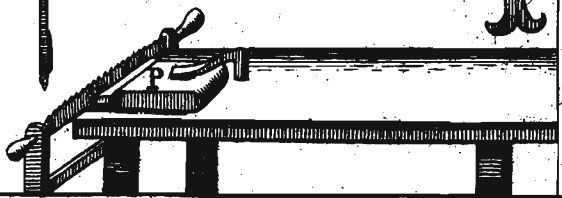
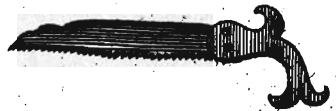
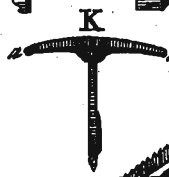
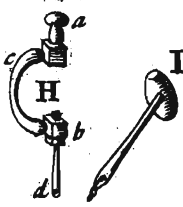
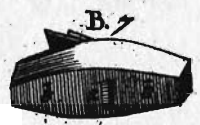
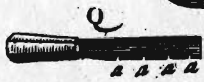
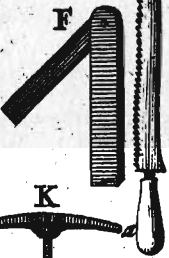
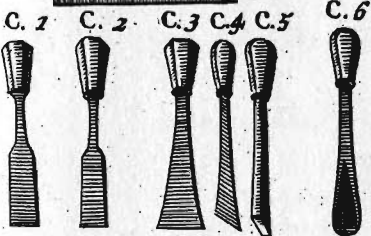
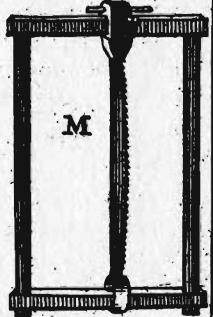
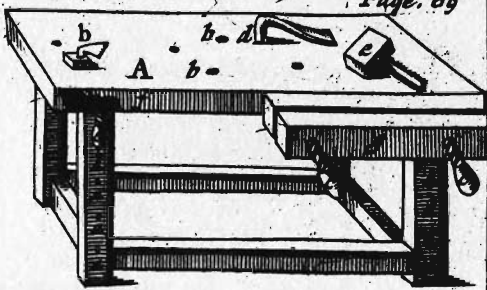
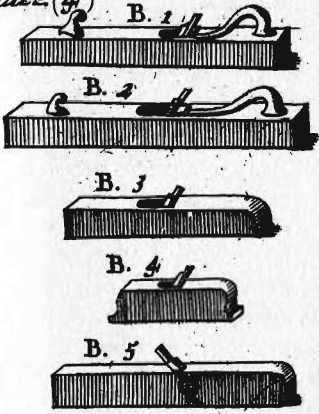
Definition.

JOINERY, is an Art Manual, whereby several Pieces of Wood are so fitted and join'd together by Straight-line, Squares, Miters or any Bevel, that they shall seem one intire Piece.

Explanation.

By *Straight-Lines* I mean that which in Joyner's Language is call'd a Joint, That is, two Pieces of Wood are Shot (that is Flained,) or else they are Pared, that is, the irregularities that hinder the closing of the two Pieces are cut off with a Pairing-chissel. They are Shot or Pared (as I said) so exactly straight, that when they are set upon one another, light shall not be discern'd betwixt them. This they call Shooting of a Joint, or Paring to a Joint, because these two Pieces are with Glew commonly join'd together, either to make a Board broad enough for their purpose, or to a Clamp one piece of Wood to the end of another piece of Wood to keep it from Casting or Warping.

By



MECHANICK EXERCISES;

O R,

The Doctrine of *Handy-Works*

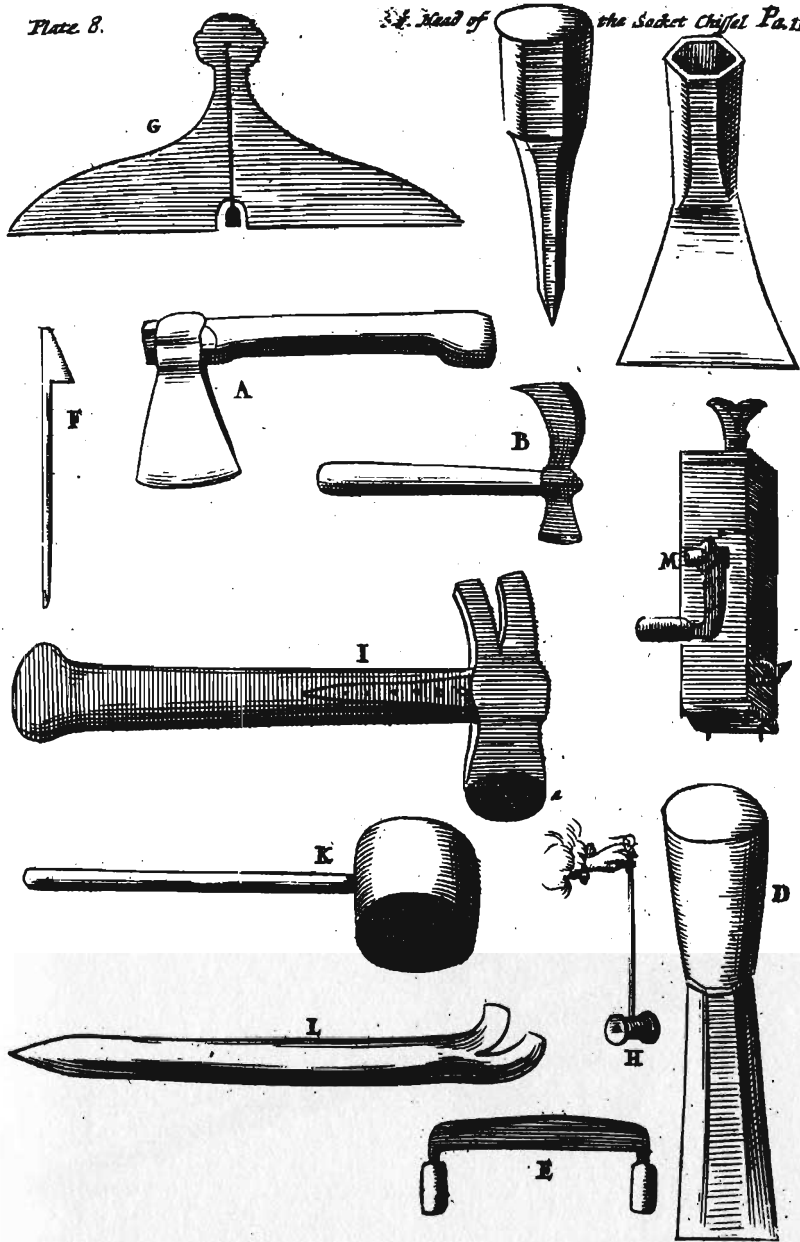
Applied to the ART of *House-Carpentry*.

B EING now come to exercise upon the *Carpenters Trade*, it may be expected, by some, that I should insist upon *Architecture*, it being so absolutely necessary for Builders to be acquainted with: But my Answer to them is, that there are so many Books of *Architecture* extant, and in them the Rules so well, so copiously, and so compleatly handled, that it is needless for me to say any thing of that Science: Nor do I think any Man that should, can do more than Collect out of their Books, and perhaps deliver their Meanings in his own Words. Besides, *Architecture* is a Mathematical Science, and therefore different from my present Undertakings, which are (as by my Title) *Mechanick Exercises*: yet because Books of *Architecture* are as necessary for a Builder to understand, as the use of Tools; and lest some Builders should not know how to enquire for them, I shall at the latter end of *Carpentry* give you the Names of some Authors, especially such as are Printed in the *English Tongue*.

Some may perhaps also think it had been more proper for me in these Exercises to have introduced *Carpentry* before *Joinery*, because Necessity, (the Mother of Invention) did doubtless compel

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MECHANICK EXERCISES:

O R,

The Doctrine of *Handy-Works*.

Applied to the ART of *TURNING*,

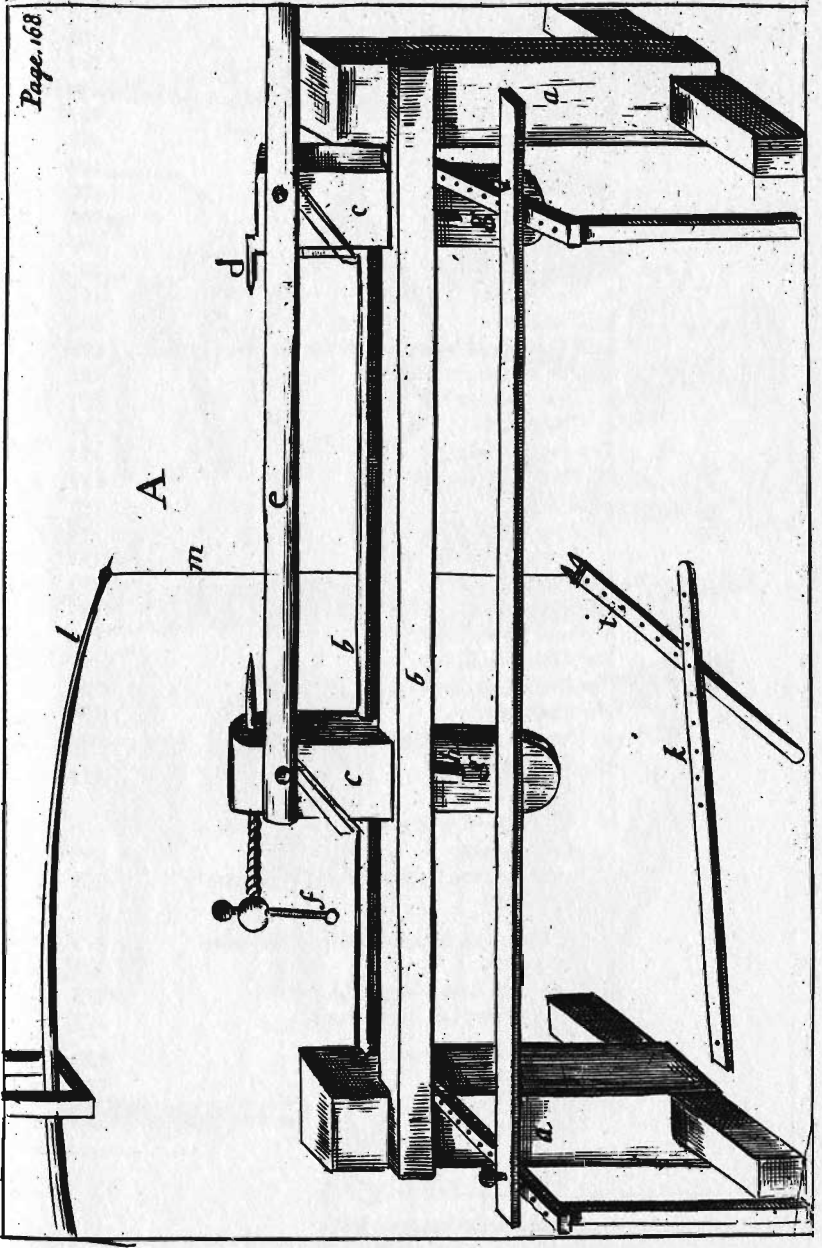
Of Turning.

AS by placing one Foot of a pair of Compasses on a Plane, and moving about the other Foot or point, describes on that Plane a Circle with the moving point; so any Substance, be it *Wood, Ivory, Brasses, &c.* pitcht steddy upon two points (as on an *Axis*) and moved about on that *Axis*, also describes a Circle Concentrick to the *Axis*: And an Edge-Tool set steddy to that part of the outside of the aforesaid Substance that is nearest the *Axis*, will in a Circumvolution of that Substance, cut off all the parts of Substance that lies farther off the *Axis*, and make the outside of that Substance also Concentrick to the *Axis*. This is a brief Collection, and indeed the whole Sum of *Turning*.

Now, as there is different Matter, or Substance, to be *Turned*, so there is also different Ways, and different Tools to be used in *Turning* each different Matter.

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MECHANICK EXERCISES:

O R,

The Doctrine of *Handy-Works*.

Applied to the ART of *Bricklayers Work*.

Definition.

Bricklayers-Work is an Art Manual, which Joins several Bodies so together, that they adhere like one entire Body.

Whether the *White Mason*, which is the Hewer of Stone, or the *Red Mason*, which is the Hewer of Brick, be the most Ancient, I know not: but in Holy Writ, we read of making of Bricks, before we read of Digging or Hewing of Stones; therefore we may suppose the *Red Mason* (or *Bricklayer*) to be the most Ancient.

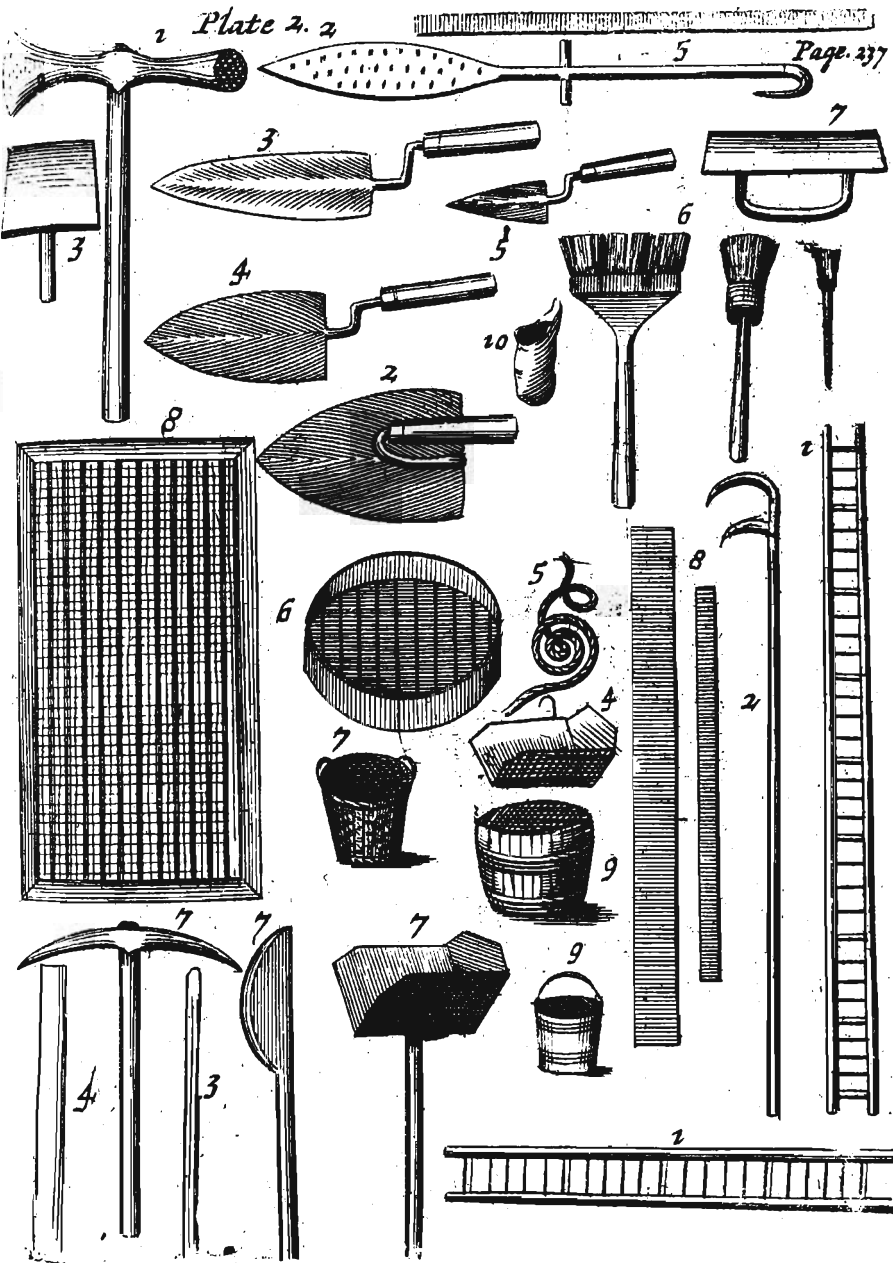
The method that I shall use in Treating of this Art shall be this.

First, I will shew what Materials they use, and their Composition.

Secondly, I will treat of their Tools, and describe their Names and Uses.

Thirdly, I will declare their Method of Working, both in *Bricks, Tiles, &c.*

And



Mechanick Dyalling:

TEACHING

Any Man, tho' of an Ordinary Capacity and unlearned in the Mathematicks,

To Draw a True

SUN-DYAL

ON ANY

GIVEN PLANE,

However Scituated :

Only with the help of a straight *Rule* and a pair of *Compasses*; and without any Arithmetical Calculation.

The Fourth Edition.

By JOSEPH MOXON, *Fellow of the Royal Society, and Hydrographer to the late King Charles.*

L O N D O N :

Printed for *Tho. Leigh and Dan. Midwinter*, at the *Rose and Crown* in *St. Paul's Church-Yard*. 1703.

Mechanick Dyalling.

Description of Dyalling.

DYalling originally is a *Mathematical Science*, attained by the Philosophical contemplation of the Motion of the Sun, the Motion of the Shadow, the Constitution of the Sphere, the Scituation of Planes, and the Consideration of Lines.

Explanation.

THE Motion of the Sun is regular, it moving in equal Space in equal Time ; But the Motion of the Shadow irregular, in all parts of the Earth, unless under the two Poles, and that more or less according to the Constitution of the *Sphere* and Scituation of the *Plane*. And therefore Scientifick Dyalists by the Geometrick Considerations of Lines, have found out Rules, to mark out the irregular Motion of the *Shadow* in all *Latitudes*, and on all *Planes*, to Comply with the regular Motion of the Sun. And these Rules of adjusting the Motion of the Shadow to the Motion of the Sun, may be called *Scientifick Dyalling*.

But though we may justly account *Dyalling* originally a *Science*, yet such have been the Generosity of many of its studious Contemplators, that they have communicated their acquired Rules ; whereby it is now become to many of the Ingenious no more difficult than an *Art*, and by many late Au-