To

Andrew Fleming West

with kind regards of

Theo. L. De Vinne

April 29, 1899.

No. 166.

This certifies that four hundred and fifty copies only, all on hand-made Holland paper and printed from types, of this edition of Moxon's "Mechanick Exercises," in two volumes, were completed in August, 1896, and that the types have been distributed.

Joseph J. Little.
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David Williams.
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Committee of the Typothetæ.

MOXON'S
MECHANICK EXERCISES

The true Effigies of **Iohn Guttemberg** *Delineated from the Original Painting at* **Mentz** *in Germanie.*

MOXON'S MECHANICK EXERCISES

OR THE DOCTRINE OF HANDY-WORKS APPLIED TO THE ART OF

PRINTING

A LITERAL REPRINT IN TWO VOLUMES OF
THE FIRST EDITION PUBLISHED IN THE YEAR 1683

WITH PREFACE AND NOTES BY
THEO. L. DE VINNE

VOLUME I

NEW-YORK
THE TYPOTHETÆ OF THE CITY OF NEW-YORK
MDCCCLXXXXVI

PREFACE

JOSEPH MOXON was born at Wakefield in Yorkshire, England, August 8, 1627. There is no published record of his parentage or his early education. His first business was that of a maker and vender of mathematical instruments, in which industry he earned a memorable reputation between the years 1659 and 1683. He was not content with this work, for he had leanings to other branches of the mechanic arts, and especially toward the designing of letters and the making of printing-types.

In 1669 he published a sheet in folio under the heading of "Prooves of the Several Sorts of Letters Cast by Joseph Moxon." The imprint is "Westminster, Printed by Joseph Moxon, in Russell street, at the Sign of the Atlas, 1669." This specimen of types seems to have been printed, not to show his dexterity as a type-founder, but to advertise himself as a dealer in mathematical and scien-

tific instruments. The reading matter of the sheet describes "Globes Celestial and Terrestrial, Large Maps of the World, A Tutor to Astronomie and to Geographie" — all of his own production. Reed flouts the typography of this sheet: "It is a sorry performance. Only one fount, the Pica, has any pretensions to elegance or regularity. The others are so clumsily cut or badly cast, and so wretchedly printed, as here and there to be almost undecipherable."[1] The rude workmanship of these early types proves, as he afterward admitted, that he had never been properly taught the art of type-founding; that he had learned it, as he said others had, "of his own genuine inclination."

It was then a difficult task to learn any valuable trade. The Star Chamber decree of 1637 ordained that there should be but four type-founders for the kingdom of Great Britain, and the number of their apprentices was restricted. When the Long Parliament met in 1640, the decrees of the Star Chamber were practically dead letters, and for a few years there was free trade in typography. In 1644 the Star Chamber regulations were reimposed; in 1662 they were made more rigorous than ever. The importation of types from abroad without the consent of the Stationers' Company was prohibited. British

[1] "A History of the Old English Letter Foundries, with Notes Historical and Biographical on the Rise and Progress of English Typography." By Talbot Baines Reed, London, 1887, p. 181.

printers were compelled to buy the inferior types of English founders, who, secure in their monopoly, did but little for the improvement of printing.[1]

It is probable that the attention of Moxon was first drawn to type-founding by the founders themselves, who had to employ mechanics of skill for the making of their molds and other implements of type-casting. In this manner he could have obtained an insight into the mysteries of the art that had been carefully concealed. He did not learn type-making or printing in the usual routine. The records of the Company of Stationers do not show that he was ever made a freeman of that guild, yet he openly carried on the two distinct businesses of type-founding and printing after 1669. It is probable that he had a special permit from a higher authority, for in 1665 he had been appointed hydrographer to the king, and a good salary was given with the office. He was then devoted to the practical side of scientific pursuits, and was deferred to as a man of ability.

He published several mathematical treatises between the years 1658 and 1687; one, called "Compendium Euclidis Curiosi," was translated by him

[1] The four founders appointed by the Star Chamber did not thrive. One of them, Arthur Nicholls, said of himself: "Of so small benifitt hath his Art bine that for 4 yeares worke and practice he hath not taken above 48£, and had it not bine for other imploymente he might have perrisht." Reed, p. 168.

from Dutch into English, and printed in London in 1677. Mores supposes that he had acquired a knowledge of Dutch by residence in Holland, but intimates that he was not proficient in its grammar.[1]

In 1676 he published a book on the shapes of letters, with this formidable title: "Regulæ Trium Ordinum Literarum Typographicarum; or the Rules of the Three Orders of Print Letters, viz: the Roman, Italick, English—Capitals and Small; showing how they are Compounded of Geometrick Figures, and mostly made by Rule and Compass. Useful for Writing Masters, Painters, Carvers, Masons and others that are Lovers of Curiosity. By Joseph Moxon, Hydrographer to the King's Most Excellent Majesty. Printed for Joseph Moxon on Ludgate Hill, at the Sign of Atlas, 1676." He then dedicated the book to Sir Christopher Wren, "as a lover of rule and proportion," or to one who might be pleased with this attempt to make alphabetical letters conform to geometric rules.

There is no intimation that the book was intended for punch-cutters. It contains specific directions about the shapes of letters, covering fifty-two pages, as proper introduction to the thirty-eight pages of model letters that follow, rudely drawn and printed from copper plates. Moxon says that these model

[1] "A Dissertation upon English Typographical Founders and Founderies." By Edward Rowe Mores, A. M. & A. S. S. [London], 1778. 8vo, p. 43.

letters are his copies of the letters of Christopher Van Dijk, the famous punch-cutter of Holland. He advises that each letter should be plotted upon a framework of small squares—forty-two squares in height and of a proportionate width, as is distinctly shown in the plates of letters in this book.[1] Upon these squares the draftsman should draw circles, angles, and straight lines, as are fully set forth in the instructions.

These diagrams, with their accompanying instruction, have afforded much amusement to type-founders. All of them unite in saying that the forming of letters by geometrical rule is absurd and impracticable. This proposition must be conceded without debate, but the general disparagement of all the letters, in which even Reed joins, may be safely controverted. It is admitted that the characters are rudely drawn, and many have faults of disproportion; but it must not be forgotten that they were designed to meet the most important requirement of a reader—to be read, and read easily. Here are the broad hair-line, the stubby serif on the lower-case and the bracketed serif on the capitals, the thick stem, the strong and low crown on letters like m and n, with other peculiarities now commended in old-style faces and often erroneously regarded as the original devices of the first Caslon. The black-letter has more merit

[1] See plates Nos. 11 to 17.

than the roman or italic. Some of the capitals are really uncouth; but with all their faults the general effect of a composition in these letters will be found more satisfactory to the bibliophile as a text-type than any form of pointed black that has been devised in this century as an improvement.

Moxon confesses no obligation to any one for his geometrical system, but earlier writers had propounded a similar theory. Books on the true proportions of letters had been written by Fra Luca Paccioli, Venice, 1509; Albert Dürer, Nuremberg, 1525; Geofroy Tory, Paris, 1529; and Yciar, Saragossa, 1548. Nor did the attempt to make letters conform to geometrical rules end with Moxon. In 1694, M. Jaugeon, chief of the commission appointed by the Academy of Sciences of Paris, formulated a system that required a plot of 2304 little squares for the accurate construction of every full-bodied capital letter. The manuscript and diagrams of the author were never put in print, but are still preserved in the papers of the Academy.

This essay on the forms of letters seems to have been sent out as the forerunner of a larger work on the theory and practice of mechanical arts. Under the general title of "Mechanick Exercises," in 1677, he began the publication, in fourteen monthly numbers, of treatises on the trades of the smith, the joiner, the carpenter, and the turner. These constitute the first volume of the "Mechanick Exercises."

The book did not find as many buyers as had been expected. Moxon attributed its slow sale to political excitement, for the Oates plot put the buying and study of trade books away from the minds of readers. He had to wait until 1683 before he began the publication of the second volume, which consists of twenty-four numbers, and treats of the art of printing only. It is this second volume that is here reprinted, for the first volume is of slight interest to the printer or man of letters.

Moxon's book has the distinction of being not only the first, but the most complete of the few early manuals of typography. Fournier's "Manuel Typographique" of 1764 is the only book that can be compared with it in minuteness of detail concerning type-making, but he treats of type-making only. Reed says: "Any one acquainted with the modern practice of punch-cutting cannot but be struck, on reading the directions laid down in the 'Mechanick Exercises,' with the slightness of the changes which the manual processes of that art have undergone during the last two centuries. Indeed, allowing for improvements in tools, and the greater variety of gauges, we might almost assert that the punch-cutter of Moxon's day knew scarcely less than the punch-cutter of our day, with the accumulated experience of two hundred years, could teach him. . . . For almost a century it remained the only authority on the subject; subsequently it

formed the basis of numerous other treatises both at home and abroad; and to this day it is quoted and referred to, not only by the antiquary, who desires to learn what the art once was, but by the practical printer, who may still on many subjects gather from it much advice and information as to what it should still be."[1]

During his business life, Moxon stood at the head of the trade in England. He was selected to cut a font of type for an edition of the New Testament in the Irish language, which font was afterward used for many other books. He cut also the characters designed by Bishop John Wilkins for his "Essay towards a Real Character and a Philosophical Language," and many mathematical and astronomical symbols. Rowe Mores, who describes him as an excellent artist and an admirable mechanic, says that he was elected a Fellow of the Royal Society in 1678.[2] There is no known record of the date of his death. Mores gives the year 1683 as the date of his relinquishment of the business of type-making, but he was active as a writer and a publisher for some years after.

The first volume of the "Mechanick Exercises," concerning carpentry, etc., went to its third edition in 1703, but the second volume, about printing, has been neglected for two centuries. During this long

[1] Reed, "Old English Letter Foundries," pp. 185, 186.

[2] Mores, "English Founders," p. 42.

interval many copies of the first small edition of five hundred copies have been destroyed. A perfect copy is rare, and commands a high price, for no early book on technical printing is in greater request.[1]

The instruction directly given is of value, but bits of information indirectly furnished are of greater interest. From no other book can one glean so many evidences of the poverty of the old printing-house. Its scant supply of types, its shackly hand-presses, its mean printing-inks, its paper windows and awkward methods, when not specifically confessed, are plainly indicated. The high standard of proof-reading here exacted may be profitably contrasted with its sorry performance upon the following pages. The garments worn by the workmen are shown in the illustrations. Some of the quainter usages of the trade are told in the "Customs of the Chappel," and those of the masters, in the ceremonies of the Stationers' Company, and in the festivals in which masters and workmen joined. To the student of printing a reading of the book is really necessary for a clear understanding of the mechanical side of the art as practised in the seventeenth century.

[1] Hansard says ("Typographia," p. vii): "I have never been able to meet with more than two copies of this work — one in the Library of the British Museum — the other in the Library of the Society of Arts." The writer knows of but three copies in America: one in the Library Company of Philadelphia; one in the Library of the Typothetæ of New-York; one in his own collection.

NOTE BY THE PRINTER

This edition of the "Mechanick Exercises" is a line-for-line and page-for-page reprint of the original text. The only suppression is that of the repetition of the words "Volume II" in the running title and the sub-titles, which would unnecessarily mislead the reader, and of the old signature marks that would confuse the bookbinder. Typographic peculiarities have been followed, even to the copying of gross faults, like doublets, that will be readily corrected by the reader. The object of the reprint is not merely to present the thought of the author, but to illustrate the typographic style of his time with its usual defects. A few deviations from copy that seemed to be needed for a clearer understanding of the meaning of the author have been specified at the end of the second volume. The irregular spelling and punctuation of the copy, its capricious use of capitals and italic, its headings of different sizes of type, have been repeated. At this point imitation has stopped. Turned and broken letters, wrong-font characters, broken space-lines, and bent rules have not been servilely reproduced. These blemishes, as well as the frequent "monks" and "friars" in the presswork, were serious enough to prevent an attempt at a photographic facsimile of the pages.

The two copies of Moxon that have served as "copy" for this reprint show occasional differences in spelling and punctuation. Changes, possibly made in the correction of batters, or after the tardy discovery of faults, must have been done while the form was on press and partly printed. The position of the plates differs seriously in the two copies; they do not follow each other in the numerical order specified. In this reprint the plates that describe types and tools have been placed near their verbal descriptions.

The type selected for this work was cast from matrices struck with the punches (made about 1740) of the first Caslon. It is of the same large English body as that of the original, but a trifle smaller as to face, and not as compressed as the type used by Moxon; but it repeats many of his peculiarities, and fairly reproduces the more important mannerisms of the printing of the seventeenth century.

The portraits have been reproduced by the artotype process of Bierstadt; the descriptive illustrations are from the etched plates of the Hagopian Photo-Engraving Company.

Joseph Moxon.
Born at Wakefeild August. 8.
Anno 1627.

MECHANICK EXERCISES:

Or, the Doctrine of

Handy-works.

Applied to the Art of

Printing.

By *Joseph Moxon*, Member of the Royal Society, and *Hydrographer* to the King's Most Excellent Majesty.

LONDON.

Printed for *Joseph Moxon* on the West-side of *Fleet-ditch*, at the Sign of *Atlas*. 1 6 8 3.

To the Right Reverend Father in GOD, *JOHN* Lord Biſhop of *Oxford*, and Dean of *Chriſt-Church*; And to the Right Honourable Sir *LEOLINE JENKINS* Knight, and Principal Secretary of State; And to the Right Honourable Sir *JOSEPH WILLIAMSON* Knight; and one of His Majeſties moſt Honourable Privy-Council.

Right Honourable.

YOur ardent affections to promote Typographie *has eminently appeared in the great Charge you have been at to make it famous here in* England; *whereby this Royal Iſland ſtands particularly obliged to your Generous and Publick Spirits, and the whole Common-Wealth of Book-men throughout the World, to your Candid Zeal for the promulgation of good Learning.*

Wherefore I humbly Dedicate this Piece of Typographie *to your Honours; and as*

as it is (I think) the first of this nature, so I hope you will favourably excuse small Faults in this Undertaking; for great ones I hope there are none, unless it be in this presumptuous Dedication; *for which I humbly beg your Honours pardon: Subscribing my self, My Lord and Gentlemen,*

Your Honours most Humble and Obedient Servant.

Joseph Moxon.

MECHANICK

MECHANICK EXERCISES:

Or, the Doctrine of

Handy-works.

Applied to the Art of

Printing.

PREFACE.

BEfore I begin with Typographie, *I ſhall ſay ſome-what of its Original Invention*; *I mean here in* Europe, *not of theirs in* China *and other Eaſtern Countries, who* (*by general aſſent*) *have had it for many hundreds of years, though their Invention is very different from ours*; *they Cutting their Letters upon Blocks in whole Pages or Forms, as among us our Wooden Pictures are Cut*; *But* Printing *with ſingle Letters Caſt in Mettal, as with us here in* Europe, *is an Invention ſcarce above Two hundred and fifteen years old*; *and yet an undecidable Controverſie about the original Contriver or Contrivers remains on foot, between*

between the Harlemers *of* Holland, *and thoſe of* Mentz *in* Germany: *But becauſe the difference cannot be determin'd for want of undeniable Authority, I ſhall only deliver both their Pleas to this* Scientifick Invention.

The Harlemers *plead that* Lawrenſz Janſz Koſter of Harlem *was the firſt Inventer of* Printing, *in the year of our Lord* 1430. *but that in the Infancy of this Invention he uſed only Wooden Blocks* (*as in* China, *&c. aforeſaid*) *but after ſome time he left off Wood, and Cut ſingle Letters in Steel, which he ſunck into Copper* Matrices, *and fitting them to Iron Molds, Caſt ſingle Letters of Mettal in thoſe* Matrices. *They ſay alſo, that his Companion,* John Gutenberg, *ſtole his Tools away while he was at Church, and with them went to* Mentz *in* Germany, *and there ſet his Tools to work, and promoted His claim to the firſt Invention of this Art, before* Koſter *did His.*

To prove this, they ſay that Rabbi Joſeph (*a Jew*) *in his Chronicle, mentions a Printed Book that he ſaw in* Venice, *in the year* 5188. *according to the Jewiſh Account, and by ours the year* 1428. *as may be read in* Pet. Scriverius.

They ſay much of a Book intituled De Spiegel, *Printed at* Harlem *in* Dutch *and* Latin; *which Book is yet there to be ſeen: and they alledge that Book the firſt that ever was Printed: But yet ſay not when this Book was Printed.*

Notwithſtanding this Plea, I do not find (*perhaps becauſe of their imperfect Proofs*) *but that* Gutenberg *of* Mentz *is more generally accepted for the firſt Inventer of* Printing, *than* Koſter *of* Harlem.

The Learned Dr. Wallis *of* Oxford, *hath made an Inquiry into the original of this Invention, and hath in brief ſum'd up the matter in theſe words.*

About

About the year of our Lord 1460. The Art of *Printing* began to be invented and practiſed in *Germany*, whether firſt at *Mentz* or firſt at *Harlem* it is not agreed: But it ſeems that thoſe who had it in conſideration before it was brought to perfection, diſagreeing among themſelves, did part Company; and ſome of them at *Harlem*, others at *Mentz* perſued the deſign at the ſame time.

The Book which is commonly reputed to have been firſt Printed is, Tullies Offices, *of which there be Copies extant (as a Rarity) in many Libraries; which in the cloſe of it is ſaid to be Printed at* Mentz, *in the year of our Lord* 1465. (*ſo ſays that Copy in the* Bodleyan *Library*) *or* 1466. (*ſo that in the Library of* Corpus Chriſti.) *The words in the cloſe of that in* Corpus Chriſti *Colledge* Oxon *are theſe*,

Præſens *Marcij Tullij* Clariſſimum opus, *Johanes Huſt, Moguntinus* Civis, non Atrimento, plumali canna, neq; ærea, ſed Arte quadam perpulchra, *Petri* manu *Petri* de *Geurſhem* pueri mei, feliciter effeci, finitum Anno M CCCC LX VI quarto die Menſis *Februarij*.

The like in the Bodleyan *Library*; *ſave there the Date is only thus*, Finitum Anno M CCCC LX V. *In the ſame Book there are theſe written Notes ſubjoyned*: Hic eſt ille *Johannes Fauſtus*, coadjutor *Johannes Gutenbergij* primi *Typographiæ* inventaris, Alter coadjuto erat *Petrus Schæfer*, i. Opilio. Quovix.

Cælando promptior alter erat, inquit *Johan. Arnoldus* in Libello de Chalcographiæ inventione, *Scheffer* primas finxit quas vocant *Matrices*. Hi tres exercuerunt artem primo in communi. mox rupto fœdere ſeorſim ſibi quiſq; privatim.

And

And again (*in a later hand*) Inventionem artis *Typographicæ* ad Annum 1453. aut exciter referunt Sabillicus *En.* 10.lib.6.&*Monſterus.* Alij ad Annum 1460. Vide *Polid. Virg.* lib. 2. de Invent. Rerum, *Theod. Bibland. de Ratione communis linguarum.* cap. de *Chalcographia.*

At Harlem *and ſome other places in* Holland, *they pretend to have Books Printed ſomewhat ancienter than this; but they are moſt of them* (*if not all*) *done by way of Carving whole Pages in Wood, not by ſingle Letters Caſt in Mettal, to be Compoſed and Diſtributed as occaſion ſerves, as is now the manner.*

The chief Inventer at Harlem *is ſaid to be* Laurens Janſz Koſter.

After theſe two places (Mentz *and* Harlem) *it ſeems next of all to have been practiſed at* Oxford: *For by the care, and at the charge of King* Henry *the 6th, and of* Thomas Bourchier *then Arch-Biſhop of* Canterbury (*and Chancellour of the Univerſity of* Oxford) Robert Turner *Maſter of the Robe, and* William Caxton *a Merchant of* London *were for that purpoſe ſent to* Harlem, *at the charges partly of the King, partly of the Arch-Biſhop, who then* (*becauſe theſe of* Harlem *were very chary of this ſecret*) *prevailed privately with one* Frederick Corſeles *an under-Workman, for a ſum of Money, to come over hither; who thereupon did at* Oxford *ſet up the Art of* Printing, *before it was exerciſed any where elſe in* England, *or in* France, Italy, Venice, Germany, *or any other place, except only* Mentz *and* Harlem (*aforementioned*): *And there be ſeveral Copies yet extant* (*as one in the Archives of the Univerſity of* Oxford, *another in the Library of Dr.* Tho. Barlow, *now Biſhop of* Lincoln) *of a Treatiſe of*

of St. Jerome (*as it is there called* (*becauſe found among St.* Jerom's *Works*) *or rather* Ruffinus *upon the Creed, in a broad* Octavo) *Printed at* Oxford *in the year* 1468. *as appears by the words in the cloſe of it.*

Explicit expoſitio Sancti *Jeronimi* in ſembolo Apoſtolorum ad papam Laurentium Impreſſi *Oxonie* & finita Anno Domini M CCCC LX VIII. xvij die *Decembris.*

Which is but three years later than that of Tullies Offices *at* Mentz, *in* 1465. *and was perhaps one of the firſt Books Printed on Paper*; (*that of* Tully *being on Vellom.*) *And there the excerciſe of* Printing *hath continued ſucceſſively to this day.*

Soon after William Caxton (*the ſame I ſuppoſe who firſt brought it to* Oxford) *promoted it to* London *alſo, which* Baker *in his Chronicle* (*and ſome others*) *ſay to have been about the year* 1471. *but we have ſcarce any Copies of Books there Printed remaining* (*that I have ſeen*) *earlier than the year* 1480. *And by that time, or ſoon after, it began to be received in* Venice, Italy, Germany, *and other places, as appears by Books yet extant, Printed at divers places in thoſe Times. Thus far Dr.* Wallis.

But whoever were the Inventers of this Art, or (*as ſome Authors will have it*) *Science*; *nay, Science of Sciences* (*ſay they*) *certain it is, that in all its Branches it can be deemed little leſs than a Science*: *And I hope I ſay not to much of* Typographie: *For Dr.* Dee, *in his Mathematical Preface to* Euclids Elements of Geometrie, *hath worthily taken pains to make* Architecture *a Mathematical Science*; *and as a vertual Proof of his own Learned Plea, quotes two Authentique Authors,* viz. Vitruvius

Vitruvius *and* Leo Baptiſta, *who both give their deſcriptions and applauſe of* Architecture: *His Arguments are ſomewhat copious, and the Original eaſily procurable in the Engliſh Tongue; therefore inſtead of tranſcribing it, I ſhall refer my Reader to the Text it ſelf.*

Upon the conſideration of what he has ſaid in behalf of Architecture, *I find that a* Typographer *ought to be equally quallified with all the Sciences that becomes an* Architect, *and then I think no doubt remains that* Typographie *is not alſo a Mathematical Science.*

For my own part, I weighed it well in my thoughts, and find all the accompliſhments, and ſome more of an Architect *neceſſary in a* Typographer: *and though my buſineſs be not Argumentation, yet my Reader, by peruſing the following diſcourſe, may perhaps ſatisfie himſelf, that a* Typographer *ought to be a man of Sciences.*

By a Typographer, *I do not mean a* Printer, *as he is Vulgarly accounted, any more than Dr.* Dee *means a* Carpenter *or* Maſon *to be an* Architect: *But by a* Typographer, *I mean ſuch a one, who by his own Judgement, from ſolid reaſoning with himſelf, can either perform, or direct others to perform from the beginning to the end, all the Handy-works and Phyſical Operations relating to* Typographie.

Such a Scientifick *man was doubtleſs he who was the firſt Inventer of* Typographie; *but I think few have ſucceeded him in Science, though the number of* Founders *and* Printers *be grown very many: Inſomuch that for the more eaſie managing of* Typographie, *the Operators have found it neceſſary to devide it into ſeveral Trades, each of which (in the ſtricteſt ſence) ſtand no nearer*

nearer related to Typographie, *than* Carpentry *or* Maſonry, *&c. are to* Architecture. *The ſeveral deviſions that are made, are,*

Firſt *The* Maſter Printer, *who is as the Soul of* Printing; *and all the Work-men as members of the Body governed by that Soul ſubſerveient to him; for the* Letter-Cutter *would Cut no Letters, the* Founder *not ſinck the* Matrices, *or Caſt and Dreſs the Letters, the* Smith *and* Joyner *not make the* Preſs *and other Utenſils for* Printing, *the* Compoſiter *not Compoſe the Letters, the* Correcter *not read Proves, the* Preſs-man *not work the Forms off at the* Preſs, *or the* Inck-maker *make* Inck *to work them with, but by Orders from the* Maſter-Printer.

Secondly, The Letter-Cutter,
Thirdly, The Letter-Caſter,
Fourthly, The Letter-Dreſſer.
} Founders.

But very few Founders *exerciſe, or indeed can perform all theſe ſeveral Trades; though each of theſe are indifferently called* Letter-Founders.

Fifthly, The Compoſiter,
Sixthly, The Correcter,
Seventhly, The Preſs-man,
} Printers.
Eighthly, The Inck-maker.

Beſides ſeveral other Trades they take in to their Aſſiſtance; as the Smith, *the* Joyner, *&c.*

ADVER-

ADVERTISEMENT.

THE continuation of my ſetting forth *Mechanick Exerciſes* having been obſtructed by the breaking out of the Plot, which took off the minds of my few Cuſtomers from buying them, as formerly; And being of late much importun'd by many worthy Perſons to continue them; I have promiſed to go on again, upon Condition, That a competent number of them may be taken off my hand by Subſcribers, ſoon after the publication of them in the *Gazet*, or poſting up Titles, or by the *Mercurius Librarius*, &c.

Therefore ſuch Gentlemen or others as are willing to promote the coming forth of theſe *Exerciſes*, are deſired to Subſcribe their Names and place of abode: That ſo ſuch Perſons as live about this City may have them ſent ſo ſoon as they come forth: Quick Sale being the beſt encouragement.

Some Gentlemen (to whom they are very acceptable) tell me they will take them when all *Trades* are finiſh't, which cannot reaſonably be expected from me (my Years conſidered) in my life-time; which implies they will be Cuſtomers when I'me dead, or perhaps by that time ſome of themſelves.

The price of theſe Books will be 2*d.* for each Printed Sheet. And 2*d.* for every Print taken off of Copper Cuts.

There are three reaſons why this price cannot be thought dear.

1. The Writing is all new matter, not Collected, or Tranſlated from any other Authors: and the drafts of the Cuts all drawn from the Tools and Machines uſed in each reſpective Trade.

2. I Print but 500 on each Sheet, And thoſe upon good Paper: which makes the charge of Printing dear, proportionable to great numbers.

3. Some Trades are particularly affected by ſome Cuſtomers, (who deſire not the reſt,) and conſequently ſooner ſold off, which renders the remainder of the un-ſold *Exerciſes* unperfect, and therefore not acceptable to ſuch as deſire all: ſo that they will remain as waſte-Paper on my hands.

JOSEPH MOXON.

MECHANICK EXERCISES:

Or, the Doctrine of

Handy-works.

Applied to the Art of

Printing.

§ 2. *Of the Office of a Maſter*-Printer.

I Shall begin with the Office of a *Maſter-Printer*, becauſe (as aforeſaid) he is the Directer of all the Work men, he is the Baſe (as the *Dutchmen* properly call him) on which the Workmen ſtand, both for providing Materials to Work withal, and ſucceſſive variety of Directions how and in what manner and order to perform that Work.

His Office is therefore to provide a Houſe, or Room or Rooms in which he is to ſet his *Printing-Houſe*. This expreſſion may ſeem ſtrange, but it is *Printers* Language: For a *Printing-Houſe* may admit of a twofold meaning; one the Vulgar acceptance, and

and is relative to the Houſe or Place wherein *Printing* is uſed; the other a more peculiar Phraſe *Printers* uſe among themſelves, *viz.* only the *Printing* Tools, which they frequently call a *Printing-Houſe*: Thus they ſay, Such a One has ſet up a *Printing-Houſe*, when as thereby they mean he has furniſh'd a Houſe with *Printing* Tools. Or ſuch a one has remov'd his *Printing-Houſe*, when thereby they only mean he has remov'd the Tools us'd in his former Houſe. Theſe expreſſions have been uſed Time out of mind, and are continued by them to this day.

But to proceed, Having conſider'd what number of *Preſſes* and *Caſes* he ſhall uſe, he makes it his buſineſs to furniſh himſelf with a Room or Rooms well-lighted, and of convenient capacity for his number of *Preſſes* and *Caſes*, allowing for each *Preſs* about Seven Foot ſquare upon the Floor, and for every *Frame* of *Caſes* which holds Two pair of *Caſes*, *viz.* one pair *Romain* and one pair *Itallica*, Five Foot and an half in length (for ſo much they contain) and Four Foot and an half in breadth, though they contain but Two Foot and Nine Inches: But then room will be left to paſs freely between two *Frames*.

We will ſuppoſe he reſolves to have his *Preſſes* and *Caſes* ſtand in the ſame Room (though in *England* it is not very cuſtomary) He places the *Caſes* on that ſide the Room where they will moſt conveniently ſtand, ſo, as when the *Compoſiter* is at work the Light may come in on his Left-hand; for elſe his Right-hand plying between the Window-light and his Eye might ſhadow the *Letter* he would pick up: And the *Preſſes* he places ſo, as the Light may fall from a Window right

right before the *Form* and *Tinpan*: And if ſcituation will allow it, on the North-ſide the Room, that the *Preſs-men*, when at their hard labour in *Summer* time, may be the leſs uncommoded with the heat of the *Sun*: And alſo that they may the better ſee by the conſtancy of that Light, to keep the whole *Heap* of an equal Colour.

He is alſo to take care that his *Preſſes* have a ſolid and firm Foundation, and an even Horizontal Floor to ſtand on, That when the *Preſſes* are ſet up their Feet ſhall need no Underlays, which both damage a *Preſs*, are often apt to work out, and conſequently ſubject it to an unſtable and looſe poſition, as ſhall further be ſhewn when we come to the Setting up of the *Preſs*.

And as the Foundation ought to be very firm, ſo ought alſo the Roof and Sides of the *Preſs Room* to be, that the *Preſs* may be faſtned with Braces overhead and on its Sides, as well and ſteddy as under foot.

He is alſo to take care that the Room have a clear, free and pretty lofty Light, not impeded with the ſhadow of other Houſes, or with Trees; nor ſo low that the Sky-light will not reach into every part of the Room: But yet not too high, leſt the violence of *Winter* (*Printers* uſing generally but Paper-windows) gain too great advantage of Freeſing the Paper and Letter, and ſo both Work and Workman ſtand ſtill. Therefore he ought to Philoſophize with himſelf, for the making the height of his Lights to bear a rational proportion to the capacity of the Room.

Here being but two ſides of the Room yet uſed, he

he places the *Correcting ſtone* againſt a good Light, and as near as he can towards the middle of the Room, that the *Compoſiters* belonging to each end of the Room may enjoy an equal acceſs to it. But ſometimes there are ſeveral *Correcting-ſtones* plac'd in ſeveral parts of the Room.

The *Lye-Trough* and *Rincing-Trough* he places towards ſome corner of the Room, yet ſo as they may have a good Light; and under theſe he cauſes a *Sink* to be made to convey the Water out of the Room: But if he have other conveniencies for the placing theſe Troughs, he will rather ſet them out of the Room to avoid the ſlabbering they cauſe in.

About the middle of the Room he places the *Deſtributing-Frame* (*viz.* the *Frame* on which the *Forms* are ſet that are to be *Deſtributed*) which may ſtand light enough, though it ſtand at ſome conſiderable diſtance from the Window.

In ſome other empty place of the Room (leaſt frequented) he cauſes ſo many *Neſt-Frames* to be made as he thinks convenient to hold the *Caſes* that may lye out of preſent uſe; and the *Letter-boards* with *Forms* ſet by on them, that both the *Caſes* and the *Forms* may be the better ſecured from running to *Pye*.

Having thus contrived the ſeveral Offices of the Room, He furniſhes it with *Letters*, *Preſſes*, *Caſes*, *Chaſes*, *Furniture*, &c. Of each of which in Order.

¶. 2. *Of*

¶. 2. *Of* Letter.

He provides a *Fount* (properly a *Fund*) of *Letter* of all Bodies; for moſt *Printing-Houſes* have all except the two firſt, *viz. Pearl, Nomparel, Brevier, Long-Primmer, Pica, Engliſh, Great-Primmer, Double-Pica, Two-Lin'd-Engliſh, Great-Cannon.*

Theſe are the *Bodies* moſt of uſe in *England*; But the *Dutch* have ſeveral other *Bodies*: which becauſe there is little and almoſt no perceivable difference from ſome of theſe mentioned, I think they are not worth naming. Yet we have one *Body* more which is ſometimes uſed in *England*; that is a *Small Pica*, but I account it no great diſcretion in a *Maſter-Printer* to provide it; becauſe it differs ſo little from the *Pica*, that unleſs the Workmen be carefuller than they ſometimes are, it may be mingled with the *Pica*, and ſo the Beauty of both *Founts* may be ſpoil'd.

Theſe aforeſaid *Bodies* are commonly *Caſt* with a *Romain, Italica*, and ſometimes an *Engliſh Face*. He alſo provides ſome *Bodies* with the *Muſick*, the *Greek*, the *Hebrew*, and the *Syriack Face*: But theſe, or ſome of theſe, as he reckons his oppertunities may be to uſe them.

And that the Reader may the better underſtand the ſizes of theſe ſeveral *Bodies*, I ſhall give him this Table following; wherein is ſet down the number of each *Body* that is contained in one Foot.

Pearl,

Pearl,	184	contained in one Foot.
Nomparel,	150	
Brevier,	112	
Long-Primmer,	92	
Pica,	75	
Engliſh,	66	
Great-Primmer,	50	
Double-Pica,	38	
Two Lin'd Engliſh,	33	
Great-Cannon.	17½	

His care in the choice of theſe *Letters* are,

Firſt, That the *Letter* have a true ſhape: Which he may know, as by the §. of *Letter-Cutting.*

I confeſs this piece of Judgement, *viz.* knowing of true Shape, may admit of ſome controverſy, becauſe neither the Ancients whom we received the knowledge of theſe *Letters* from, nor any other authentick Authority have delivered us Rules, either to make or know true ſhape by: And therefore it may be objected that every one that makes *Letters* but tolerably like *Romain, Italick, &c.* may pretend his to be true ſhap'd.

To this I anſwer, that though we can plead no Ancient Authority for the ſhape of *Letters,* yet doubtleſs (if we judge rationally) we muſt conclude that the *Romain Letters* were Originally invented and contrived to be made and conſiſt of Circles, Arches of Circles, and ſtraight Lines; and therefore thoſe *Letters* that have theſe Figures, either entire, or elſe properly mixt, ſo as the Courſe and Progreſs of the Pen

Pen may beſt admit, may deſerve the name of true Shape, rather than thoſe that have not.

Beſides, Since the late made *Dutch-Letters* are ſo generally, and indeed moſt deſervedly accounted the beſt, as for their Shape, conſiſting ſo exactly of Mathematical Regular Figures as aforeſaid, And for the commodious Fatneſs they have beyond other *Letters*, which eaſing the Eyes in Reading, renders them more Legible; As alſo the true placing their Fats and their Leans, with the ſweet driving them into one another, and indeed all the accompliſhments that can render *Letter* regular and beautiful, do more viſibly appear in them than in any *Letters* Cut by any other People: And therefore I think we may account the Rules they were made by, to be the Rules of true ſhap'd *Letters*.

For my own part, I liked their *Letters* ſo well, eſpecially thoſe that were Cut by *Chriſtophel Van Dijck* of *Amſterdam*, that I ſet my ſelf to examine the Proportions of all and every the parts and Members of every *Letter*, and was ſo well pleaſed with the Harmony and Decorum of their Symetrie, and found ſo much Regularity in every part, and ſo good reaſon for his Order and Method, that I examined the biggeſt of his *Letters* with Glaſſes, which ſo magnified the whole *Letter*, that I could eaſily diſtinguiſh, and with ſmall Deviders meaſure off the ſize, ſcituation and form of every part, and the proportion every part bore to the whole; and for my own future ſatisfaction collected my Obſervations into a Book, which I have inſerted in my *Exerciſes* on *Letter-Cutting*. For therein I have exhibited to

the

the World the true Shape of *Chriſtophel Van Dijcks* aforeſaid *Letters*, largely Engraven in Copper Plates.

Whence I conclude, That ſince common conſent of Book-men aſſign the Garland to the *Dutch-Letters* as of late *Cut*, and that now thoſe *Letters* are reduced unto a Rule, I think the Objection is Anſwered; And our *Maſter-Printers* care in the choice of good and true ſhap'd *Letters* is no difficult Task: For if it be a large Bodied *Letter*, as *Engliſh*, *Great-Primmer* and upwards, it will ſhew it ſelf; and if it be ſmall, as *Pearl*, *Nomparel*, &c. though it may be difficult to judge the exact Symetry with the naked Eye, yet by the help of a *Magnifying-Glaſs* or two if occaſion be, even thoſe ſmall *Letters* will appear as large as the biggeſt Bodied *Letters* ſhall to the naked Eye: And then it will be no difficult Task to judge of the Order and Decorum even of the ſmalleſt Bodied *Letters*. For indeed, to my wonder and aſtoniſhment, I have obſerv'd *V. Dijcks Pearl Dutch Letters* in Glaſſes that have Magnified them to great *Letters*, and found the whole Shape bear ſuch true proportion to his great *Letters*, both for the *Thickneſs*, *Shape*, *Fats* and *Leans*, as if with Compaſſes he could have meaſur'd and ſet off in that ſmall compaſs every particular Member, and the true breadth of every *Fat* and *Lean Stroak* in each *Letter*, not to exceed or want (when magnified) of *Letter Cut* to the *Body* it was Magnified to.

His ſecond care in the choice of *Letters* is, That they be deep *Cut*; for then they will *Print* clear the longer, and be leſs ſubject to entertain *Picks*.

His third care, That they be deep ſunck in the *Matrices*,

Matrices leaſt the bottom line of a *Page* Beard. Yet though they be deep ſunk, His care ought to be to ſee the Beard alſo well cut off by the *Founder*.

And a Fourth Care in the choice of *Letter* is, That his *Letter* be Caſt upon good Mettal, that it may laſt the longer.

Of each Body he provides a *Fount* ſuitable to ſuch ſorts of Work as he deſigns to do; But he provides not an equal weight of every *Fount*; Becauſe all theſe Bodies are not in equal uſe: For the *Long-Primmer*, *Pica* and *Engliſh* are the Bodies that are generally moſt uſed; And therefore he provides very large *Founts* of theſe, *viz.* of the *Long-Primmer* in a ſmall *Printing-Houſe*, Five hundred Pounds weight *Romain* and *Italica*, whereof One hundred and fifty Pounds may be *Italica*. Of the *Pica* and *Engliſh*, *Roman* and *Italica*, Eight, Nine hundred, or a Thouſand Pounds weight: when as of other *Founts* Three or Four hundred Pounds weight is accounted a good *Fount*: And of the *Cannon* and *Great-Cannon*, One hundred Pounds or ſomewhat leſs may ſerve his turn; Becauſe the common uſe of them is to ſet Titles with.

Beſides *Letters* he Provides Characters of Aſtronomical Signs, *Planets*, *Aſpects*, *Algebraical* Characters, Phyſical and Chimical Characters, *&c.* And theſe of ſeveral of the moſt uſed Bodies.

He Provides alſo *Flowers* to ſet over the Head of a *Page* at the beginning of a Book: But they are now accounted old-faſhion, and therefore much out of uſe. Yet *Wooden-Borders*, if well Drawn, and neatly Cut, may be *Printed* in a Creditable Book, As alſo,

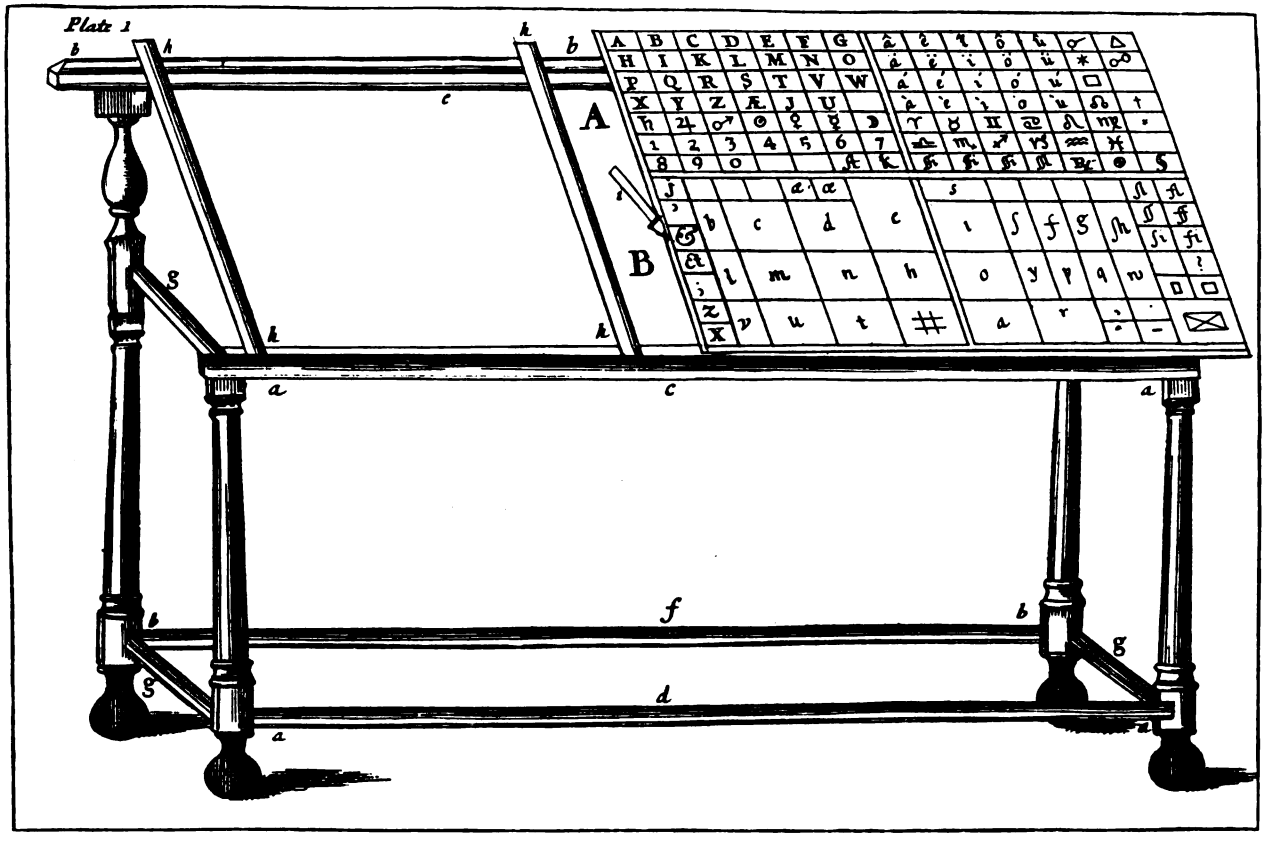
Wooden-Letters well Drawn and neatly Cut may be uſed at the beginning of a *Dedication, Preface, Section, &c.* Yet inſtead of *Wooden Letters, Capitals* Caſt in Mettal generally now ſerves; becauſe but few or good *Cutters* in *Wood* appear.

He alſo provides *Braſs Rules* of about Sixteen Inches long, that the *Compoſiter* may cut them into ſuch Lengths as his Work requires.

In the choice of his *Braſs Rules,* he examines that they be exactly *Letter* high; for if they be much too high, they may cut through *Paper, Tinpan* and *Blankets* too; And if they be but a little too high, not only the Sholder, or Beard, on either ſide them will *Print* black; but they will bear the *Plattin* off the *Letters* that ſtand near them, ſo that thoſe *Letters* will not *Print* at all: And if they be too low, then the *Rules* themſelves will not *Print.*

It ſometimes happens through the unskilfulneſs of the *Joyner,* (for they commonly, but unproperly, imploy *Joyners* to make them) that a Length ſhall be hollow in the middle both on the Face and Foot, and ſhall run driving higher and higher towards both ends: Hence it comes to paſs, that when the *Compoſiter* cuts a piece of *Rule* to his intended Length, the *Rule* ſhall *Print* hard at one end, and the other ſhall not *Print* at all; So that he ſhall be forced to knock up the foot of the low end, as ſhall be ſhewn in its proper place.

But the careful *Maſter-Printer* having found that his *Braſs Rules* is *Letter* high all the whole Length, will alſo examine whether it be ſtraight all the whole Length, which he does by applying both the Face



Face and Foot to the ſurface of the *Correcting-ſtone*; And if the Face and Foot comply ſo cloſely with the *Correcting-ſtone*, that light cannot be ſeen between them, he concludes the *Braſs-Rule* is ſtraight.

Then he examines the Face or Edge of the *Rule*, whether it have an Edge of an equal breadth all the whole Length, and that the Edge be neither too thick nor too fine for his porpoſe.

He ſhould alſo take care that the *Braſs*, before it be cut out, be well and skilfully Planiſh't, nor would that charge be ill beſtowd; for it would be ſaved out of the thickneſs of the *Braſs* that is commonly uſed: For the *Joyners* being unskilful in Planiſhing, buy Neal'd thick *Braſs* that the *Rule* may be ſtrong enough, and ſo cut it into ſlips without Hammering, which makes the *Rule* eaſily bow any way and ſtand ſo, and will never come to ſo good and ſmooth an Edge as Planiſh't *Braſs* will. Beſides, *Braſs* well Planiſh't will be ſtiffer and ſtronger at half the thickneſs than unplaniſh't *Braſs* will at the whole: As I ſhall further ſhew when I come to Exerciſe upon *Mathematical Inſtrument-making*.

§. 3. *Of* Caſes.

Next he provides *Caſes*. A Pair of *Caſes* is an *Upper-Caſe* and a *Lower Caſe*.

The *Upper Caſe* and the *Lower-Caſe* are of an equal length, breadth and depth, *viz.* Two Foot nine Inches long, One Foot four Inches and an half broad, and about an Inch and a quarter deep, beſides the bottom Board; But for ſmall Bodied *Letters* they are made ſomewhat ſhallower, and for great Bodies deeper.

Long-

Long-Primmer and downwards are accounted ſmall Bodies; *Engliſh* and upwards are accounted great Bodies.

The conveniencies of a ſhallow *Caſe* is, that the *Letters* in each Box lye more viſible to the laſt, as being leſs ſhadowed by the ſides of the *Boxes*.

The conveniencies of a deep *Caſe* is, that it will hold a great many *Letters*, ſo that a *Compoſiter* needs not ſo often *Deſtribute*. 2dly. It is not ſo ſoon *Low*, (as *Compoſiters* ſay when the *Caſe* grows towards empty) and a *Low Caſe* is unconvenient for a *Compoſiter* to work at, partly becauſe the *Caſe* ſtanding ſhelving downwards towards them, the *Letters* that are in the *Caſe* tend towards the hither ſide of the *Caſe*, and are ſhadowed by the hither ſide of that *Box* they lye in, ſo that they are not ſo eaſily ſeen by the Eye, or ſo ready to come at with the Fingers, as if they lay in the middle of the *Box*.

Theſe *Caſes* are encompaſſed about with a *Frame* about Three quarters of an Inch broad, that the ends of the ſeveral partitions may be let into the ſubſtance of the *Frame*: But the hithermoſt ſide of the *Frame* is about half an Inch higher than the other ſides, that when either the *Galley* or another pair of *Caſes* are ſet upon them, the bottom edge of the *Galley*, or of thoſe *Caſes* may ſtop againſt that higher *Frame*, and not ſlide off.

Both the *Upper* and the *Lower Caſe* have a thick Partition about three quarters of an Inch broad, Duff-tail'd into the middle of the upper and under Rail of the *Frame*. This Partition is made thus broad, that Grooves may be made on either ſide of it to receive

ceive the ends of thoſe Partitions that devide the breadth of the *Caſe*, and alſo to ſtrengthen the whole *Frame*; for thè bottom Board is as well nailed to this thick Partition as to the outer *Frame* of the *Caſe*.

But the deviſions for the ſeveral *Boxes* of the *Upper* and *Lower Caſes* are not alike: for each half of the whole length of the *Upper-Caſe* is devided into ſeven equal parts, as you may ſee in Plate 1. at A, and its breadth into ſeven equal parts, ſo that the whole *Upper-Caſe* is divided into Ninety eight ſquare *Boxes*, whoſe ſides are all equal to one another.

But the Two halfs of the length of the *Lower-Caſe* are not thus devided; for each half of the length of the *Lower-Caſe* is devided into Eight equal parts, and its breadth into Seven; but it is not throughout thus devided neither; for then the *Boxes* would be all of equal ſize: But the *Lower-Caſe* is devided into four ſeveral ſizes of *Boxes*, as you may ſee in Plate 1. B.

The reaſon of theſe different ſizes of *Boxes* is, That the biggeſt *Boxes* may be diſpoſed neareſt the *Compoſiters* hand, becauſe the Engliſh Language, and conſequently all Engliſh *Coppy* runs moſt upon ſuch and ſuch Sorts; ſo that the *Boxes* that holds thoſe Sorts ought to be moſt capacious.

His care in the choice of theſe *Caſes* is, That the Wood they are made of be well-ſeaſon'd Stuff.

That the Partitions be ſtrong, and true let into one another, and that the ends fill up and ſtand firm in the Grooves of the *Frame* and middle *Rail* of the *Caſe*.

There is an inconvenience that often happens, theſe thin Partitions, eſpecially if they be made of unſeaſon'd Stuff, *viz.* as the Stuff dries it ſhrinks in the Grooves

Grooves of the *Frame*, and so not only grows loose, but sometimes starts out above the top of the *Frame*. To prevent this inconvenience, I have of late caused the ends of these thin partitions to be made Male-Duf-tails, broadest on the under side, and have them fitted into Female-Duf-tails in the Frame of the *Case*, and middle Rail before the bottom Boards are nailed on.

That the Partitions be full an *English* Body thick.

That the Partitions lye close to the bottom of the *Case*, that so the *Letters* slide not through an upper into an under *Box*, when the Papers of the *Boxes* may be worn.

§. 4. *Of* Frames *to set the* Cases *on.*

Frames are in most *Printing-Houses* made of thick *Deal-board Battens*, having their several *Rails Tennanted* into the *Stiles*: but these sorts of *Frames* are, in respect of their matter (*viz. Fir*) so weak, and in respect of their substance (*viz.* little above an Inch thick) so slight, that experience teaches us, when they are even new made, they tremble and totter, and having lasted a little while, the thinness of their *Tennants* being a little above a quarter of an Inch thick, according to the Rules of *Joynery*, as I have shewn in *Numb.* 5. §. 17. They Craze, their *Tennants* break, or *Mortesses* split, and put the *Master-Printer* to a fresh Charge.

It is rationally to be imagined that the *Frames* should be designed to last as long as the *Printing house*; and therefore our *Master-Printer* ought to take care that they be made of matter strong enough, and of substance big enough to do the Service they are intended for;

for; that they ſtand ſubſtantial and firm in their place, ſo as a ſmall Joſtle againſt them ſhake them not, which often reiterated weakens the *Frame-work*, and at that preſent is ſubject to ſhake the *Letter* in the *Galley* down.

I ſhall not offer to impoſe Rules upon any here, eſpecially ſince I have no Authority from Preſcript or Cuſtom; yet I ſhall ſet down the Scantlings that I my ſelf thought fit to uſe on this occaſion. A Delineation of the *Frames* are in Plate 1. at C.

a a a a The *Fore-Rails.*
b b b b The *Hind-Rails.*
c The *Top Fore-Rail.*
d The *Bottom-Fore-Rail.*
e The *Top Hind-Rail.*
f The *Bottom Hind-Rail.*
g g g g The *End-Rail.*
h h h h Croſs-Bearers.

I made the *Rails* and *Stiles* of well-ſeaſoned fine *Oak*, clean, (that is free from Knots and Shakes) the *Stiles* and *Rails* two Inches and an half ſquare, the Top and Bottom *Fore-Rails* and the Bottom *Hind-Rail* four Foot three Inches long, beſides their *Tennants*; And the Top *Hind Rail* five Foot three Inches long. The two *Fore-Rails* and Bottom *Hind-Rail* had Iron Female Screws let into them, which, through an hole made in the *Stiles*, received a Male-Screw with a long ſhank, and a Sholder at the end of it to ſcrew them tight and firm together, even as the Rails of a *Bedſted* are ſcrewed into the *Morteſſes* of a *Bed-Poſt*. Each

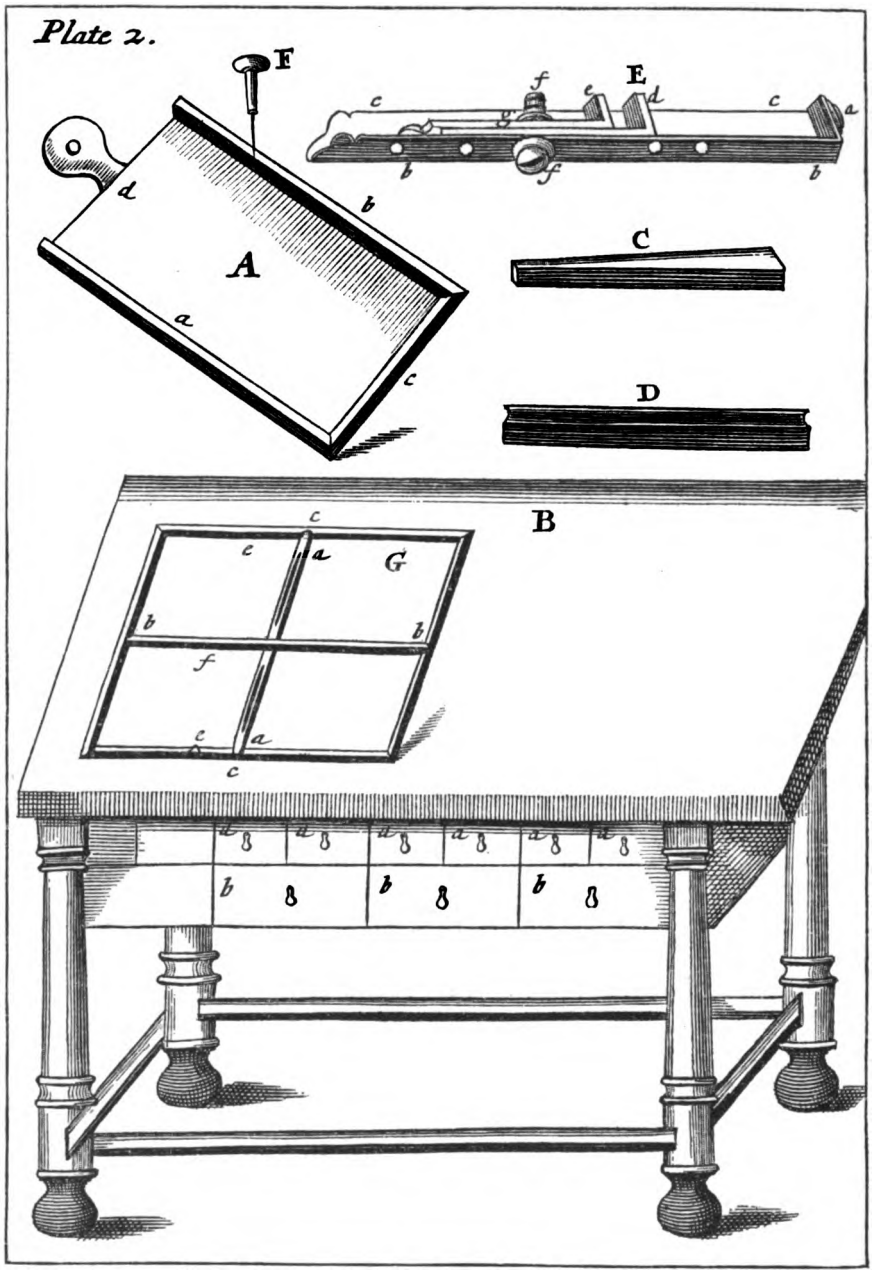
Each *Back Stile* was four Foot one Inch and an half high beſides their *Tennants*, and each *Fore-Stile* three Foot three Inches high, each *Fore* and *Back-Stile* had two *Rails* one Foot ſeven Inches long, beſides their *Tennants* Tennanted and Pin'd into them, becauſe not intended to be taken aſſunder.

It muſt be conſidered, that the *Fore ſtiles* be of a convenient height for the pitch of an ordinary Man to ſtand and work at, which the heighth aforeſaid is; And that the *Hind ſtiles* be ſo much higher than the *Fore-ſtiles*, that when the *Croſs-Bearers* are laid upon the upper *Fore* and *Hind-Rail*, and the *Caſes* laid on them, the *Caſes* may have a convenient declivity from the upper ſide the *Upper-Caſe*, to the lower ſide the *Lower-Caſe*.

The Reaſon of this declivity is, becauſe the *Caſes* ſtanding thus before the Workman, the farther *Boxes* of the *Upper-Caſe* are more ready and eaſie to come at, than if they lay flat; they being in this poſition ſomewhat nearer the hand, and the *Letters* in thoſe *Boxes* ſomewhat eaſier ſeen.

If the Workman prove taller than Ordinary, he lays another or two pair of *Caſes* under the *Caſes* he uſes, to mount them: If the Workman be ſhort, as Lads, *&c.* He lays a *Paper-board* (or ſometimes two) on the floor by the Fore-ſide of the *Frame*, and ſtanding to work on it, mounts himſelf.

The *Bearers* are made of *Slit-Deal*, about two Inches broad, and ſo long as to reach from the *Fore-Rail* through the *Upper-Rail*, and are let in, ſo as to lye even with the ſuperficies of the *Fore* and *Hind-Rail*, and at ſuch a diſtance on both the *Rails*, as you may ſee in the Figure. On



On the Superficies of the *Fore-Rail*, even with its Fore-Edge is nailed a ſmall *Riglet* about half an Inch high, and a quarter and half quarter of an Inch thick, that the *Caſes* ſet on the *Frame* having the aforeſaid declivity, may by it be ſtop't from ſliding off.

§. 5. *Of the* Galley.

Our *Maſter-Printer* is alſo to provide *Galleys* of different ſizes, That the *Compoſiter* may be ſuited with ſmall ones when he *Compoſes* ſmall *Pages*, and with great ones for great *Pages*.

The *Galley* is marked A in Plate 2.

a b c The Sides or Frame of the *Galley*.
d The *Slice*.

Theſe *Galleys* are commonly made of two flat *Wainſcot Boards*, each about a quarter and half quarter of an Inch thick, the uppermoſt to ſlide in Grooves of the Frame, cloſe down to the undermoſt, though for ſmall *Pages* a ſingle Board with two ſides for the Frame may ſerve well enough: Thoſe *Wainſcot Boards* are an Oblong Square, having its length longer than its breadth, even as the form of a *Page* hath. The three Sides of the Frame are fixed faſt and ſquare down on the upper Plain of the undermoſt Board, to ſtand about three fifth parts of the height of the *Letter* above the ſuperficies of the *Slice*. The Sides of the Frame muſt be broad enough to admit of a pretty many good ſtrong *Oaken Pins* along the

the Sides, to be drove hard into the Bottom Board, and almoſt quite through the Sides of the Frame, that the Frame may be firmly fixed to it: But by no means muſt they be Glewed on to the Bottom Board, becauſe the *Compoſiter* may ſometimes have occaſion to wet the *Page* in the *Galley*, and then (the *Galley* ſtanding aſlope upon the *Caſe*) the Water will ſoak between the ſides of the Frame, and under Board, and quickly looſen it.

§. 6. *Of the* Correcting-ſtone.

The *Correcting-Stone* marked B in Plate 2. is made of *Marble*, *Purbeck*, or any other Stone that may be made flat and ſmooth: But yet the harder the Stone is the better; wherefore *Marble* is more preferable than *Purbeck*. Firſt, Becauſe it is a more compact Stone, having fewer and ſmaller Pores in it than *Purbeck*. And Secondly, becauſe it is harder, and therefore leſs ſubject to be prick'd with the corners of a *Chaſe*, if through careleſneſs (as it ſometimes happens) it be pitch'd on the Face of the Stone.

It is neceſſary to have it capacious, *viz.* large enough to hold two *Chaſes* and more, that the *Compoſiter* may ſometimes for his convenience, ſet ſome *Pages* by on it ready to *Impoſe*, though two *Chaſes* lye on the *Stone*: Therefore a *Stone* of about Four Foot and an half long, and Two Foot broad is a convenient ſize for the generality of Work.

This *Stone* is to be laid upon a ſtrong *Oaken*-wood Frame, made like the Frame of a common Table, ſo high, that the Face of the *Stone* may lye about three Foot

Foot and an Inch above the Floor: And under the upper Rail of the Frame may be fitted a Row or two of Draw-Boxes, as at *a a a a a a* and *b b b* on each of its longeſt Sides to hold *Flowers*, *Braſs-Rules*, *Braces*, *Quotations*, ſmall *Scabbords*, &c.

§. 7. *Of* Letter-Boards, *and* Paper-Boards.

Letter-Boards are Oblong Squares, about two Foot long, eighteen Inches broad, and an Inch and a quarter thick. They ought to be made of clean and well-ſeaſon'd Stuff, and all of one piece: Their upper-ſide is to be Plained very flat and ſmooth, and their under-ſide is Clamped with pieces about two Inches ſquare, and within about four Inches of either end, as well to keep them from Warping, as to bear them off the Ground or any other Flat they ſtand on, that the Fingers of the *Compoſiter* may come at the bottom of the Board to remove it whither he will: They are commonly made of *Fir*, though not ſo thick as I have mentioned, or all of one Piece: *Deal-Boards* of this breadth may ſerve to make them of; but *Joyners* commonly put *Maſter-Printers* off with ordinary *Deal-Boards*, which not being broad enough, they joyn two together; for which cauſe they frequently ſhrink, ſo as the joynt comes aſſunder, and the *Board* becomes uſeleſs, unleſs it be to ſerve for a *Paper-Board* afterwards: For ſmall and thin *Letters* will, when the Form is open, drop through, ſo as the *Compoſiter* cannot uſe the Board.

I us'd to make them of *Sugar-Cheſt*; That Stuff being commonly well-ſeaſon'd, by the long lying of the *Sugar*

Sugar in it, and is beſides a fine hard Wood, and therefore leſs ſubject to be injured by the end of the *Shooting-Stick* when a *Form* is *Unlocking*.

Paper-Boards are made juſt like the *Letter-Boards*, though ſeldom ſo large, unleſs for great Work: Nor need ſuch ſtrict care be taken in making them ſo exactly ſmooth: their Office being only to ſet *Heaps of Paper* on, and to *Preſs* the *Paper* with.

§. 8. *Of* Furniture, Quoyns, Scabbord, &c.

By *Furniture* is meant the *Head-ſticks*, *Foot-ſticks*, *Side-ſticks*, *Gutter-ſticks*, *Riglets*, *Scabbords* and *Quoyns*.

Head ſticks and all other *Furniture*, except *Scabbord*, are made of dry *Wainſcot*, that they may not ſhrink when the *Form* ſtands by; They are *Quadrat* high, ſtraight, and of an equal thickneſs all the length: They are made of ſeveral thickneſſes for ſeveral Works, *viz.* from a *Brevier* which ſerves for ſome *Quarto's* to ſix or eight *Pica* thick, which is many times us'd to *Folio's*: And many of the *Head-ſticks* may alſo ſerve to make Inner *Side-ſticks* of; for the *Maſter Printer* provides them of lengths long enough for the *Compoſiter* to cut to convenient Scantlins or Lengths, they being commonly about a Yard long when they come from the *Joyners*. And *Note*, that the *Head* and *Side-ſticks* are called *Riglets*, if they exceed not an *Engliſh* thick.

Outer *Side-ſticks* and *Foot-ſticks* marked C in Plate 2. are of the ſame heighth of the *Head-ſticks*, *viz.* *Quadrat* high, and are by the *Joyner* cut to the given length, and to the breadth of the particular *Pages* that

that are to be *Impoſed*: The *Side-ſticks* are placed againſt the outer ſide of the *Page*, and the *Foot-ſticks* againſt the foot or bottom of the *Page*: The outer ſides of theſe *Side* and *Foot-ſticks* are bevil'd or ſloped from the further to the hither end.

Gutter-ſticks marked D in Plate 2. are as the former, *Quadrat* high, and are uſed to ſet between *Pages* on either ſide the *Croſſes*, as in *Octavo's*, *Twelves*, *Sixteens*, and *Forms* upwards; They are made of an equal thickneſs their whole length, like *Head-ſticks*; but they have a Groove, or Gutter laid on the upper ſide of them, as well that the Water may drain away when the *Form* is Waſhed or Rinced, as that they ſhould not *Print*, when through the tenderneſs of the *Tinpan*, the *Plattin* preſſes it and the *Paper* lower than ordinary.

Scabbord is that ſort of *Scale* commonly ſold by ſome *Iron-mongers* in Bundles; And of which, the *Scabbords* for *Swords* are made: The *Compoſiter* cuts it *Quadrat* high, and to his Length.

The *Maſter-Printer* is to provide both *Thick* and *Thin Scabbord*, that the *Compoſiter* may uſe either when different Bodied *Letter* happens in a *Page*, to juſtifie the *Page* to a true length; And alſo that the *Preſsman* may chuſe *Thick* or *Thin* to make truer *Regiſter*, as ſhall be ſhewed in proper place.

Quoyns are alſo *Quadrat* high, and have one of their ſides Bevil'd away to comply with the Bevil of the *Side* and *Foot-ſticks*; they are of different Lengths, and different Breadths: The great *Quoyns* about three Inches ſquare, except the Bevil on one ſide as aforeſaid; and theſe ſizes deminiſh downwards to

to an Inch and an half in length, and half an Inch in breadth.

Of theſe *Quoyns* our *Maſter-Printer* provides ſeveral hundreds, and ſhould provide them of at the leaſt ten different Breadths between the aforeſaid ſizes, that the *Compoſiter* may chuſe ſuch as will beſt fit the *Chaſe* and *Furniture*.

The Office of theſe *Quoyns* are to *Lock* up the *Form, viz.* to wedge it up (by force of a *Mallet* and *Shooting-ſtick*) ſo cloſe together, both on the ſides and between Head and Foot of the *Page*, that every *Letter* bearing hard againſt every next *Letter*, the whole *Form* may *Riſe*; as ſhall be ſhewed hereafter.

Their farther Office is to make *Regiſter* at the *Preſs*.

§. 9. ¶. 1. *Of the* Mallet, Shooting-ſtick *and* Dreſſing-Block, Compoſing-ſticks, Bodkin, *and* Chaſe. *&c.*

Printers Mallets have a *Cilindrick* Head, and a round Handle; The Head ſomewhat bigger, and the Handle ſomewhat longer than thoſe *Joyners* commonly uſe; Yet neither ſhape or ſize different for any reaſon to be given: But only a Cuſtom always uſed to have them ſo. The Head is commonly made of *Beech*.

¶. 2. *Of*

¶. 2. *Of the* Shooting-ſtick.

The *Shooting-ſtick* muſt be made of *Box*, which Wood being very hard, and withal tough, will beſt and longeſt endure the knocking againſt the *Quoyns*. Its ſhape is a perfect Wedge about ſix Inches long, and its thicker end two Inches broad, and an Inch and an half thick; and its thin end about an Inch and an half broad, and half an Inch thick.

¶. 3. *Of the* Dreſſing-Block.

The *Dreſſing-Block* ſhould be made of *Pear-tree*, Becauſe it is a ſoft wood, and therefore leſs ſubject to injure the Face of the *Letter*; it is commonly about three Inches ſquare, and an Inch high. Its Office is to run over the Face of the *Form*, and whilſt it is thus running over, to be gently knock't upon with the Head of the *Shooting ſtick*, that ſuch *Letters* as may chance to ſtand up higher than the reſt may be preſſed down.

Our *Maſter-Printer* muſt alſo provide a pair of *Sheers*, ſuch as *Taylors* uſe, for the cutting of *Braſs-Rules*, *Scabbords*, &c.

A large *Spunge* or two, or more, he muſt alſo provide, one for the *Compoſiters* uſe, and for every *Preſs* one.

Pretty fine *Packthread* to tye up *Pages* with; But this is often choſen (or at leaſt directed) by the *Compoſiter*, either finer or courſer, according to the great or ſmall *Letter* he works upon.

¶. 4. *Of*

¶. 4. *Of the* Compoſing-ſtick.

Though every *Compoſiter* by Cuſtom is to provide himſelf a *Compoſing-ſtick*, yet our *Maſter-Printer* ought to furniſh his Houſe with theſe Tools alſo, and ſuch a number of them as is ſuitable to the ſize of his Houſe; Becauſe we will ſuppoſe our *Maſter-Printer* intends to keep ſome Apprentices, and they, unleſs by contract or courteſie, are not uſed to provide themſelves *Compoſing-ſticks*: And beſides, when ſeveral *Compoſiters* work upon the ſame Book, their Meaſures are all ſet alike, and their *Titles* by reaſon of *Notes* or *Quotations* broader than their common Meaſure, So that a *Compoſing-ſtick* is kept on purpoſe for the *Titles*, which muſt therefore be common to all the *Compoſiters* that work upon that Work; And no one of them is obliged to provide a *Compoſing-ſtick* in common for them all: Therefore it becomes our *Maſter-Printers* task to provide them.

It is delineated in Plate 2. at *E*.

a The *Head.*
b b The *Bottom.*
c c The *Back.*
d The lower *Sliding-Meaſure*, or *Cheek.*
e The upper *Sliding-Meaſure*, or *Cheek.*
f f The *Male-Screw.*
g The *Female-Screw.*

Theſe *Compoſing-ſticks* are made of Iron Plate about the thickneſs of a thin *Scabbord*, and about ten Inches

Inches long doubled up ſquare; ſo as the Bottom may be half an Inch and half a quarter broad, and the Back about an whole Inch broad. On the further end of this Iron Plate thus doubled up, as at *a* is Soldered on an Iron Head about a *Long-Primmer* thick; But hath all its outer edges Baſil'd and Fil'd away into a Molding: This Iron Head muſt be ſo let into the Plate, and Soldered on to it, that it may ſtand truly ſquare with the bottom, and alſo truly ſquare with the Back, which may be known by applying the outer ſides of a ſquare to the Back and Bottom; as I ſhewed, *Numb.* 3. *Fol.* 38, 39. About two Inches from the Head, in the Bottom, is begun a row of round holes about an Inch aſſunder, to receive the ſhank of the *Male-Screw* that ſcrews the *Sliding Meaſures* faſt down to the Bottom; ſo that the *Sliding-Meaſures* may be ſet nearer or further from the Head, as the Meaſure of a *Page* may require.

The lower *Sliding-Meaſure* marked *d* is an Iron Plate a *thick Scabbord* thick, and of the Breadth of the inſide of the Bottom; It is about four Inches long, and in its middle hath a Groove through it within half an Inch of the Fore-end, and three quarters of an Inch of the hinder end. This Groove is ſo wide all the way, that it may receive the Shank of the *Screw*. On the Fore-end of this Plate ſtands ſquare upright another Iron Head about a *Brevier* thick, and reaches ſo high as the top of the Back.

The upper *Sliding-Meaſure* is made juſt like the lower, only it is about three quarters of an Inch ſhorter.

Between

Between these two *Sliding-Measures*, *Marginal Notes* are *Composed* to any Width.

Compositers commonly examine the Truth of their *Stick* by applying the head of the *Sliding-Measure* to the inside of the Head of the *Stick*; and if they comply, they think they are square and true made: But this Rule only holds when the Head it self is square. But if it be not, 'tis easy to file the *Sliding-Measures* to comply with them: Therefore, as aforesaid, the square is the only way to examine them by.

¶. 5. *Of the* Bodkin.

The *Bodkin* is delineated in Plate 2. at *F* Its *Blade* is made of *Steel*, and well tempered, its shape is round, and stands about two Inches without the *Shank* of the *Handle*. The *Handle* is turned of soft wood as *Alder*, *Maple*, &c. that when *Compositers* knock the Head of the *Bodkin* upon the Face of a Single *Letter* when it stands too high, it may not batter the Face.

¶. 6. *Of* Chases, *marked* G *on the* Correcting-Stone, *Plate* 2.

A *Chase* is an Iron Frame about two and twenty Inches long, eighteen Inches broad, and half Inch half quarter thick; and the breadth of Iron on every side is three quarters of an Inch: But an whole Inch is much better, because stronger. All its sides must stand exactly square to each other; And when it is laid on the *Correcting-Stone* it must lye exactly flat, *viz.*

viz. equally bearing on all its ſides and Angles: The outſide and inſide muſt be Filed ſtraight and ſmooth. It hath two *Croſſes* belonging to it, *viz.* A *Short-Croſs* marked *a a* and a *Long-Croſs* marked *b b*: Theſe two *Croſſes* have on each end a Male Duftail Filed Bevil away from the under to the upper ſide of the *Croſs*, ſo that the under ſide of the Duftail is narrower than the upper ſide of the Duftail. Theſe Male-Duftails are fitted into Female-Duftails, Filed in the inſide of the *Chaſe*, which are alſo wider on the upper ſide of the *Chaſe* than on the under ſide; becauſe the upper ſide of the *Croſs* ſhould not fall through the lower ſide. Theſe *Croſſes* are called the *Short* and the *Long Croſs*.

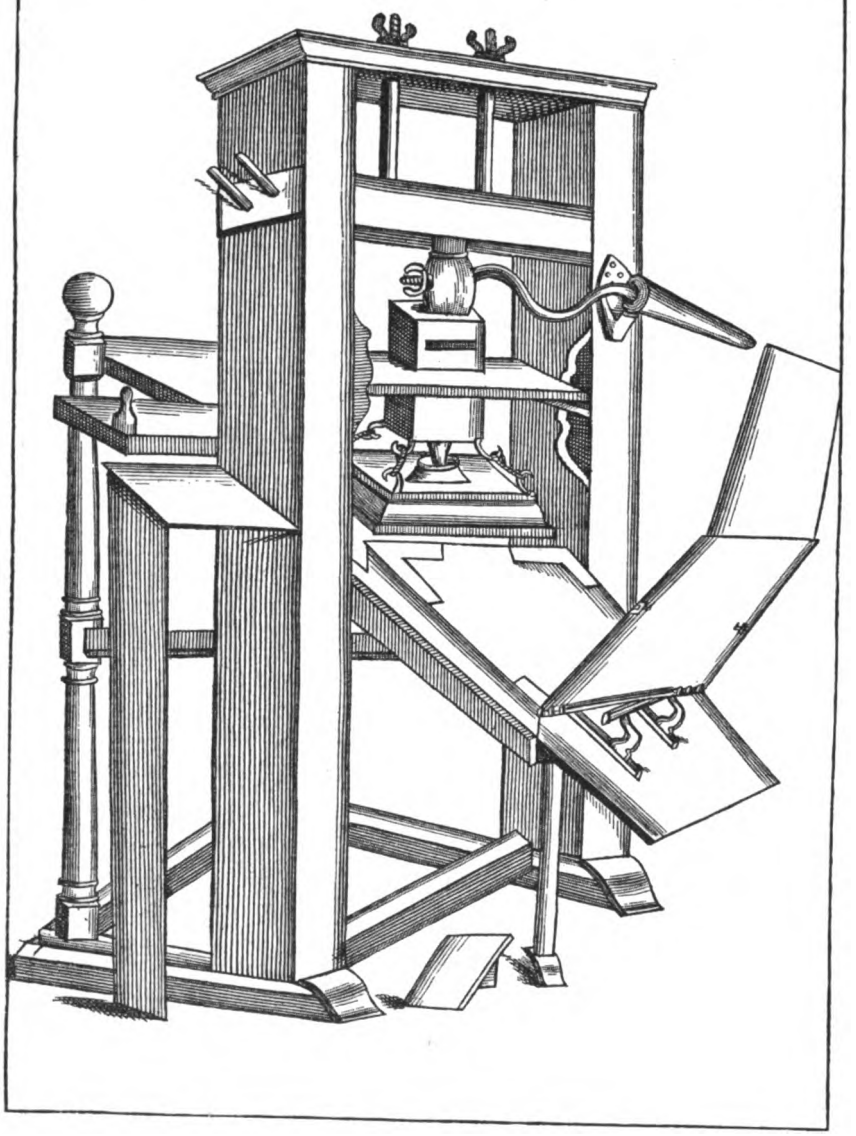
The *Short-Croſs* is Duftail'd in as aforeſaid, juſt in the middle of the *Chaſe* as at *c c*, and the *Long-Croſs* in the middle of the other ſides the *Chaſe*, as at *d d*. The *Short-Croſs* is alſo Duftail'd into Female-Duftails, made as aforeſaid, about three Inches and an half from the middle, as at *e e*: So that the *Short Croſs* may be put into either of the Female-Duftails as occaſion ſerves. The middle of theſe two *Croſſes* are Filed or notched half way through, one on its upper, the other on its under ſide to let into one another, *viz.* the *Short-Croſs* is Filed from the upper towards the under ſide half way, and the *Long-Croſs* is Filed from the lower towards the upper-ſide half way: The *Croſſes* are alſo thus let into each other, where they meet at *f*, when the *Short-Croſs* is laid into the other Female-Duftails fitted to it at *e e*.

In the middle, between the two edges of the upper ſide of the *Short-Croſs*, is made two Grooves parallel

rallel to the ſides of the *Croſs*, beginning at about two Inches from each end, and ending at about ſeven Inches from each end: It is made about half an Inch deep all the way, and about a quarter of an Inch broad, that the *Points* may fall into them. The *Short-Croſs* is about three quarters of an Inch thick, and the *Long Croſs* about half that thickneſs. All their ſides muſt be Fil'd ſtraight and ſmooth, and they muſt be all the way of an equal thickneſs.

Hitherto our *Maſter-Printer* hath provided Materials and Implements only for the *Compoſiters* uſe; But he muſt provide Machines and Tools for the *Preſsmans* to uſe too: which (becauſe I am loath to diſcourage my Cuſtomers with a ſwelling price at the firſt reviving of theſe Papers) I ſhall (though againſt my intereſt) leave for the ſubject of the next ſucceeding *Exerciſes*.

Plate 3.



MECHANICK EXERCISES:

Or, the Doctrine of

Handy-works.

Applied to the Art of

Printing.

§. 10. *Of the* Preſs.

THere are two ſorts of *Preſſes* in uſe, *viz.* the old faſhion and the new faſhion; The old faſhion is generally uſed here in *England*; but I think for no other reaſon, than becauſe many *Preſs-men* have ſcarce Reaſon enough to diſtinguiſh between an excellently improved Invention, and a make-ſhift ſlovenly contrivance, practiced in the minority of this Art.

The New-faſhion'd *Preſſes* are uſed generally throughout all the *Low-Countries*; yet becauſe the Old-

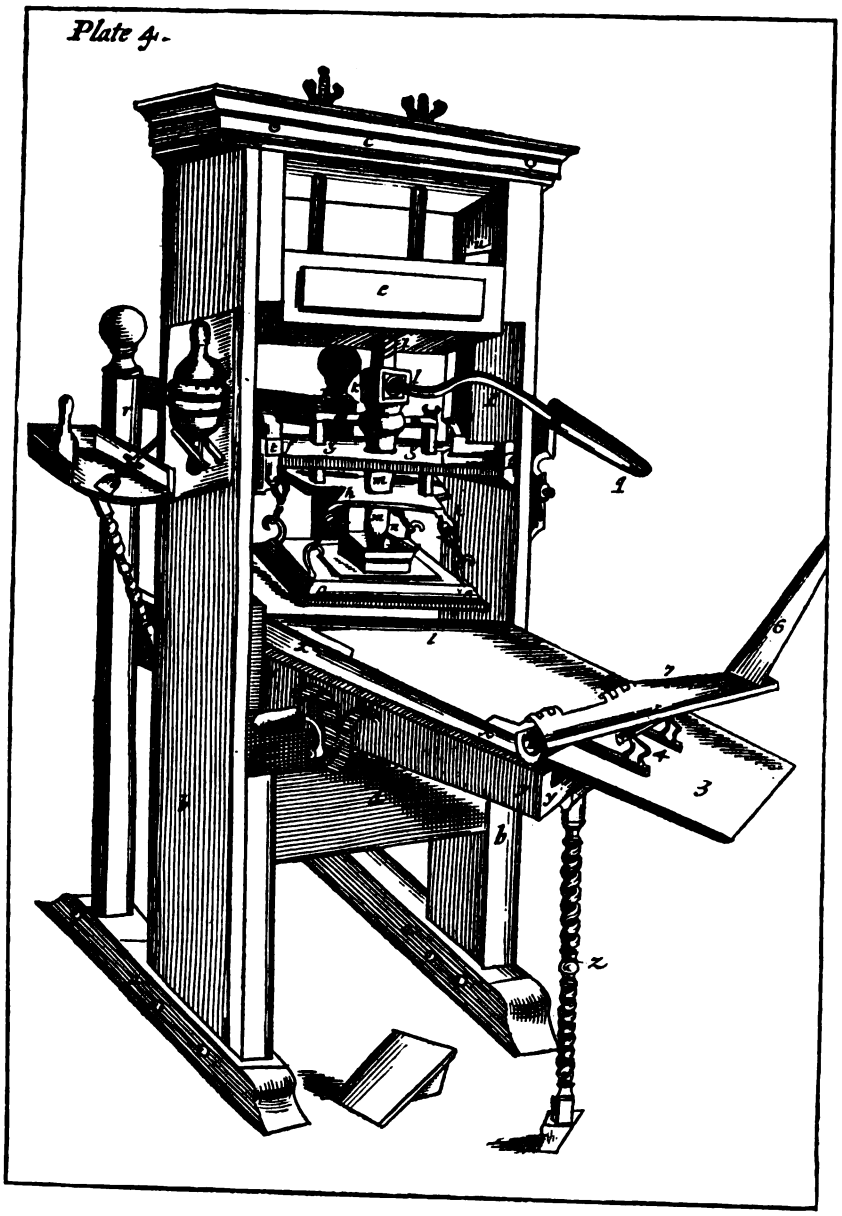
Old-faſhion'd *Preſſes* are uſed here in *England* (and for no other Reaſon) I have in Plate 3. given you a delineation of them; But though I give you a draft of them; yet the demenſions of every particular Member I ſhall omit, referring thoſe that think it worth their while, to the *Joyners* and *Smiths* that work to *Printers*: But I ſhall give a full deſcription of the New-faſhion'd *Preſs*, becauſe it is not well known here in *England*; and if poſſible, I would for Publick benefit introduce it.

But before I proceed, I think it not amiſs to let you know who was the Inventer of this New-faſhion'd *Preſs*, accounting my ſelf ſo much oblig'd to his Ingeniety for the curioſity of this contrivance, that ſhould I paſs by this oppertunity without nameing him, I ſhould be injurious to his Memory.

It was *Willem Janſen Blaew* of *Amſterdam*: a Man as well famous for good and great *Printing*, as for his many *Aſtronomical* and *Geographical* exhibitions to the World. In his Youth he was bred up to *Joynery*, and having learn'd his Trade, betook himſelf (according to the mode of *Holland*) to Travel, and his fortune leading him to *Denmark*, when the noble *Tycho Brahe* was about ſetting up his *Aſtronomical Obſervatory*, was entertain'd into his ſervice for the making his Mathematical-Inſtruments to Obſerve withal; in which Inſtrument-making he ſhew'd himſelf ſo intelligent and curious, that according to the general report of many of his perſonal acquaintance, all or moſt of the *Syderal Obſervations* ſet forth in *Tycho's* name, he was intruſted to make, as well as the Inſtruments.

And

Plate 4.



And before theſe Obſervations were publiſh'd to the World, *Tycho*, to gratify *Blaew*, gave him the Copies of them, with which he came away to *Amſterdam*, and betook himſelf to the making of *Globes*, according to thoſe Obſervations. But as his Trade increaſed, he found it neceſſary to deal in *Geographical Maps* and *Books* alſo, and grew ſo curious in *Engraving*, that many of his beſt *Globes* and *Maps* were *Engraved* by his own Hands; and by his converſation in *Printing* of Books at other *Printing-houſes*, got ſuch in-ſight in this Art, that he ſet up a *Printing-houſe* of his own. And now finding inconveniencies in the obſolete Invention of the *Preſs*, He contrived a remedy to every inconvenience, and fabricated nine of theſe New-faſhioned *Preſſes*, ſet them all on a row in his *Printing-houſe*, and call'd each *Preſs* by the name of one of the *Muſes*.

This ſhort Hiſtory of this excellent Man is, I confeſs forraign to my Title; But I hope my Reader will excuſe the digreſſion, conſidering it tends only to the commemoration of a Perſon that hath deſerved well of Poſterity, and whoſe worth without this ſmall Monument, might elſe perhaps have ſlid into Oblivion.

The *Preſs* is a Machine conſiſting of many Members; it is delineated in Plate 4.

a a The *Feet.*
b b The *Cheeks.*
c The *Cap.*
d The *Winter.*
e The *Head.*
f The *Till.*

g g The

g g The *Hoſe.* In the Croſs-Iron of which, encompaſſing the *Spindle*, is the *Garter.*

h h h h The *Hooks* on the *Hoſe* the *Plattin* hangs on.

i k l m n The *Spindle.*

i Part of the *Worm* below the *Head*, whoſe upper part lies in the *Nut* in the *Head.*

k l The *Eye* of the *Spindle.*

m The *Shank* of the *Spindle.*

n The *Toe* of the *Spindle.*

o o o o The *Plattin* tyed on the *Hooks* of the *Hoſe.*

p The *Bar.*

q The *Handle* of the *Bar.*

r r The *Hind-Poſts.*

s s The *Hind-Rails.*

t t The *Wedges* of the *Till.*

u u The *Morteſſes* of the *Cheeks*, in which the *Tennants* of the *Head* plays.

x x x x y y The *Carriage.*

x x x x The outer *Frame* of the *Carriage.*

y y The *Wooden-Ribs* on which the *Iron-Ribs* are faſtned.

z The *Stay* of the *Carriage*, or the *Stay.*

1. The *Coffin.*
2. The *Gutter.*
3. The *Planck.*
4. The *Gallows.*
5. The *Tinpans.*
6. The *Friſket.*
7. The *Points.*
8. The *Point-Screws.*

All theſe ſeveral Members, by their Matter, Form and Poſition, do particularly contribute ſuch an aſſiſtance

ſiſtance to the whole Machine, that it becomes an Engine managable and proper for its intended purpoſe.

But becauſe the ſmallneſs of this altogether-Draft may obſcure the plain appearance of many of theſe Parts; Therefore I ſhall give you a more particular deſcription, and large delineation of every Member in the *Preſs*: And firſt of the Wooden work: Where, *Note*, that all the Fram'd Wooden-work of a *Preſs* is made of Good, Fine, Clean, Well-ſeaſon'd *Oak*.

¶. 1. *Of the* Feet.

The *Feet* (marked *a a* in Plate 5.) are two Foot nine Inches and an half long, five Inches deep; and ſix Inches broad, and have their out-ſides Tryed to a true ſquare, as was taught, *Numb.* 5. §. 15. It hath (for ornament ſake) its two ends bevil'd away in a Molding, from its upper-ſide to its lower, about four Inches within the ends; about four Inches and three quarters within each end of each Foot is made in the middle of the Breadth of the upper-ſide of the Foot a Morteſs two Inches wide, to receive the *Tennants* of the lower-end of the *Cheek*, and the *Tennant* of the lower end of the *Hind-Poſt*: The Morteſs for the *Cheek* is eight Inches long, *viz.* the Breadth of the *Cheek*: And the Morteſs for the Hind-Poſt is four Inches long, *viz.* the ſquare of the *Hind-Poſt*.

¶. 2. *Of the* Cheeks.

The *Cheeks* (marked *b b* in Plate 5) are five Foot and ten Inches long (beſides the *Tennants* of the top and

and bottom) eight Inches broad, and four Inches and an half thick. All its Sides are tryed ſquare to one another. It hath a *Tennant* at either end, its lower *Tennant* marked *a* to enter the Fore-end of the Foot, runs through the middle of the Breadth of the *Cheek*, which therefore is made to fit the Morteſs in the *Foot*, and is about four Inches long, and therefore reaches within an Inch of the bottom of the *Foot*; But the *Tennant* at the upper end of the *Cheek* marked *a*, is cut a-thwart the breadth of the *Cheek*, and therefore can have but four Inches and an half of Breadth, and its thickneſs is two Inches, Its length is four Inches; ſo that it reaches into the Morteſs in the *Cap*, within half an Inch of the Top.

In the lower-end-*Tennant* is two holes bored, within an Inch and an half of either ſide, and within an Inch and an half of the Sholder, with a three quarter Inch *Augure*, to be pin'd into the *Feet* with an Iron Pin.

In the middle of the upper *Tennant*, and within an Inch and an half of the Sholder, is bored another hole, to Pin the *Tennant* into the *Cap*, alſo with an Iron Pin.

Between *b c* two Foot and half an Inch, and three Foot ſeven Inches of the Bottom Sholder of the *Tennant*, *viz.* from the top of the *Winter* to the under Sholder the *Till* reſts upon, is cut flat away into the thickneſs of the *Cheek*, three Inches in the Inſide of the *Cheek*; ſo that in that place the *Cheek* remains but an Inch and an half thick: And the *Cheeks* are thus widened in this place, as well becauſe the Duftail *Tennants* of the *Winter* may go in between them, as alſo

ſo that the *Carriage* and *Coffin* may be made the wider.

Even with the lower Sholder of this flat cutting-in, is made a Duſtail Morteſs as at *d*, to reach eight Inches and an half, *viz.* the depth of the *Winter* below the ſaid Sholder. This Morteſs is three Inches wide on the inſide the *Cheek*, and three Inches deep; But towards the inſide the *Cheek*, the Morteſs widens in a ſtraight line from the ſaid three Inches to five Inches, and ſo becomes a Duſtail Morteſs. Into this Duſtail Morteſs is fitted a Duſtail *Tennant*, made at each end of the *Winter*.

Two Inches above the aforeſaid Cutting-in, is another cutting-in of the ſame depth, from the Inſide the *Cheek* as at *e*. This cutting-in is but one Inch broad at the farther ſide the *Cheek*, and an Inch and a quarter on the hither ſide the *Cheek*. The under ſide of this Cutting-in, is ſtraight through the *Cheek*, *viz.* Square to the ſides of the *Cheek*: But the upper ſide of this Cutting-in, is not ſquare through the *Cheeks*, But (as aforeſaid) is one quarter of an Inch higher on the fore-ſide the *Cheek* than it is on the further ſide; So that a Wedge of an Inch at one end, and an Inch and a quarter at the other end may fill this Cutting-in.

At an Inch within either ſide the *Cheek*, and an Inch below this Cutting-in, as at *f f*, is made a ſmall Morteſs an Inch and an half wide, to which two *Tennants* muſt be fitted at the ends of the *Till*, ſo that the *Tennants* of the *Till* being ſlid in through the Cutting-in aforeſaid, may fall into theſe Morteſſes, and a Wedge being made fit to the Cutting-in, may preſs upon the *Tennants* of the *Till*, and force it down to keep it ſteddy in its place. Here

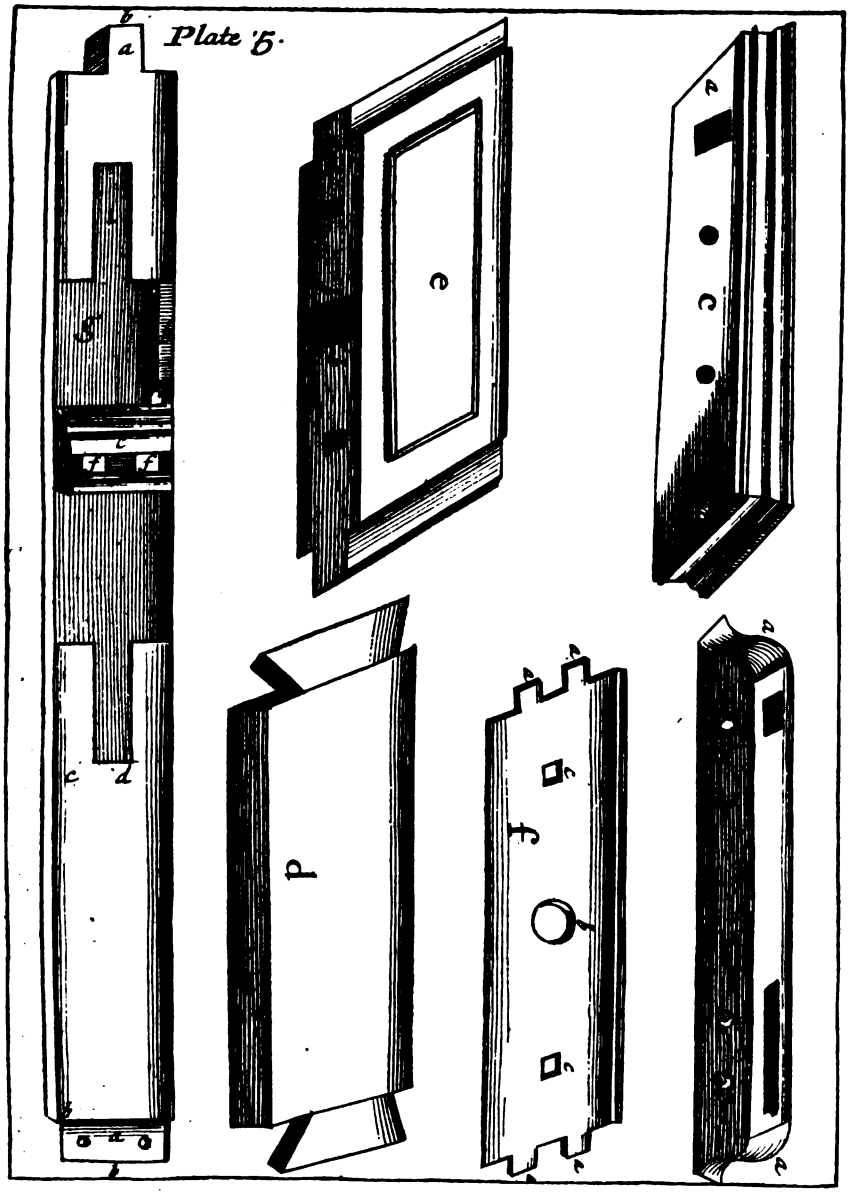
Here we ſee remains a ſquare Sholder or ſubſtance of Wood between two Cuttings-in; But the under corner of this ſquare Sholder is for Ornament-ſake Bevil'd away and wrought into an *Ogee*.

At two Inches above the laſt Cutting-in, is another Cutting-in, but this Cutting-in goes not quite through the breadth of the *Cheek*, but ſtops at an Inch and an half within the further ſide the *Cheek*; So that above the *Till* and its *Wedge* is another Sholder or ſubſtance of Wood, whoſe upper Corner is alſo Bevil'd away, and wrought to a Molding as the former.

The laſt Cutting-in is marked *g*, and is eight Inches and a quarter above the Sholder of the *Till*, that it may eaſily contain the depth of the *Head*; The ſubſtance remaining is marked *h*. This Cutting-in is made as deep into the thickneſs of the *Cheek* as the former Cuttings-in are, *viz.* three Inches; and the reaſon the *Cheek* is cut-in here, is, that the *Cheeks* may be wide enough in this place to receive the *Head*, and its *Tennants*, without un-doing the *Cap* and *Winter*.

Juſt above this Cutting-in is made a ſquare Mortes in the middle of the *Cheek*, as at *i*, it is eight Inches long, and two Inches and an half wide, for the *Tennant* of the *Head* to play in.

Upon the fore-ſide of the *Cheek* is (for Ornament ſake) laid a Molding through the whole length of the *Cheek* (a ſquare at the Top and Bottom an Inch deep excepted) it is laid on the outer ſide, and therefore can be but an Inch broad; Becauſe the Cuttings-in on the inſide leaves the ſubſtance of Stuff but an Inch



Inch and an half thick, and ſhould the Moldings be made broader, it would be interrupted in the ſeveral Cuttings in, or elſe a ſquare of a quarter of an Inch on either ſide the Molding could not be allowed, which would be ungraceful.

¶. 3. *Of the* Cap *marked* c *in Plate* 5.

The *Cap* is three Foot and one Inch long, four Inches and an half deep, and nine Inches and an half broad; But its fore-ſide is cut away underneath to eight Inches, *Viz.* the breadth of the *Cheeks.* Three quarters of an Inch above the bottom of the *Cap*, is a ſmall *Facia*, which ſtands even with the thickneſs of the *Cheeks*; Half an Inch above that a Bead-Molding, projecting half an Inch over the *Facia.* Two Inches above that a broad *Facia*, alſo even with the thickneſs of the *Cheeks*; and an Inch and a quarter above that is the upper Molding made projecting an Inch and an half over the two *Facia*'s aforeſaid, and the thickneſs of the *Cheeks.*

Each end of the *Cap* projects three Inches quarter and half quarter over the *Cheeks*, partly for Ornament, but more eſpecially that ſubſtance may be left on either end beyond the Morteſſes in the *Cap*; and theſe two ends have the ſame Molding laid on them that the fore-ſide of the *Cap* hath.

Within two Inches and half quarter of either end, on the under-ſide the *Cap* is made a ſquare Morteſs two Inches wide, and four Inches and an half long, *viz.* the thickneſs of the *Cheek* inwards, as at *a a*, to receive the Top *Tennants* of the *Cheeks*; which Top

Tennants

Tennants are with an Iron Pin (made tapering of about three quarters of an Inch thick) pin'd into the Mortesses of the *Cap*, to keep the *Cheeks* steddy in their position.

¶. 4. *Of the* Winter *marked* d *in* Plate 5.

The Length of the *Winter* besides the *Tennants*, is one Foot nine Inches and one quarter of an Inch; The Breadth of the *Winter* eight Inches, *viz.* the Breadth of the *Cheek*, and its depth nine Inches; all its sides are tryed square; But its two ends hath each a Duftail-*Tennant* made through the whole depth of the *Winter*, to fit and fall into the Duftail Mortesses made in the *Cheeks*: These Duftail-*Tennants* are intended to do the Office of a *Summer*, Because the spreading of the ends of these two *Tennants* into the spreading of the Mortesses in the *Cheeks*, keeps the two *Cheeks* in a due distance, and hinders them from flying assunder.

But yet I think it very convenient to have a *Summer* also, the more firmly and surer to keep the *Cheeks* together; This *Summer* is only a Rail *Tennanted*, and let into Mortesses made in the inside of the *Cheeks*, and Screwed to them as the Rails described, *Numb.* 15. §. 4. are Screwed into the Stiles of the *Case-Frame*; Its depth four Inches and an half, and its breadth eight Inches, *viz*, the breadth of the *Cheeks*.

¶. 5. *Of*

¶. 5. *Of the* Head *marked* e *in* Plate 5.

The length of the *Head* beſides the *Tennant* at either end, is one Foot nine Inches and one quarter of an Inch; The breadth eight Inches and an half, and its depth eight Inches. The Top, Bottom and Hind-ſides are tryed Square, but the foreſide projects half an Inch over the Range of the fore-ſides of the *Cheeks*; in which Projecture is cut a Table with a hollow Molding about it, two Inches diſtant from all the ſides of the fore-ſide of the *Head*: Its *Tennants* are three Inches Broad, and are cut down at either end, from the top to the bottom of the *Head*, and made fit to the Morteſſes in the *Cheeks*, that they may ſlide tight, and yet play in them.

In the under-ſide of the *Head* is cut a ſquare Hole, (as at *a*,) about four Inches ſquare, and three Inches and an half deep, into which the *Braſs-Nut* is to be fitted: And to keep this *Nut* in its place (leſt the weight of it ſhould make it fall out) is made on either ſide the ſquare hole, at about half an Inch diſtance from it, (as at *b b*) a ſquare Hole quite through the Top and Bottom of the *Head* about three quarters of an Inch wide; and into this ſquare Hole is fitted a ſquare piece of Iron to reach quite through the *Head*, having at its under-end a Hook turned ſquare to claſpe upon the under-ſide of the *Nut*; and on its upper-end a Male-Screw reaching about an Inch above the upper-ſide of the *Head*, which by the help of a Female-ſcrew made in an Iron *Nut*, with Ears to it to turn it about draws the *Claſp* at the bottom of the Iron *Shank* cloſe

cloſe againſt the *Nut*, and ſo keeps it from falling out.

In the middle of the wide ſquare Hole that the *Nut* is let into, is bored a round Hole through the top of the *Head*, of about three quarters of an Inch wide, for the *Preſs-man* to pour *Oyl* in at ſo oft as the *Nut* and *Spindle* ſhall want *Oyling*.

At three Inches from either end of the *Head* (as at *c c*) is bored a Hole quite through the top and bottom of the *Head*, which holes have their under ends ſquar'd about two Inches upwards, and theſe ſquares are made ſo wide as to receive a ſquare Bar of Iron three quarters of an Inch ſquare; But the other part of theſe Holes remain round: Into theſe Holes two Irons are fitted called the *Screws*.

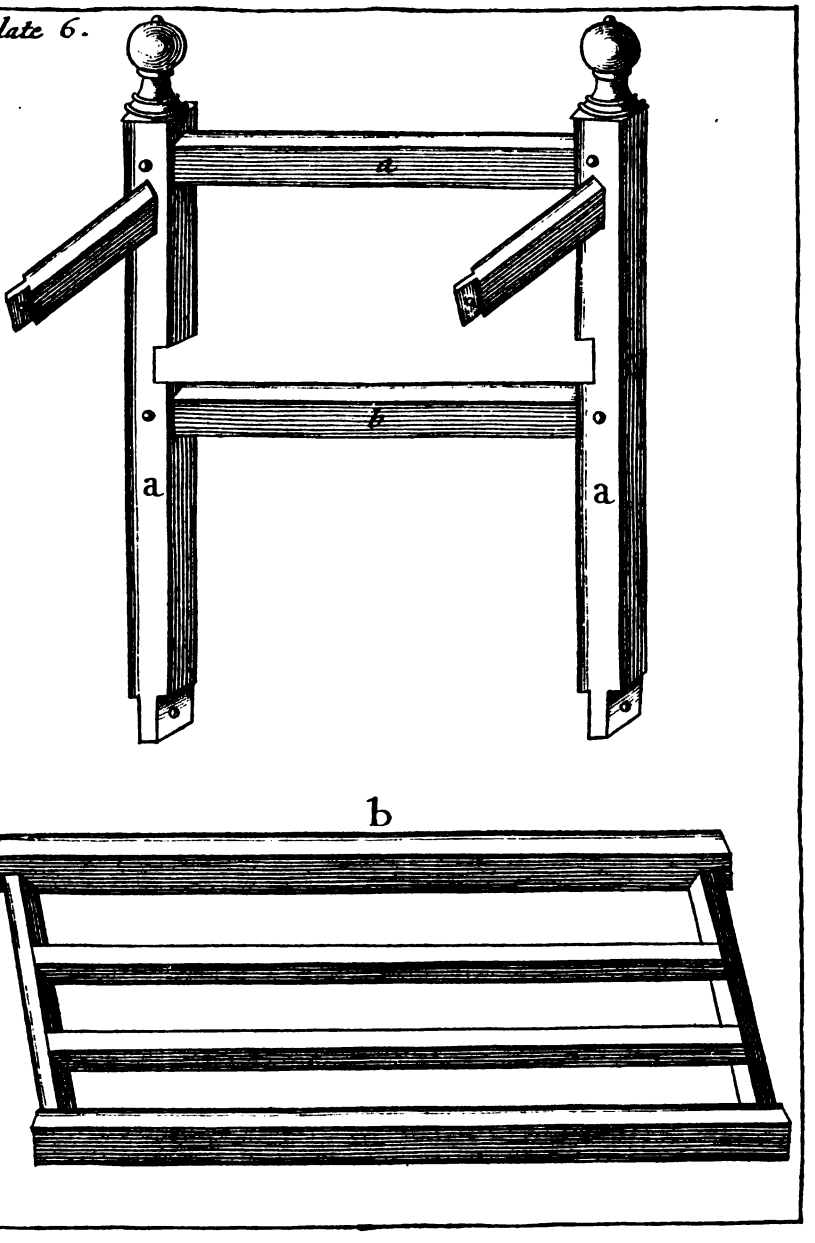
The Shanks of theſe *Screws* are made ſo long as to reach through the *Head* and through the *Cap*: At the upper-end of theſe Shanks is made Male-ſcrews, and to theſe Male-ſcrews, Iron Female-ſcrews are fitted with two Ears to twiſt them the eaſier about.

So much of theſe Iron Shanks as are to lye in the ſquare Hole of the *Head* aforeſaid, are alſo ſquared to fit thoſe ſquare Holes, that when they are fitted and put into the Holes in the *Head*; they may not twiſt about.

To the lower-ends of theſe Iron-Shanks are made two Square, Flat Heads, which are let into and buried in the under-ſide of the *Head*; And upon the Sholders of thoſe two Flat Heads, reſts the weight of the *Head* of the *Preſs*; And by the *Screws* at the Upper-end of the Shanks are hung upon the upper-ſide of the *Cap*, and Screwed up or let down as occaſion requires.

¶. 6. *Of*

Plate 6.



¶. 6. *Of the* Till, *marked* f *in* Plate 5.

The *Till* is a Board about one Inch thick, and is as the *Head* and *Winter*, one Foot nine Inches and a quarter long, beſides the *Tennants* at either end; Its Breadth is the Breadth of the *Cheeks*, *viz.* eight Inches; It hath two *Tennants* at either end as at *a a a a*, each of them about an Inch and an half long, and an Inch and an half broad, and are made at an Inch diſtance from the fore and Back-ſide, ſo that a ſpace of two Inches is contained in the middle of the ends between the two *Tennants*; theſe *Tennants* are to be laid in the Morteſſes in the *Cheeks* delineated at *f f* in Plate 5. and deſcribed in this §. 10. ¶. 2.

In its middle it hath a round Hole about two Inches and an half wide, as at *b*, for the Shank of the *Spindle* to paſs through.

At ſeven Inches and a quarter from either end, and in the middle between the Fore and Back-ſide, is made two ſquare Holes through the *Till*, as at *c c*, for the Iron *Hoſe* to paſs through.

¶. 7. *Of the* Hind-Poſts *marked* a a *in* Plate 6.

At one Foot diſtance from the Hind-ſides of the *Cheeks* are placed upright two *Hind-Poſts*, they are three Foot and four Inches long beſides the *Tennants*, which *Tennants* are to be placed in the Morteſſes in the hinder ends of the *Feet*; Their thickneſs is four Inches on every ſide, and every ſide is tryed ſquare;

But

But within eight Inches of the top is turned a round Ball with a Button on it, and a Neck under it, and under that Neck a ſtraight Plinth or Baſe: This turn'd work on the top is only for Ornament ſake.

There are ſix *Rails* fitted into theſe *Hind-Poſts*, two behind marked *a b*, one of them ſtanding with its upper ſide at two Inches below the turned Work, the other having its upper-ſide lying level with the upper-ſide of the *Winter*.

Theſe two *Rails* are each of them *Tennanted* at either end, and are made ſo long, that the out-ſides of the *Hind-Poſts* may ſtand Range or even with the outer-ſides of the *Cheeks*; Theſe *Tennants* at either end are let into Morteſſes made in the in-ſides of the *Hind-Poſts*, and Pin'd up with half Inch wooden Pins, Glewed in, as was ſhewn Vol. 1. *Numb.* 5. §. 17. Becauſe the two *Hind-Poſts* need not be ſeparated for any alteration of the *Preſs*.

The two *Side-Rails* on either ſide the *Preſs* are *Tennanted* at each end, and let into Morteſſes made in the *Cheeks* and *Hind-Poſts*, ſo as they may ſtand Range with the outer-ſides of the *Cheeks* and *Hind-Poſts*; But the *Tennants* that enter the Morteſſes in the *Cheeks* are not pin'd in with Wooden Pins, and Glewed, becauſe they may be taken aſſunder if need be; But are Pin'd in with Iron Pins, made a little tapering towards the entring end, ſo as they may be driven back when occaſion ſerves to alter the *Preſs*: And the *Tennants* that enter the Morteſſes in the *Hind-Poſts* are faſtned in by a Female-ſcrew, let in near the end of the *Rail*, which receives a Male-ſcrew thruſt through the *Hind-Poſts*, even as I ſhew'd in §. 4.

§. 4. the *Fore* and *Back-Rails* of the *Caſe-Frames* was.

¶. 8. *Of the* Ribs *marked* b *in* Plate 6.

The *Ribs* lye within a Frame of four Foot five Inches long, one Foot eleven Inches broad; its two *End-Rails* one Inch and an half thick, its *Side-Rails* two Inches and an half thick; and the breadth of the *Side* and *End-Rails* two Inches and an half. But the *Side-Rails* are cut away in the in-ſide an Inch and an half towards the outer ſides of the *Rails*, and an Inch deep towards the Bottom ſides of the *Rails*, ſo that a ſquare *Cheek* on either *Side-Rail* remains. This cutting down of the *Outer-Rails* of the *Frame* is made, becauſe the Planck of the *Carriage* being but one Foot eight Inches and an half broad, may eaſily ſlide, and yet be gaged between theſe *Cheeks* of the *Rail*, that the *Cramp-Irons* Nailed under the *Carriage Planck* joggle not on either ſide off the *Ribs*, as ſhall more fully be ſhewn in the next §.

Between the two *Side-Rails* are framed into the two *End-Rails* the two *Wooden-Ribs* two Inches and an half broad, and an Inch and an half thick; they are placed each at an equal diſtance from each *Side-Rail*, and alſo at the ſame diſtance between themſelves. Upon theſe two *Ribs* are faſt Nailed down the *Iron-Ribs*, of which more shall be ſaid when I come to ſpeak of the Iron-work.

¶. 9. *Of*

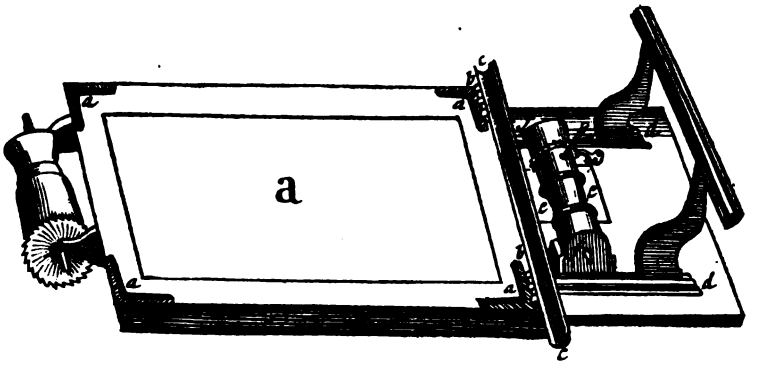
¶. 9. *Of the* Carriage, Coffin *and its* Planck, *marked* a *in* Plate 7.

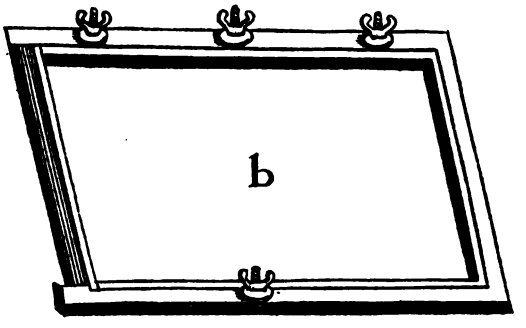
The *Planck* of the *Carriage* is an Elm-Planck an Inch and an half thick, four Foot long, and one Foot eight Inches and three quarters broad; upon this *Planck* at its fore-end is firmly Nailed down a ſquare Frame two Foot four Inches long, one Foot ten Inches broad, and the thickneſs of its Sides two Inches and an half ſquare; This Frame is called the *Coffin*, and in it the *Stone* is *Bedded*.

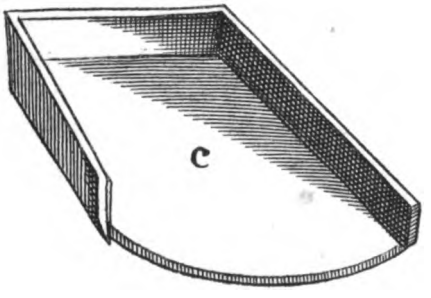
Upon each of the four Corners of this *Coffin* is let in and faſtned down a ſquare Iron Plate as at *a a a a*, with Return Sides about ſix Inches long each ſide, half a quarter of an Inch thick, and two Inches and a quarter broad; upon the upper outer-ſides of each of theſe Plates is faſtned down to them with two or three Rivets through each ſide, another ſtrong Iron half an Inch deep, and whoſe outer Angles only are ſquare, but the Inner Angles are obtuſe, as being ſloped away from the Inner-Angle towards the farther-end of each inner-ſide, ſo as the *Quoins* may do the Office of a Wedge between each inner-ſide and the *Chaſe*.

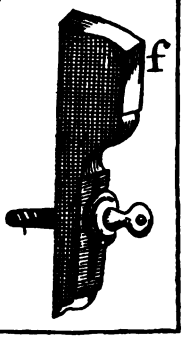
The Plates of theſe Corners (as I ſaid) are let in on the outer-Angles of the upper-ſide of the Frame of the *Coffin*, ſo as the upper-ſides of the Plates lye even with it, and are Nailed down, or indeed rather Rivetted down through the bottom and top-ſides of the Frame of the *Coffin*, becauſe then the upper-ſides of the Holes in the Iron Plates being ſquare Bored

Plate 7.









Bored (that is, made wider on the upper ſide of the Plate, as I ſhall ſhew when I come to the making of *Mathematical Inſtruments*) the ends of the Shanks of the Iron Pins may be ſo battered into the Square-boring, that the whole Superficies of the Plate when thus Rivetted ſhall be ſmooth, which elſe with the exturberancies of Nail-heads would hinder the free ſliding of the *Quoins*.

At the hinder end of the Frame of the *Coffin* are faſtned either with ſtrong Nails, Rivets, or rather Screws, two Iron *Half-Joynts*, as at *b b*, which having an Iron Pin of almoſt half an Inch over put through them, and two *Match-half-Joynts* faſtned on the Frame of the *Tympan*, theſe two *Match-half-Joynts* moving upon the Iron Pin aforeſaid, as on an *Axis*, keeps the *Tinpan* ſo truly gaged, that it always falls down upon the *Form* in the place, and ſo keeps *Regiſter* good, as ſhall further be ſhewed in proper place.

Behind the *Coffin* is Nailed on to its outſide, a Quarter, as at *c c* this Quarter is about three Inches longer than the breadth of the *Coffin*, it hath all its ſides two Inches over, and three of them ſquare; but its upper ſide is hollowed round to a Groove or Gutter an Inch and an half over. This Gutter is ſo Nailed on, that its hither end ſtanding about an Inch higher than its further end, the Water that deſcends from the *Tympan* falling into it is carried away on the farther ſide the *Coffin* by the declivity of the farther end of the Gutter, and ſo keeps the Planck of the *Carriage* neat and cleanly, and preſerves it from rotting.

Parallel

Parallel to the outer ſides of the hind part of the Planck of the *Carriage*, at three Inches diſtance from either ſide, is Nailed down on the upper ſide of the Planck two Female-Duftail Grooves, into which is fitted (ſo as they may ſlide) two Male-Duftails made on the two Feet of the *Gallows* (as at *d d*) that the *Tinpan* reſts upon; and by the ſliding forward or backward of theſe Duftail Feet, the heighth of the *Tinpan* is raiſed or depreſſed according to the Reaſon or Fancy of the *Preſs-man*.

At three Inches from the hinder Rail of the *Coffin*, in the middle, between both ſides of the Planck, is cut an Hole four Inches ſquare (as at *e e*) and upon the hither and farther ſide of this Hole is faſtned down on each ſide a *Stud* made of Wood (as at *f f*) and in the middle of theſe two *Studs* is made a round Hole about half an Inch over, to receive the two round ends of an Iron Pin; which Iron Pin, though its ends be round, is through the middle of the Shank ſquare, and upon that ſquare is fitted a round *Wooden-Rowler* or *Barrel*, with a Shoulder on either ſide it, to contain ſo much of the *Girt* as ſhall be rowled upon it; And to one end of the *Rowler* is faſtned an Iron *Circle* or *Wheel*, having on its edge *Teeth* cut to ſtop againſt a *Clicker*, when the *Rowler* with an Iron Pin is turned about to ſtrain the *Girt*.

¶. 10. *Of the* Tympan *and* Inner-Tympan, *marked* b *in* Plate 7.

The *Tympan* is a ſquare Frame, three ſides whereof are Wood, and the fourth Iron. Its width is one Foot

Foot eight Inches, its length two Foot two Inches; the breadth of the wooden Sides an Inch and an half, and the depth one Inch.

On its ſhort Wooden-ſide, *viz.* its Hind-end, at the two Corners is Rivetted an Iron *Match-Joynt*, to be pinned on to another *Half joynt* faſtned on the *Hind-Rail* of the *Coffin*.

The other end, *viz.* the Fore-end of the *Tympan* is made of Iron, with a ſquare *Socket* at either end for the Wooden ends of the *Tympan* to fit and faſten into. This Iron is ſomewhat thinner and narrower than an ordinary Window-Caſement.

Upon the outer edge of this Iron, about an Inch and an half off the ends of it, is made two Iron *Half-joynts* to contain a Pin of about a quarter of an Inch over, which Pin entring this *half-joynt*, and a *match Half-joynt* made upon the *Friſket*, ſerves for the *Friſket* to move truly upon.

In the middle of each long *Rail* of the *Tympan*, is made through the top and bottom an Hole half an Inch ſquare, for the ſquare Shanks of the *Point-Screws* to fit into.

The like Holes are alſo made in the *Tympan*, at one third part of its length from the Fore-end or *Friſket-joynt*, to place the *Point Screws* in; when a *Twelves*, *Eighteens*, &c. is wrought.

Into the Inner-ſide of this *Tympan* is fitted the *Inner-Tympan*, whoſe three ſides are alſo made of Wood, and its fourth ſide of Iron, as the *Tympan*, but without *joynts*; it is made ſo much ſhorter than the *Outer-Tympan*, that the outer edge of the Iron of the *Inner-Tympan* may lye within the inner edge of the Iron on the *Outer-Tympan*;

pan; and it is made ſo much narrower than the inſide of the *Tympan*, that a convenient room may be allowed to paſte a *Vellom* between the inſide of the *Tympan*, and the outſide of the *Inner-Tympan*.

About the middle, through the hither-ſide of the *Inner-Tympan*, is let in and faſtned an Iron Pin about a quarter of an Inch over, and ſtands out three quarters of an Inch upon the hither out-ſide of the *Inner-Tympan*, which three quarters of an Inch Pin fits into a round hole made in the inner-ſide of the *Tympan*, to gage and fit the *Inner-Tympan* right into the *Tympan*; for then by the help of an Iron turning *Claſp* on the further ſide the *Tympan*, the *Inner-Tympan* is kept firmly down and in its poſition.

¶. 11. *Of the* Inck-Block, Slice, Brayer, *and* Catch *of the* Bar, *marked* c d e f in Plate 7.

To the *Rail* between the hither *Cheek* and *Hind-Poſt* is faſtned the *Inck-Block*, which is a Beechen-board about thirteen Inches long, nine Inches broad, and commonly about two Inches thick, and hath the left hand outer corner of it cut away; it is Railed in on its farther and hinder-ſides, and a little above half the hither-ſide, with Wainſcot-Board about three quarters of an Inch thick, and two Inches and an half above the upper-ſide the board of the *Inck-Block*. It is deſcribed in Plate 7. at c.

The *Brayer* marked *a* is made of *Beech*: It is turned round on the ſides, and flat on the bottom, its length is

is about three Inches, and its diameter about two Inches and an half; it hath an Handle to it about four Inches long. Its Office is to rub and mingle the *Inck* on the *Inck-Block* well together.

The *Slice* is a little thin Iron *Shovel* about three or four Inches broad, and five Inches long; it hath an Handle to it of about ſeven Inches long. Near the *Shovel* through the Handle is fitted a ſmall Iron of about two Inches long ſtanding Perpendicular to both the ſides of the Handle, and is about the thickneſs of a ſmall Curtain-Rod. It is deſcribed at e.

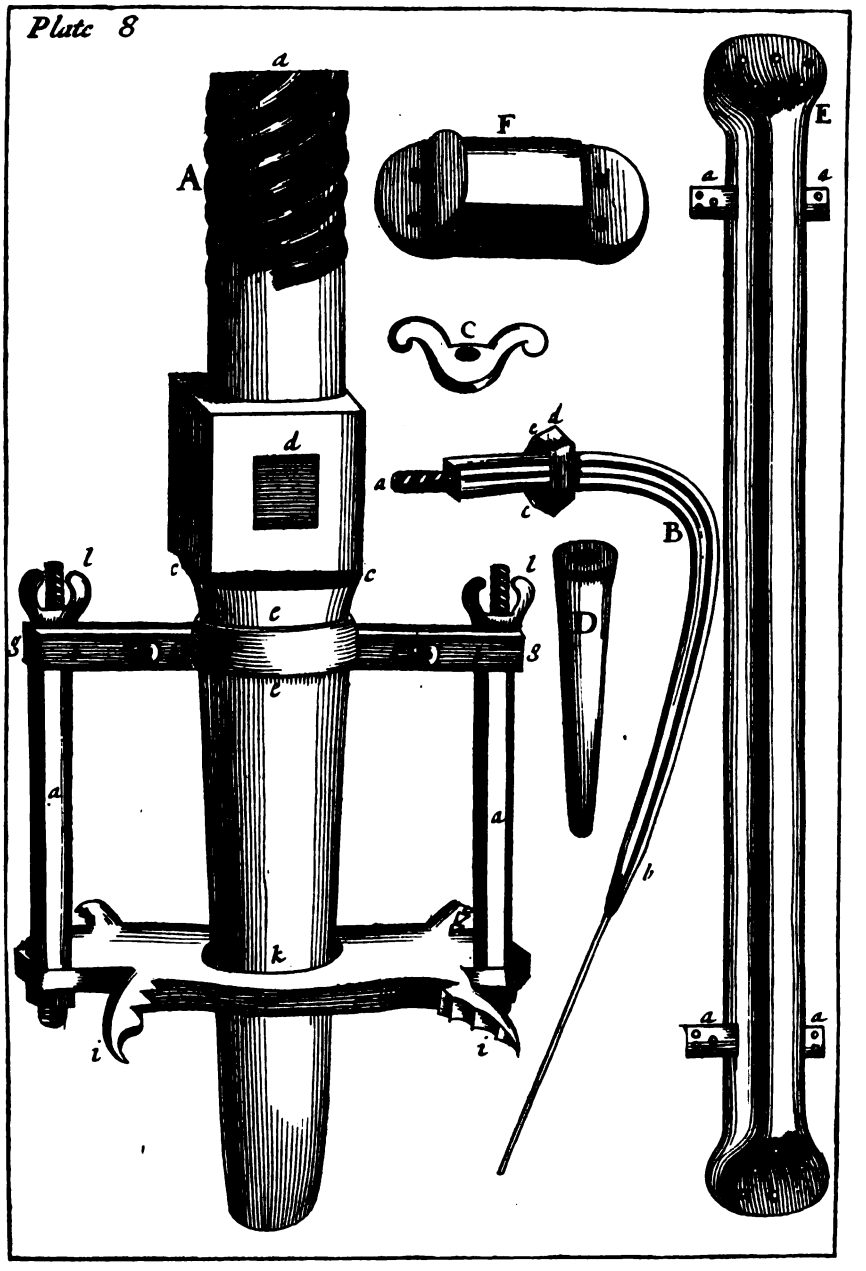
The *Catch* of the *Bar* deſcribed at f is a piece of Wood two Inches thick, four Inches broad, and ten Inches long; The top of it is a little Bevil'd or Slop'd off, that the *Bar* may by its *Spring* fly up the Bevil till it ſtick. This Bevil projects three Inches over its ſtraight Shank, which reaches down to the bottom; in the middle of this Shank, through the fore and back-ſide, is a Morteſs made from within an Inch of the Rounding to an Inch and an half of the bottom; This Morteſs is three quarters of an Inch wide, and hath an Iron Pin with a Shoulder at one end fitted to it, ſo as it may ſlide from one end of the Morteſs to the other. At the other end of the Iron Pin is made a Male-Screw which enters into a Female Iron Screw let into the further *Cheek* of the *Preſs*; ſo that the *Catch* may be Screwed cloſe to the *Cheek*, as ſhall further be ſpoken to hereafter.

¶. 12. *Of*

¶. 12. *Of the Iron-work, and firſt of the* Spindle *marked* A *in Plate* 8.

From the Top to the *Toe* of the *Spindle, viz.* from *a* to *b* is ſixteen Inches and a half, the length of the Cilinder the *Worms* are cut upon is three Inches and a quarter, and the diameter of that Cilinder two Inches and a quarter; between the bottom of the *Worms* and top of the Cube one Inch and an half; the Cube marked *c c c c* is two Inches and three quarters, the ſquare *Eye* at *d* in the middle of the Cube is an Inch and a quarter through all the ſides of the Cube; one Inch under the Cube at *e* is the *Neck* of the *Spindle*, whoſe diameter is two Inches, It is one Inch between the two ſhoulders, *viz.* the upper and under ſhoulders of the *Neck* at *e e*, ſo that the Cilinder of the *Neck* is one Inch long; the very bottom of the *Spindle* at *b* is called the *Toe*, it is made of an Hemiſpherical form, and about one Inch in diameter; This *Toe* ſhould be made of *Steel*, and well Temper'd, that by long or careleſs uſage, the point of preſſure wear not towards one ſide of the *Toe*, but may remain in the Axis of the *Spindle*.

§. 11. *Of*



§. 11. *Of the* Worms *of the* Spindle.

I promiſed at the latter end of *Numb.* 2. to give a more copious account than there I did of making *Worms*, when I came to exerciſe upon *Printing-Preſs Spindles*; and being now arrived to it, I ſhall here make good my promiſe.

¶. 1. The *Worms* for *Printing-Preſs Spindles* muſt be projected with ſuch a declivity, as that they may come down at an aſſigned progreſs of the *Bar*.

The aſſigned progreſs may be various, and yet the *Spindle* do its office: For if the *Cheeks* of the *Preſs* ſtand wide aſſunder, the ſweep or progreſs of the ſame *Bar* will be greater than if they ſtand nearer together.

It is confirm'd upon good conſideration and Reaſon as well as conſtant experience, that in a whole Revolution of the *Spindle*, in the *Nut*, the *Toe* does and ought to come down two Inches and an half; but the *Spindle* in work ſeldom makes above one quarter of a Revolution at one *Pull*, in which ſweep it comes down but half an Inch and half a quarter of an Inch; and the reaſon to be given for this coming down, is the ſqueezing of the ſeveral parts in the *Preſs*, ſubject to ſqueeze between the Morteſſes of the *Winter* and the Morteſſes the *Head* works in; and every Joynt between theſe are ſubject to ſqueeze by the force of a *Pull*. As firſt, The *Winter* may ſqueeze down into its Morteſs one third part of the thickneſs of a *Scabbord*. (Allowing a *Scabbord* to be half a *Nomparel* thick.) Secondly, The *Ribs* ſqueeze cloſer to the

the *Winter* one *Scabbord.* Thirdly, The *Iron-Ribs* to the Wooden *Ribs* one *Scabbord.* Fourthly, The *Cramp-Irons* to the *Planck* of the *Coffin* one *Scabbord.* Fifthly, The *Planck* it ſelf half a *Scabbord.* Sixthly, The *Stone* to the *Planck* one *Scabbord.* Seventhly, The *Form* to the *Stone* half a *Scabbord.* Eighthly, The *Juſtifyers* in the Mortes of the *Head* three *Scabbords.* Ninthly, The *Nut* in the *Head* one *Scabbord.* Tenthly, The *Paper*, *Tympans* and *Blankets* two *Scabbords.* Eleventhly, Play for the Irons of the *Tympans* four *Scabbords.* Altogether make fifteen *Scabbords* and one third part of a *Scabbord* thick, which (as aforeſaid) by allowing two *Scabbords* to make a *Nomparel*, and as I ſhewed in *Vol.* 2. *Numb.* 2. §. 2. One hundred and fifty *Nomparels* to make one Foot, gives twelve and an half *Nomparels* for an Inch, and conſequently twenty five *Scabbords* for an Inch; ſo by proportion, fifteen *Scabbords* and one third part of a *Scabbord*, gives five eighth parts of an Inch, and a very ſmall matter more, which is juſt ſo much as the *Toe* of the *Spindle* comes down in a quarter of a Revolution.

This is the Reaſon that the coming down of the *Toe* ought to be juſt thus much; for ſhould it be leſs, the natural Spring that all theſe Joynts have, when they are unſqueez'd, would mount the Irons of the *Tympans* ſo high, that it would be troubleſom and tedious for the *Preſs-man* to *Run* them under the *Plattin*, unleſs the *Cheeks* ſtood wider aſſunder, and conſequently every ſweep of the *Bar* in a *Pull* exceed a quarter of a Revolution, which would be both laborious for the *Preſs-man*, and would hinder his uſual riddance of Work. I ſhew'd

I ſhew'd in *Numb.* 2. *fol.* 31, 32, 33, 34, 35. the manner of making a Screw in general; but aſſigned it no particular Riſe; which for the aforeſaid reaſon, theſe *Printing-Preſs Screws* are ſtrictly bound to have: Therefore its aſſigned Riſe being two Inches and an half in a Revolution, This meaſure muſt be ſet off upon the Cilindrick Shank, from the top towards the Cube of the *Spindle*, on any part of the *Cilinder*, and there make a ſmall mark with a fine *Prick-Punch*, and in an exact Perpendicular to this mark make another ſmall mark on the top of the Cilinder, and laying a ſtraight *Ruler* on theſe two marks, draw a ſtraight line through them, and continue that line almoſt as low as the Cube of the *Spindle*. Then devide that portion of the ſtraight line contained between the two marks into eight equal parts, and ſet off thoſe equal parts from the two Inch and half mark upwards, and then downwards in the line ſo oft as you can: Devide alſo the Circumference of the Shank of the Cilinder into eight equal parts, and draw ſtraight lines through each deviſion, parallel to the firſt upright line; and deſcribe the *Screw* as you were directed in the afore-quoted place; ſo will you find that the revolution of every line ſo carried on about the Shank of the Cilinder, will be juſt two Inches and an half off the top of the Shank: which meaſure and manner of working may be continued downward to within an Inch and an half of the Cube of the *Spindle*. This is the Rule and Meaſure that ought to be obſerv'd for ordinary *Preſſes*: But if for ſome by-reaſons the aforeſaid Meaſure of two Inches and an half muſt be varied, then the varied Meaſure muſt

muſt be ſet off from the top of the Cilinder, and working with that varied Meaſure as hath been directed, the *Toe* of the *Spindle* will come down lower in a revolution if the varied Meaſure be longer, or not ſo low if the varied Meaſure be ſhorter.

There is a Notion vulgarly accepted among Workmen, that the *Spindle* will Riſe more or leſs for the number of *Worms* winding about the Cilinder; for they think, or at leaſt by tradition are taught to ſay, that a *Three-Worm'd Spindle* comes faſter and lower down than a *four-Worm'd Spindle*: But the opinion is falſe; for if a *Spindle* were made but with a *Single-Worm*, and ſhould have this Meaſure, *viz.* Two Inches and an half ſet off from the top, and a *Worm* cut to make a Revolution to this Meaſure, it would come down juſt as faſt, and as low, as if there were two, three, four, five or ſix *Worms*, &c. cut in the ſame Meaſure: For indeed, the numbers of *Worms* are only made to preſerve the *Worms* of the *Spindle* and *Nut* from wearing each other out the faſter; for if the whole ſtreſs of a *Pull* ſhould bear againſt the Sholder of a ſingle *Worm*, it would wear and ſhake in the *Nut* ſooner by half than if the ſtreſs ſhould be borne by the Sholders of two *Worms*; and ſo proportionably for three, four, five *Worms*, *&c.*

But the reaſon why four *Worms* are generally made upon the *Spindle*, is becauſe the Diameters of the *Spindle* are generally of this propos'd ſize; and therefore a convenient ſtrength of Mettal may be had on this ſize for four *Worms*; But ſhould the Diameter of the *Spindle* be ſmaller, as they ſometimes are when the *Preſs* is deſigned for ſmall Work, only three *Worms* will

will be a properer number than four; becauſe when the Diameter is ſmall, the thickneſs of the *Worms* would alſo prove ſmall, and by the ſtreſs of a *Pull* would be more ſubject to break or tear the *Worms* either of the *Spindle* or *Nut*.

And thus I hope I have performed the promiſe here I made at the latter end of *Numb.* 2. Whither I refer you for the breadth, and reaſon of the breadth of the *Worm*.

¶. 13. *Of the* Bar *marked* B *in* Plate 8.

This *Bar* is Iron, containing in length about two Foot eight Inches and an half, from *a* to *b*, and its greateſt thickneſs, except the Sholder, an Inch and a quarter; The end *a* hath a Male-Screw about an Inch Diameter and an Inch long, to which a *Nut* with a Female-Screw in it as at C is fitted. The Iron *Nut* in which this Female-Screw is made, muſt be very ſtrong, *viz.* at leaſt an Inch thick, and an Inch and three quarters in Diameter; in two oppoſite ſides of it is made two Ears, which muſt alſo be very ſtrong, becauſe they muſt with heavy blows be knock't upon to draw the Sholder of the ſquare ſhank on the *Bar*, when the ſquare Pin is in the *Eye* of the *Spindle* cloſe and ſteddy up to the Cube on the *Spindle*. The ſquare Pin of the *Bar* marked *c* is made to fit juſt into the *Eye*, through the middle of the Cube of the *Spindle*, on the hither end of this ſquare Pin is made a Sholder or ſtop to this ſquare Pin, as at *d*. This Sholder muſt be Filed exactly Flat on all its four in-ſides, that they may be drawn cloſe and tight up to

to any flat ſide of the Cube on the *Spindle*; It is two Inches ſquare, that it may be drawn the firmer, and ſtop the ſteddyer againſt any of the flat ſides of the ſaid Cube, when it is hard drawn by the ſtrength of the Female-Screw in the aforeſaid *Nut* at C. The thickneſs from *d* to *e* of this Sholder is about three quarters of an Inch, and is Bevil'd off towards the *Handle* of the *Bar* with a ſmall Molding.

The ſubſtance of this *Bar*, as aforeſaid, is about an Inch and a quarter; but its Corners are all the way flatted down till within five Inches of the end: And from theſe five Inches to the end, it is taper'd away, that the *Wooden-Handle* may be the ſtronger forced and faſtned upon it.

About four Inches off the Sholder, the *Bar* is bowed beyond a right Angle, yet not with an Angle, but a Bow, which therefore lies ready to the *Preſs-man*'s Hand, that he may Catch at it to draw the *Wooden-Handle* of the *Bar* within his reach.

This *Wooden-Handle* with long Working grows oft looſe; but then it is with hard blows on the end of it forced on again, which oft ſplits the *Wooden-Handle* and looſens the ſquare Pin at the other end of the *Bar*, in the *Eye* of the *Spindle*: To remedy which inconvenience, I uſed this Help, *viz.* To weld a piece of a Curtain-Rod as long as the *Wooden-Handle* of the *Bar*, to the end of the Iron *Bar*, and made a Male-ſcrew at the other end with a Female-ſcrew to fit it; Then I bored an hole quite through the *Wooden-Handle*, and Turn'd the very end of the *Wooden-Handle* with a ſmall hollow in it flat at the bottom, and deep enough to bury the Iron-*Nut* on the end of the Curtain-

tain-Rod, and when this Curtain-Rod was put through the Hollow in the *Wooden Handle* and Screwed faſt to it at the end, it kept the *Wooden-Handle*, from flying off; Or if it looſened, by twiſting the *Nut* once or twice more about, it was faſtned again.

¶. 14. *Of the* Hoſe, Garter, *and* Hoſe-Hooks.

The *Hoſe* are the upright Irons in Plate 8. at *a a*, They are about three quarters of an Inch ſquare, both their ends have Male-ſcrews on them; The lower end is fitted into a ſquare Hole made at the parting of the *Hoſe-Hooks*, which by a ſquare *Nut* with a Female-ſcrew in it, is Screwed tight up to them; Their upper ends are let into ſquare Holes made at the ends of the *Garter*, and by *Nuts* with Female-Screws in them, and Ears to turn them about as at *l l* are drawn up higher, if the *Plattin-Cords* are too looſe; or elſe let down lower if they are too tight: Theſe upper Screws are called the *Hoſe-Screws*.

The *Garter* (but more properly the *Coller*) marked *b b*, is the round Hoop incompaſſing the flat Groove or Neck in the Shank of the *Spindle* at *e e*; This round Hoop is made of two half round Hoops, having in a Diametrical-line without the Hoop ſquare Irons of the ſame piece proceeding from them, and ſtanding out as far as *g g*, Theſe Irons are ſo let into each other, that they comply and run Range with the ſquare Sholders at both ends, wherein ſquare Holes are made at the ends of the *Hoſe*. They are Screwed together with two ſmall Screws, as at *h h*.

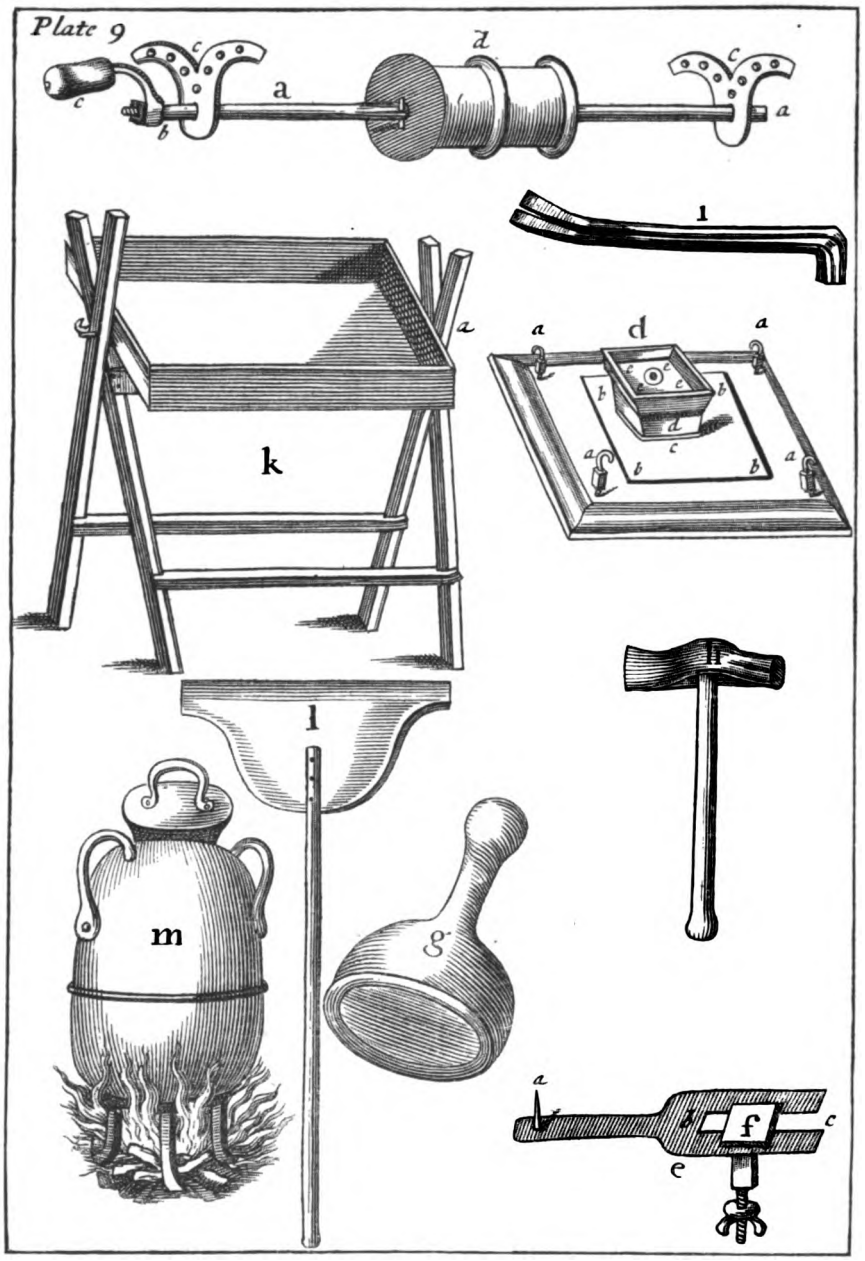
The

The four *Hoſe-Hooks* are marked *i i i i*, They proceed from two Branches of an Iron Hoop at *k* encompaſſing the lower-end of the *Spindle*, on either Corner of the Branch, and have notches filled in their outer-ſides as in the Figure, which notches are to contain ſeveral Turns of *Whip-cord* in each notch, which *Whip-cord* being alſo faſtned to the *Hooks* on the *Plattin*, holds the *Plattin* tight to the *Hooks* of the *Hoſe*.

¶. 15. *Of the* Ribs, *and* Cramp-Irons.

The *Ribs* are delineated in Plate 8. at E, they are made of four-ſquare Irons the length of the *Wooden-Ribs* and *End-Rails*, *viz.* Four Foot five Inches long, and three quarters of an Inch ſquare, only one end is batter'd to about a quarter of an Inch thick, and about two Inches and an half broad, in which battering four or five holes are Punch't for the nailing it down to the *Hind-Rail* of the *Wooden-Ribs*. The Fore-end is alſo batter'd down as the Hind-end, but bound downwards to a ſquare, that it may be nailed down on the outer-ſide of the *Fore-Rail* of the *Wooden-Ribs*.

Into the bottom of theſe *Ribs*, within nine Inches of the middle, on either ſide is made two Female-Duftails about three quarters of an Inch broad, and half a quarter of an Inch thick, which Female-Duftails have Male-Duftails as at *a a a a* fitted ſtiff into them, about an Inch and three quarters long; and theſe Male-Duftails have an hole punched at either end, that when they are fitted into the Female-Duftails in the *Ribs*, they may in theſe Holes be Nailed down the firmer to the *Wooden-Ribs*. Theſe



Theſe *Ribs* are to be between the upper and the under ſide exactly of an equal thickneſs, and both to lye exactly Horizontal in ſtraight lines; For irregularities will both Mount and Sink the *Cramp-Irons*, and make them *Run* rumbling upon the *Ribs*.

The upper-ſides of theſe *Ribs* muſt be purely Smooth-fil'd and Polliſh'd, and the edges a little Bevil'd roundiſh away, that they may be ſomewhat Arching at the top; becauſe then the *Cramp-Irons Run* more eaſily and tickliſhly over them.

The *Cramp-Irons* are marked F in Plate 8. They are an Inch and an half long beſides the Battering down at both ends as the *Ribs* were; They have three holes Punched in each Battering down, to Nail them to the *Planck* of the *Coffin*; They are about half an Inch deep, and one quarter and an half thick; their upper-ſides are ſmoothed and rounded away as the *Ribs*.

¶. 16. *Of the* Spindle *for the* Rounce, *deſcribed in Plate* 9. *at* a.

The *Axis* or *Spindle* is a ſtraight Bar of Iron about three quarters of an Inch ſquare, and is about three Inches longer than the whole breadth of the Frame of the *Ribs*, *viz.* two Foot two Inches: The farther end of it is Filed to a round Pin (as at *a*) three quarters of an Inch long, and three quarters of an Inch in Diameter; the hither end is filed away to ſuch another round Pin, but is two Inches and a quarter long (as at *b*); at an Inch and a quarter from this end is Filed a Square Pin three quarters of an Inch long, and with-

within half an Inch of the end is Filed another round Pin, which hath another Male-Screw on it, to which is fitted a ſquare Iron *Nut* with a Female-Screw in it.

On the Square Pin is fitted a *Winch* ſomewhat in form like a Jack-winch, but much ſtronger; the *Eye* of which is fitted upon the Square aforeſaid, and Screwed up tight with a Female-Screw. On the ſtraight Shank of this Winch is fitted the *Rounce*, marked *e*.

The round ends of this *Axis* are hung up in two Iron-Sockets (as at *c c*) faſtned with Nails (but more properly with Screws) on the outſide the Wooden Frame of the *Ribs*.

The *Girt-Barrel* marked *d* is Turned of a Piece of Maple or Alder-wood, of ſuch a length, that it may play eaſily between the two Wooden *Ribs*; and of ſuch a diameter, that in one revolution of it, ſuch a length of *Girt* may wind about it as ſhall be equal to half the length contained between the fore-end Iron of the *Tympan*, and the inſide of the Rail of the *Inner-Tympan*; becauſe two Revolutions of this *Barrel* muſt move the *Carriage* this length of ſpace.

This *Barrel* is fitted and faſtned upon the Iron *Axis*, at ſuch a diſtance from either end, that it may move round between the Wooden *Ribs* aforeſaid.

¶. 17. *Of the* Preſs-Stone.

The *Preſs-Stone* ſhould be Marble, though ſometimes Maſter *Printers* make ſhift with Purbeck, either becauſe they can buy them cheaper, or elſe becauſe they can neither diſtinguiſh them by their appearance, or know their different worths.

Its thickneſs muſt be all the way throughout equal

qual, and ought to be within one half quarter of an Inch the depth of the inſide of the *Coffin*; becauſe the matter it is *Bedded* in will raiſe it high enough. Its length and breadth muſt be about half an Inch leſs than the length and breadth of the inſide of the *Coffin*: Becauſe *Juſtifiers* of Wood, the length of every ſide, and almoſt the depth of the *Stone*, muſt be thruſt between the inſides of the *Coffin* and the outſides of the *Stone*, to Wedge it tight and ſteddy in its place, after the *Preſs-man* has *Bedded* it. Its upper-ſide, or Face muſt be exactly ſtraight and ſmooth.

I have given you this deſcription of the *Preſs-Stone*, becauſe they are thus generally uſed in all *Printing-Houſes*: But I have had ſo much trouble, charge and vexation with the often breaking of *Stones*, either through the careleſneſs or unskilfulneſs (or both) of *Preſs-men*, that neceſſity compell'd me to conſider how I might leave them off; and now by long experience I have found, that a piece of *Lignum-vitæ* of the ſame ſize, and truly wrought, performs the office of a *Stone* in all reſpects as well as a *Stone*, and eaſes my mind, of the trouble, charge and vexation aforeſaid, though the firſt coſt of it be greater.

¶. 18. *Of the* Plattin *marked* d *in Plate* 9.

The *Plattin* is commonly made of Beechen-Planck, two Inches and an half thick, its length about fourteen Inches, and its breadth about nine Inches. Its ſides are Tryed Square, and the Face or under-ſide of the *Plattin* Plained exactly ſtraight and ſmooth. Near the four Corners on the upper-ſide, it hath four

four Iron *Hooks* as at *a a a a*, whoſe Shanks are Wormed in.

In the middle of the upper-ſide is let in and faſtned an Iron Plate called the *Plattin-Plate*, as *b b b b*, a quarter of an Inch thick, ſix Inches long, and four Inches broad; in the middle of this Plate is made a ſquare Iron Frame about half an Inch high, and half an Inch broad, as at *c*. Into this ſquare Frame is fitted the *Stud* of the *Plattin Pan*, ſo as it may ſtand ſteddy, and yet to be taken out and put in as occaſion may require.

The *Stud* marked *d*, is about an Inch thick, and then ſpreads wider and wider to the top (at *e e e e*) of it, till it becomes about two Inches and an half wide; and the ſides of this ſpreading being but about half a quarter of an Inch thick makes the *Pan*. In the middle of the bottom of this *Pan* is a ſmall Center hole Punch'd for the *Toe* of the *Spindle* to work in.

§. 19. *Of the* Points *and* Point-Screws.

The Points are made of Iron Plates about the thickneſs of a Queen *Elizabeth* Shilling: It is delineated at e in Plate 9. which is ſufficient to ſhew the ſhape of it, at the end of this Plate, as at *a*, ſtands upright the Point. This *Point* is made of a piece of ſmall Wyer about a quarter and half quarter of an Inch high, and hath its lower end Filed away to a ſmall Shank about twice the length of the thickneſs of the Plate; ſo that a Sholder may remain. This ſmall Shank is fitted into a ſmall Hole made near the end of the Plate, and Revetted on the other ſide, as was taught

taught *Numb.* 2. *Fol.* 24. At the other end of the Plate is filed a long ſquare notch in the Plate as at *b c* quarter and half quarter Inch wide, to receive the ſquare ſhank of the *Point-Screws*.

The *Point-Screw* marked f is made of Iron; It hath a thin Head about an Inch ſquare, And a ſquare Shank juſt under the Head, an Inch deep, and almoſt quarter and half quarter Inch ſquare, that the ſquare Notch in the hinder end of the Plate may ſlide on it from end to end of the Notch; Under this ſquare Shank is a round Pin filed with a Male-Screw upon it, to which is fitted a *Nut* with a Female-Screw in it, and Ears on its out-ſide to twiſt about, and draw the Head of the Shank cloſe down to the *Tympan*, and ſo hold the *Point-Plate* faſt in its Place.

¶. 20. *Of the* Hammer, *deſcribed at* h, *and* Sheeps-Foot *deſcribed at* i *in Plate* 9.

The *Hammer* is a common *Hammer* about a quarter of a Pound weight; It hath no *Claws* but a *Pen*, which ſtands the *Preſs-man* inſtead when the *Chaſe* proves ſo big, that he is forced to uſe ſmall *Quoins*.

The Figure of the *Sheeps-Foot* is deſcription ſufficient. Its uſe is to nail and un-nail the *Balls*.

The *Sheeps-Foot* is all made of Iron, with an Hammer-head at one end, to drive the *Ball-Nails* into the *Ball-Stocks*, and a Claw at the other end, to draw the *Ball-Nails* out of the *Ball-Stocks*.

¶. 21. *Of*

¶. 21. *Of the* Foot-ſtep, Girts, Stay *of the* Carriage, Stay *of the* Friſket, Ball-Stocks, Paper-Bench, Lye-Trough, Lye-Bruſh, Lye-Kettle, Tray *to* wet Paper *in*, Weights to Preſs Paper, Pelts, *or* Leather, Wool *or* Hair, Ball-Nails *or* Pumping-Nails.

The *Foot-Step* is an Inch-Board about a Foot broad, and ſixteen Inches long. This Board is nailed upon a piece of Timber about ſeven or eight Inches high, and is Bevil'd away on its upper-ſide, as is alſo the Board on its under-ſide at its hither end, that the Board may ſtand aſlope upon the Floor. It is placed faſt on the Floor under the Carriage of the Preſs. Its Office ſhall be ſhewed when we come to treat of Exerciſe of the *Preſs-man.*

Girts are Thongs of Leather, cut out of the Back of an Horſe-hide, or a Bulls hide, ſometimes an Hogs-hide. They are about an Inch and an half, or an Inch and three quarters broad. Two of them are uſed to carry the *Carriage* out and in. Theſe two have each of them one of their ends nailed to the *Barrel* on the *Spindle* of the *Rounce*, and the other ends nailed to the *Barrel* behind the *Carriage* in the *Planck* of the *Coffin*, and to the *Barrel* on the fore-end of the Frame of the *Coffin.*

The *Stay* of the *Carriage* is ſometimes a piece of the ſame *Girt* faſtned to the outſide of the further *Cheek*, and

and to the further hinder ſide of the Frame of the *Carriage*. It is faſtned at ſuch a length by the *Preſs man*, that the *Carriage* may ride ſo far out, as that the Irons of the *Tympan* may juſt riſe free and clear off the fore-ſide of the *Plattin*.

Another way to ſtay the *Carriage* is to let an Iron Pin into the upper-ſide of the further Rail of the Frame of the *Ribs*, juſt in the place where the further hinder Rail of the *Carriage* ſtands projecting over the *Rib-Rail*, when the Iron of the *Tympan* may juſt riſe free from the Fore-ſide of the *Plattin*; for then that projecting will ſtop againſt the Iron Pin.

The *Stay* of the *Friſket* is made by faſtning a Batten upon the middle of the Top-ſide of the *Cap*, and by faſtning a Batten to the former Batten perpendicularly downwards, juſt at ſuch a diſtance, that the upper-ſide of the *Friſket* may ſtop againſt it when it is turned up juſt a little beyond a Perpendicular. When a *Preſs* ſtands at a convenient diſtance from a Wall, that Wall performs the office of the aforeſaid *Stay*.

Ball-Stocks are Turn'd of *Alder* or *Maple*. Their Shape is delineated in Plate 9. at g: They are about ſeven Inches in Diameter, and have their under ſide Turned hollow, to contain the greater quantity of *Wool* or *Hair*, to keep the *Ball-Leathers* plump the longer.

The *Lye-Trough* (delineated in Plate 9. at k) is a Square Trough made of Inch-Boards, about four Inches deep, two Foot four Inches long, and one Foot nine Inches broad, and flat in the Bottom. Its in-ſide is Leaded with Sheet-Lead, which reaches up over the upper Edges of the *Trough*. In the middle of the two ends (for ſo I call the ſhorteſt ſides) on the outer ſides as *a a*, is faſtned a round Iron Pin, which moves

moves in a round hole made in an Iron Stud with a ſquare Sprig under it, to be drove and faſtned into a *Wooden Horſe*, which *Horſe* I need not deſcribe, becauſe in Plate aforeſaid I have given you the Figure of it.

The *Paper-Bench* is only a common Bench about three Foot eight Inches long, one Foot eight Inches broad, and three Foot four Inches high.

The *Lye Bruſh* is made of *Hogs-Briſtles* faſtned into a Board with Braſs-Wyer, for durance ſake: Its Board is commonly about nine Inches long, and four and an half Inches broad; and the length of the Briſtles about three Inches.

To perform the Office of a *Lye-Kettle* (which commonly holds about three Gallons) the old-faſhion'd *Chafers* are moſt commodious, as well becauſe they are more handy and manageable than *Kettles* with Bails, as alſo becauſe they keep *Lye* longer hot.

The *Tray* to *Wet Paper* in is only a common Butchers Tray, large enough to *Wet* the largeſt *Paper* in.

The *Weight* to *Preſs Paper* with, is either Mettal, or Stone, flat on the Bottom, to ly ſteddy on the *Paper-Board*: It muſt be about 50 or 60 pound weight.

For *Pelts* or *Leather*, *Ball-Nails* or *Pumping-Nails*, *Wool* or *Hair*, *Vellom* or *Parchment* or *Forrel*, the *Preſs-man* generally eaſes the *Maſter-Printer* of the trouble of chooſing, though not the charge of paying for them: And for *Paſte*, *Sallad Oyl*, and ſuch accidental Requiſites as the *Preſs-man* in his work may want, the *Devil* commonly fetches for him.

¶. 22. *Of* Racks *to Hang* Paper *on, and of the* Peel.

Our Maſter-*Printer* muſt provide *Racks* to hang *Paper* on to *Dry*. They are made of Deal-board Battens, ſquare,

ſquare, an Inch thick, and an Inch and an half deep, and the length the whole length of the Deal, which is commonly about ten or eleven Foot long, or elſe ſo long as the convenience of the Room will allow: The two upper corners of theſe *Rails* are rounded off that they may not mark the *Paper*.

Theſe *Racks* are Hung over Head, either in the *Printing-Houſe*, or *Ware-houſe*, or both, or any other Room that is moſt convenient to *Dry Paper* in; they are hung a-thwart two *Rails* an Inch thick, and about three or four Inches deep, which *Rails* are faſtned to ſome Joyſts or other Timber in the Ceiling by Stiles perpendicular to the Ceiling; Theſe *Rails* ſtand ſo wide aſſunder, that each end of the *Racks* may hang beyond them about the diſtance of two Foot, and have on their upper edge at ten Inches diſtance from one another, ſo many ſquare Notches cut into them as the whole length of the *Rail* will bear; Into theſe ſquare notches the *Racks* are laid parallel to each other with the flat ſide downwards, and the Rounded off ſide upwards.

The *Peel* is deſcribed in Plate 9. at l, which Figure ſufficiently ſhews what it is; And therefore I ſhall need ſay no more to it, only its Handle may be longer or ſhorter according as the height of the Room it is to be uſed in may require.

¶. 23. *Of* Inck.

The providing of good *Inck*, or rather good *Varniſh* for *Inck*, is none of the leaſt incumbent cares upon our *Maſter-Printer*, though Cuſtom has almoſt made it ſo here in *England*; for the proceſs of making *Inck* being as well laborious to the Body, as noyſom

ſom and ungrateful to the Sence, and by ſeveral odd accidents dangerous of Firing the Place it is made in, Our *Engliſh Maſter-Printers* do generally diſcharge themſelves of that trouble; and inſtead of having good *Inck*, content themſelves that they pay an *Inck-maker* for good *Inck*, which may yet be better or worſe according to the Conſcience of the *Inck-maker*.

That our Neighbours the *Hollanders* who exhibit Patterns of good *Printing* to all the World, are careful and induſtrious in all the circumſtances of good *Printing*, is very notorious to all Book-men; yet ſhould they content themſelves with ſuch *Inck* as we do, their Work would appear notwithſtanding the other circumſtances they obſerve, far leſs graceful than it does, as well as ours would appear more beautiful if we uſed ſuch *Inck* as they do: for there is many Reaſons, conſidering how the *Inck* is made with us and with them, why their *Inck* muſt needs be better than ours. As *Firſt*, They make theirs all of good old *Linſeed-Oyl* alone, and perhaps a little *Roſin* in it ſometimes, when as our *Inck-makers* to ſave charges mingle many times *Trane-Oyl* among theirs, and a great deal of *Roſin*; which *Trane-Oyl* by its groſsneſs, Furs and Choaks up a *Form*, and by its fatneſs hinders the *Inck* from drying; ſo that when the Work comes to the *Binders*, it *Sets off*; and beſides is dull, ſmeary and unpleaſant to the Eye. And the *Roſin* if too great a quantity be put in, and the *Form* be not very *Lean Beaten*, makes the *Inck* turn yellow: And the ſame does New *Linſeed-Oyl*.

Secondly, They ſeldom *Boyl* or *Burn* it to that conſiſtence the *Hollanders* do, becauſe they not only ſave labour and Fewel, but have a greater weight of *Inck* out

out of the ſame quantity of *Oyl* when leſs *Burnt* away than when more *Burnt* away; which want of Burning makes the *Inck* alſo, though made of good old *Linſeed Oyl* Fat and Smeary, and hinders its *Drying*; ſo that when it comes to the *Binders* it alſo *Sets off*.

Thirdly, They do not uſe that way of clearing their *Inck* the *Hollanders* do, or indeed any other way than meer Burning it, whereby the *Inck* remains more *Oyly* and *Greaſie* than if it were well clarified.

Fourthly, They to ſave the *Preſs-man* the labour of *Rubbing* the *Blacking* into *Varniſh* on the *Inck-Block*, *Boyl* the *Blacking* in the *Varniſh*, or at leaſt put the *Blacking* in whilſt the *Varniſh* is yet *Boyling-hot*, which ſo *Burns* and *Rubifies* the *Blacking*, that it loſes much of its briſk and vivid black complexion.

Fifthly, Becauſe *Blacking* is dear, and adds little to the weight of *Inck*, they ſtint themſelves to a quantity which they exceed not; ſo that ſometimes the *Inck* proves ſo unſufferable *Pale*, that the *Preſs-man* is forc'd to *Rub* in more *Blacking* upon the *Block*; yet this he is often ſo loth to do, that he will rather hazard the content the Colour ſhall give, than take the pains to amend it: ſatisfying himſelf that he can lay the blame upon the *Inck-maker*.

Having thus hinted at the difference between the *Dutch* and *Engliſh Inck*, I ſhall now give you the Receipt and manner of making the *Dutch-Varniſh*.

They provide a *Kettle* or a *Caldron*, but a *Caldron* is more proper, ſuch an one as is deſcribed in Plate 9. at m. This Veſſel ſhould hold twice ſo much *Oyl* as they intend to *Boyl*, that the *Scum* may be ſome conſiderable time a *Riſing* from the top of the *Oyl* to the top of the Veſſel to prevent danger. This *Caldron*

dron hath a Copper Cover to fit the Mouth of it, and this Cover hath an Handle at the top of it to take it off and put it on by. This *Caldron* is ſet upon a good ſtrong Iron *Trevet*, and fill'd half full of old *Linſeed-Oyl*, the older the better, and hath a good Fire made under it of ſolid matter, either *Sea Coal*, *Charcoal* or pretty big Chumps of Wood that will burn well without much Flame; for ſhould the Flame riſe too high, and the *Oyl* be very hot at the taking off the Cover of the *Caldron*, the fume of the *Oyl* might be apt to take Fire at the Flame, and endanger the loſs of the *Oyl* and Firing the Houſe: Thus they let *Oyl* heat in the *Caldron* till they think it is Boyling-hot; which to know, they peel the outer Films of an *Oynion* off it, and prick the *Oynion* faſt upon the end of a ſmall long Stick, and ſo put it into the heating *Oyl*: If it be Boyling-hot, or almoſt Boyling-hot, the *Oynion* will put the *Oyl* into a Fermentation, ſo that a Scum will gather on the top of the *Oyl*, and riſe by degrees, and that more or leſs according as it is more or leſs Hot: But if it be ſo very Hot that the Scum riſes apace, they quickly take the *Oynion* out, and by degrees the Scum will fall. But if the *Oyl* be Hot enough, and they intend to put any *Roſin* in, the quantity is to every Gallon of *Oyl* half a Pound, or rarely a whole Pound. The *Roſin* they beat ſmall in a *Mortar*, and with an Iron Ladle, or elſe by an Handful at a time ſtrew it in gently into the *Oyl* leſt it make the Scum riſe too faſt; but every Ladle-full or Handful they put in ſo leaſurely after one another, that the firſt muſt be wholly diſſolv'd before they put any more in; for elſe the Scum will Riſe too faſt, as aforeſaid: So that you

you may perceive a great care is to keep the Scum down: For if it Boyl over into the Fire never ſo little, the whole Body of *Oyl* will take Fire immediately.

If the *Oyl* be Hot enough to *Burn*, they *Burn* it, and that ſo often till it be *Hard* enough, which ſometimes is ſix, ſeven, eight times, or more.

To *Burn* it they take a long ſmall Stick, or double up half a Sheet of Paper, and light one end to ſet Fire to the *Oyl*; It will preſently Take if the *Oyl* be Hot enough, if not, they Boyl it longer, till it be.

To try if it be *Hard* enough, they put the end of a Stick into the *Oyl*, which will lick up about three or four drops, which they put upon an Oyſter-ſhell, or ſome ſuch thing, and ſet it by to cool, and when it is cold they touch it with their Fore or Middle-Finger and Thumb, and try its conſiſtence by ſticking together of their Finger and Thumb; for if it draw ſtiff like ſtrong *Turpentine* it is Hard enough, if not, they Boyl it longer, or *Burn* it again till it be ſo conſolidated.

When it is well Boyled they throw in an Ounce of Letharge of Silver to every four Gallons of *Oyl* to Clarifie it, and Boyl it gently once again, and then take it off the Fire to ſtand and cool, and when it is cool enough to put their Hand in, they Strain it through a Linnen Cloath, and with their Hands wring all the *Varniſh* out into a Leaded Stone Pot or Pan, and keeping it covered, ſet it by for their uſe; The longer it ſtands by the better, becauſe it is leſs ſubject to turn Yellow on the Paper that is Printed with it.

This is the *Dutch* way of making *Varniſh*, and the way the Engliſh *Inck-makers* ought to uſe.

Note, *Firſt*, That the *Varniſh* may be made without *Burning* the *Oyl*, *viz.* only with well and long Boyl-

Boyling it; for *Burning* is but a violent way of Boyling, to conſolidate it the ſooner.

Secondly, That an *Apple* or a *Cruſt* of *Bread*, *&c.* ſtuck upon the end of a Stick inſtead of an *Oynion* will alſo make the Scum of the *Oyl* riſe: For it is only the Air contained in the Pores of the *Apple*, *Cruſt* or *Oynion*, &c. preſſed or forced out by the violent heat of the *Oyl*, that raiſes the many Bubbles on the top of the *Oyl*: And the connection of thoſe Bubbles are vulgarly called *Scum*.

Thirdly, The Engliſh *Inck-makers* that often make *Inck*, and that in great quantities, becauſe one Man may ſerve all *England*, inſtead of ſetting a *Caldron* on a *Trevet*, build a *Furnace* under a great *Caldron*, and Trim it about ſo with Brick, that it Boyls far ſooner and more ſecurely than on a *Trevet*; becauſe if the *Oyl* ſhould chance to Boyl over, yet can it not run into the Fire, being Fenced round about with Brick as aforeſaid, and the *Stoking-hole* lying far under the *Caldron*.

Fourthly, When for want of a *Caldron* the *Maſter-Printer* makes *Varniſh* in a *Kettle*, He provides a great piece of thick *Canvaſs*, big enough when three or four double to cover the *Kettle*, and alſo to hang half round the ſides of the *Kettle*: This *Canvaſs* (to make it more ſoluble) is wet in Water, and the Water well wrung out again, ſo that the *Canvaſs* remains only moiſt: Its uſe is to throw flat over the Mouth of the *Kettle* when the *Oyl* is *Burning*, to keep the ſmoak in, that it may ſtifle the Flame when they ſee cauſe to put it out. But the Water as was ſaid before, muſt be very well wrung out of the *Canvaſs*, for ſhould but a drop or two fall from the ſides of it into the *Oyl* when it is Burning, it will ſo enrage the *Oyl*, and raiſe the Scum, that it might endanger the working over the top of the *Kettle*.

Having ſhewn you the *Maſter-Printers* Office, I account it ſuitable to proper Method, to let you know how the *Letter-Founder* Cuts the *Punches*, how the *Molds* are made, the *Matrices* Sunck, and the *Letter Caſt* and *Dreſt*, for all theſe Operations precede the *Compoſiters* Trade, as the *Compoſiters* does the *Preſsmans*; wherefore the next *Exerciſes* ſhall be (God willing) upon *Cutting* of the *Steel-Punches*. *ME-*

MECHANICK EXERCISES:

Or, the Doctrine of

Handy-works.

Applied to the Art of

Letter-Cutting.

PREFACE.

LEtter-Cutting *is a Handy-Work hitherto kept ſo conceal'd among the Artificers of it, that I cannot learn any one hath taught it any other; But every one that has uſed it, Learnt it of his own Genuine Inclination. Therefore, though I cannot (as in other Trades) deſcribe the general Practice of Work-men, yet the Rules I follow I ſhall ſhew here, and have as good an Opinion of theſe Rules, as thoſe have that are ſhyeſt of diſcovering theirs. For, indeed, by the appearance of ſome Work done, a judicious Eye may doubt whether they go by any Rule at all, though Geometrick Rules, in no Practice whatever, ought to be more nicely or exactly obſerved than in this.*

§ 12.

§. 12. ¶. 1. *Of Letter-Cutters Tools.*

THe making of *Steel Punches* is a Branch of the *Smith*'s Trade: For, as I told you in the Preface to *Numb.* 1. The *Black-Smith*'s Trade comprehends all Trades that uſe either Forge or File, from the *Anchor-Smith*, to the *Watch-maker*: They all working by the ſame Rules, though not with equal exactneſs; and all uſing the ſame Tools, though of different Sizes from thoſe the Common *Black-Smith* uſes; and that according to the various purpoſes they are applied, *&c.* Therefore, indeed, a *Letter-Cutter* ſhould have a Forge ſet up, as by *Numb.* 1. But ſome *Letter-Cutters* may ſeem to ſcorn to uſe a Forge, as accounting it too hard Labour, and Ungenteel for themſelves to officiate at. Yet they all well know, that though they may have a common *Black-Smith* perform their much and heavy Work, that many times a Forge of their own at Hand would be very commodious for them in ſeveral accidental little and light Jobs, which (in a Train of Work) they muſt meet withal.

But if our *Letter-Cutter* will have no Forge, yet he muſt of neceſſity accommodate himſelf with a *Vice*, *Hand-Vice*, *Hammers*, *Files*, *Small* and *Fine Files* (commonly called *Watch-makers Files)* of theſe he ſaves all, as they wear out, to ſmooth and burniſh the Sides and Face of his Letter with, as ſhall be ſhewed; *Gravers*, and *Sculpters* of all ſorts, an *Anvil*, or a *Stake*, an *Oyl-ſtone*, *&c.* And of theſe, ſuch as are ſuitable and ſizable to the ſeveral Letters he

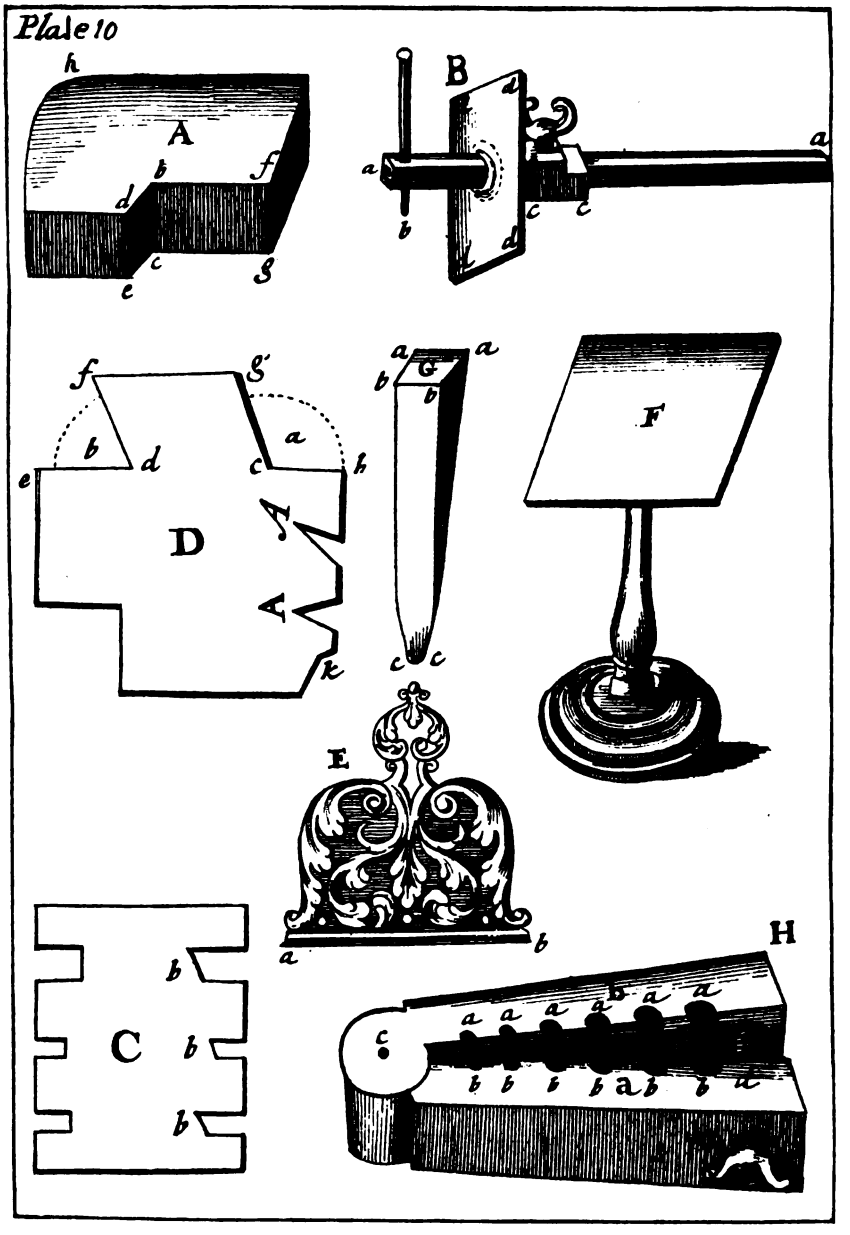


Plate 10
A
B
C
D
E
F
G
H

he is to Cut. Theſe, or many of theſe Tools, being deſcribed in *Numb.* 1. I refer my Reader thither, and proceed to give an account of ſome Tools peculiar to the *Letter-Cutter*, though not of particular uſe to the Common *Black-Smith.*

¶. 2. *Of the* Uſing-File.

This *File* is about nine or ten Inches long, and three or four Inches broad, and three quarters of an Inch thick: The two broad ſides muſt be exactly flat and ſtraight: And the one ſide is commonly cut with a *Baſtard-Cut*, the other with a *Fine* or *Smooth Cut.* (See *Numb.* 1. *Fol.* 14, 15.) Its uſe is to *Rub* a piece of Steel, Iron, or Braſs, *&c.* flat and ſtraight upon, as ſhall be ſhewed hereafter.

In chuſing it, you muſt ſee it be exactly Flat and Straight all its Length and Breadth: For if it in any part Belly out, or be Hollow inwards, what is Rubbed upon it will be Hollow, Rubbing on the Bellying part; and Bellying, Rubbing on the Hollow part. You muſt alſo ſee that it be very Hard; and therefore the thickeſt *Uſing-Files* are likelieſt to prove beſt, becauſe the thin commonly Warp in Hardning.

¶. 3. *Of the* Flat-Gage.

The *Flat-Gage* is deſcribed in *Plate* 10. at A. It is made of a flat piece of Box, or other Hard Wood. Its Length is three Inches and an half, its Breadth two Inches and an half, and its Thickneſs one Inch and an

an half. This is on the Flat, first made Square, but afterwards hath one of its Corners (as *h*) a little rounded off, that it may the easier comply with the Ball of the Hand. Out of one of its longest Sides, *viz.* that not rounded off, is Cut through the thickness of it an exact Square, whose one side *b f*, *c g* is about an Inch and three quarters long; and its other side *b d*, *c e* about half an Inch long. The Depth of these Sides and their Angle is exactly Square to the top and bottom of the upper and under Superficies of the *Flat-Gage*.

Its Use is to hold a Rod of Steel, or Body of a *Mold*, *&c.* exactly perpendicular to the Flat of the *Using-File*, that the end of it may rub upon the *Using-File*, and be Filed away exactly Square, and that to the Shank; as shall more at large be shewed in §. 2. ¶. 3.

¶. 4. *Of the* Sliding Gage.

The *Sliding Gage* is described in *Plate* 10. at *Fig.* B. It is a Tool commonly used by *Mathematical Instrument-Makers*, and I have found it of great use in *Letter-Cutting*, and making of *Molds*, *&c.* *a a* the Beam, *b* the Tooth, *c c* the Sliding Socket, *d d d d* the Shoulder of the Socket.

Its Use is to measure and set off Distances between the Sholder and the Tooth, and to mark it off from the end, or else from the edge of your Work.

I always use two or three of these *Gages*, that I need not remove the Sholder when it is set to a Distance which I may have after-use for; as shall in Working be shewed more fully.

¶. 5.

¶. 5. *Of the* Face-Gages, *marked* C *in Plate* 10.

The *Face-Gage* is a Square Notch cut with a File into the edge of a thin Plate of Steel, Iron, or Braſs, the thickneſs of a piece of common Latton, and the Notch about an *Engliſh* deep. There be three of theſe Gages made, for the Letters to be cut on one Body; but they may be all made upon one thin Plate, the readier to be found, as at D. As firſt, for the Long Letters; Secondly, for the Aſſending Letters; And Thirdly, for the Short Letters. The Length of theſe ſeveral Notches, or Gages, have their Proportions to the Body they are cut to, and are as follows. We ſhall imagine (for in Practice it cannot well be perform'd, unleſs in very large Bodies) that the Length of the whole Body is divided into forty and two equal Parts.

The *Gage* for the Long Letters are the length of the whole Body, *viz.* forty and two equal Parts. The *Gage* for the Aſſending Letters, *Roman* and *Italica*, are five Seventh Parts of the Body, *viz.* thirty Parts of Forty two, and thirty and three Parts for *Engliſh* Face. The *Gage* for the Short Letters are three Seventh Parts of the whole Body, *viz.* eighteen Parts of Forty two for the *Roman* and *Italica*, and twenty two Parts for the *Engliſh* Face.

It may indeed be thought impoſſible to divide a Body into ſeven equal Parts, and much more difficult to divide each of thoſe ſeven equal Parts into ſix equal Parts, which are Forty two, as aforeſaid, eſpecially if the Body be but ſmall; but yet it is poſſible

poſſible with curious Working: For ſeven thin Spaces may be Caſt and Rubb'd to do it. And for dividing each of the thin Spaces into ſix equal Parts, you may Caſt and Rub Full Point . to be of the thickneſs of one thin Space, and one ſixth part of a thin Space: And you may Caſt and Rub : to be the thickneſs of one thin Space, and two ſixth parts of a thin Space: And you may Caſt and Rub , to be the thickneſs of one thin Space, and three ſixth parts of a thin Space: And you may Caſt and Rub - to be the thickneſs of one thin Space, and four ſixth parts of a thin Space: And you may Caſt and Rub ; to be the thickneſs of one thin Space, and five ſixth parts of a thin Space.

The reaſon why I propoſe . to be Caſt and Rubb'd one ſixth part thicker than a thin Space, is only that it may be readily diſtinguiſhed from : , - ; which are two ſixth parts, three ſixth parts, four ſixth parts, five ſixth parts thicker than a thin Space. And for ſix ſixth parts thicker than a thin Space, two thin Spaces does it.

The manner of adjuſting theſe ſeveral Sixth Parts of Thickneſſes is as follows. You may try if ſix . exactly agree, and be even with ſeven thin Spaces; (or, which is all one, a Body) for then is each of thoſe ſix . one ſixth part thicker than a thin Space, becauſe it drives out a thin Space in ſix thin Spaces. And you may try if ſix : be equal to a Body and one thin Space; for then is each : two ſixth parts thicker than a thin Space. If ſix , be equal to nine thin Spaces, then each , is three ſixth parts of a thin Space thicker than a thin Space. If ſix - be

be equal to ten thin Spaces, then each - is four ſixth parts of a thin Space thicker than a thin Space. If ſix ; be equal to eleven thin Spaces, then each ; is five ſixth parts of a thin Space thicker than a thin Space.

Now, as aforeſaid, a thin Space being one ſeventh part of the Body, and the thin Space thus divided, you have the whole Body actually divided into forty and two equal parts, as I have divided them in my Drafts of Letters down the Sides, and in the Bottom Line.

Though I have thus ſhewed how to divide a thin Space into ſix equal Parts, yet when the Letter to be Cut proves of a ſmall Body, the thin Space divided into two equal Parts may ſerve: If it prove bigger, into three or four equal Parts: And of the largeſt Bodies, they may be divided into ſix, as aforeſaid.

If now you would make a *Gage* for any number of thin Spaces and Sixth Parts of a thin Space, you muſt take one thin Space leſs than the number of thin Spaces propoſed, and add . : , - ; according as the number of ſixth Parts of a thin Space require; and to thoſe complicated Thickneſſes you may file a ſquare Notch on the edge of the thin Plate aforeſaid, which ſhall be a ſtanding Gage or Meaſure for that number of thin Spaces and ſixth Parts of a thin Space.

All the Exception againſt this way of Meaſuring is, that thin Spaces caſt in Metal may be ſubject to bow, and ſo their Thickneſſes may prove deceitful. But, in Anſwer to that, I ſay, you may, if you will,

Caſt

Caſt I for two thin Spaces thick, e for three thin Spaces thick, S for four thin Spaces thick, L for five thin Spaces thick, D for ſix thin Spaces thick, or any other Letters near theſe ſeveral Thickneſſes, as you think fit; only remember, or rather, make a Table of the number of thin Spaces that each Letter on the Shank is Caſt for. And by complicating the Letters and Points, as aforeſaid, you will have any Thickneſs, either to make a Gage by, or to uſe otherwiſe.

On the other Edge of the *Face-Gage* you may file three other Notches, of the ſame Width with thoſe on the former Edge, for the Long, the Aſſending, and Short Letters. But though the two ſides of each of theſe Notches are parallel to each other, yet is not the third ſide ſquare to them, but hath the ſame Slope the *Italick* hath from the *Roman*; as you may ſee in the Figure at *b b b*.

¶. 6. *Of* Italick, *and other* Standing Gages.

Theſe *Gages* are to meaſure (as aforeſaid) the Slope of the *Italick* Stems, by applying the Top and Bottom of the *Gage* to the Top and Bottom Lines of the Letters, and the other Side of the *Gage* to the Stem: for when the Letter complies with theſe three ſides of the *Gage* that Letter hath its true Slope.

The manner of making theſe *Gages* (and indeed all other *Angular Gages*) is thus.

Place one Point of a Pair of Steel *Dividers* upon the thin Plate aforeſaid, at the Point *c* or *d* (in Fig.

Fig. D in *Plate* 10.) and with the other Point deſcribe a ſmall fine Arch of a Circle; as, *e f* or *g h*. In this Arch of the Circle muſt be ſet off on the *Gage a* 110 Degrees, and on the *Gage b* 70 Degrees, and draw from the Centres *c* and *d* two ſtraight Lines through thoſe numbers of Degrees: Then Filing away the Plate between the two Lines, the *Gages* are finiſhed.

To find the Meaſure of this, or any other number of Degrees, do thus; Deſcribe a Circle on a piece of Plate-Braſs of any Radius (but the larger the better) draw a ſtraight Line exactly through the Centre of this Circle, and another ſtraight Line to cut this ſtraight Line at right Angles in the Centre, through the Circle; ſo ſhall the Circle be divided into four Quadrants: Then fix one Foot of your Compaſſes (being yet unſtirr'd) in one of the Points where any of the ſtraight Lines cuts the Circle, and extend the moving Foot of your Compaſſes where it will fall in the Circle, and make there a Mark, which is 60 Degrees from the fixed Foot of the Compaſſes: Then fix again one Foot of your Compaſſes in the Interſection of the ſtraight Line and Circle that is next the Mark that was made before, and extend the moving Foot in the ſame Quadrant towards the ſtraight Line where you firſt pitch'd the Foot of your Compaſſes, and with the moving Foot make another Mark in the Circle. Theſe two Marks divide the Quadrant into three equal Parts: The ſame way you may divide the other three Quadrants; ſo ſhall the whole Circle be divided into twelve equal Parts; and each of theſe twelve equal parts contain

tain an Arch of thirty Degrees: Then with your Dividers divide each of theſe 30 Degrees into three equal Parts, and each of theſe three equal Parts into two equal Parts, and each of theſe two equal Parts into five equal Parts, ſo ſhall the Circle be divided into 360 equal Parts, for your uſe.

To uſe it, deſcribe on the Centre of the Circle an Arch of almoſt a Semi-Circle: This Arch muſt be exactly of the ſame Radius with that I preſcribed to be made on the *Gages a b*, from *e* to *f*, and from *g* to *h*; then count in your Circle of Degrees from any Diametral Line 110 Degrees; and laying a ſtraight Ruler on the Centre, and on the 110 Degrees aforeſaid, make a ſmall Mark through the ſmall Arch; and placing one Foot of your Compaſſes at the Interſection of the ſmall Arch, with the Diametral Line, open the other Foot to the Mark made on the ſmall Arch for 110 Degrees, and tranſfer that Diſtance to the ſmall Arch made on the *Gage:* Then through the Marks that the two Points of your Compaſſes make in the ſmall Arch on the *Gage*, draw two ſtraight Lines from the Centre *c:* and the Braſs between thoſe two ſtraight Lines being filed away, that *Gage* is made. In like manner you may ſet off any other number of Degrees, for the making of any other *Gage*.

In like manner, you may meaſure any Angle in the Drafts of Letters, by deſcribing a ſmall Arch on the Angular Point, and an Arch of the ſame Radius on the Centre of your divided Circle: For then, placing one Foot of your Compaſſes at the Interſection of the ſmall Arch with either of the ſtraight Lines

Lines proceeding from the Angle in the Draft, and extending the other Foot to the Interſection of the ſmall Arch, with the other ſtraight Line that proceeds from the Angle, you have between the Feet of your Compaſſes, the Width of the Angle; and by placing one Foot of your Compaſſes at the Interſection of any of the ſtraight Lines that proceed from the Centre of the divided Circle, and the ſmall Arch you made on it, and making a Mark where the other Foot of your Compaſſes falls in the ſaid ſmall Arch, you may, by a ſtraight Ruler laid on the Centre of the divided Circle, and the Mark on the ſmall Arch, ſee in the Limb of the Circle the number of Degrees contained between the Diametral, or ſtraight Line and the Mark.

If you have already a dividing-Plate of 360 Degrees, of a larger Radius than the Arch on your *Gage*, you may ſave your ſelf the labour of dividing a Circle (as aforeſaid,) and work by your dividing-Plate as you were directed to do with the Circle that I ſhewed you to divide.

In theſe Documents I have expoſed my ſelf to a double Cenſure; Firſt, of *Geometricians:* Secondly, of *Letter-Cutters. Geometricians* will cenſure me for writing anew that which almoſt every young Beginner knows: And *Letter-Cutters* will cenſure me for propoſing a Rule for that which they dare pretend they can do without Rule.

To the *Geometricians* I croſs the Cudgels: yet I writ this not to them; and I doubt I have written ſuperfluouſly to *Letter-Cutters*, becauſe I think few of them either will or care to take pains to underſtand theſe

theſe ſmall Rudiments of *Geometry*. If they do, and be ingenious, they will thank me for diſcovering this Help in their own Way, which few of them know. For by this Rule they will not only make Letters truer, but alſo quicker, and with leſs care; becauſe they ſhall never need to ſtamp their *Counter-Punch* in Lead, to ſee how it pleaſes them; which they do many times, before they like their *Counter-Punch*, (be it of A *A* V v W w *V W*, and ſeveral other Letters) and at laſt finiſh their *Counter-Punch* but with a good Opinion they have that it may do well, though they frequently ſee it does not in many Angular Letters on different Bodies Cut by the ſame Hand. And were *Letter-Cutting* brought to ſo common Practice as *Joynery*, *Cabinet-making*, or *Mathematical Inſtrument-making*, every young Beginner ſhould then be taught by Rules, as they of theſe Trades are; becauſe *Letter-Cutting* depends as much upon Rule and Compaſs as any other Trade does.

You may in other places, where you find moſt Convenience (as at *i*) make a Square, which may ſtand you in ſtead for the Squaring the Face and Stems of the *Punch* in *Roman* Letters, and alſo in many other Uſes.

And you may make *Gages*, as you were taught before to try the *Counter-Punches* of Angular Letters; as, A K M N V X Y Z, *Romans* and *Italicks*, *Capitals* and *Lower-Caſe*. But then, that you may know each diſtinct *Gage*, you may engrave on the ſeveral reſpective *Gages*, at the Angle, A *A* 4 *&c.* For by examining by the Drafts of Letters, what Angle their Inſides make, you may ſet that Angle off, and make

make the *Gage* as you were taught before, in the *Gage* for the Slope of *Italicks*.

¶. 7. *Of the* Liner.

The *Liner* is marked E in *Plate* 10. It is a thin Plate of Iron or Braſs, whoſe Draft is ſufficient to expreſs the Shape. The Uſe of it is on the under-edge *a b* (which is about three Inches long) and is made truly ſtraight, and pretty ſharp or fine; that being applied to the Face of a *Punch*, or other piece of Work, it may ſhew whether it be ſtraight or no.

¶. 8. *Of the* Flat-Table.

The *Flat-Table* at F in *Plate* 10. The Figure is there ſufficient. All its Uſe is the Table F, for that is about one Inch and an half ſquare, and on its Superficies exactly ſtraight and flat. It is made of Iron or Braſs, but Braſs moſt proper. Its Uſe is to try if the Shank of a *Punch* be exactly Perpendicular to its Face, when the Face is ſet upon the *Table*; for if the Shank ſtand then directly upright to the Face of the *Table*, and lean not to any ſide of it, it is concluded to be perpendicular.

It hath ſeveral other Uſes, which, when we come to *Caſting* of *Letters*, and *Juſtifying* of *Matrices*, ſhall be ſhewn.

¶. 9.

¶. 9. *Of the* Tach.

The *Tach* is a piece of Hard-Wood, (Box is very good) about three Inches broad, ſix Inches long, and three quarters of an Inch thick. About half its Length is faſtned firm down upon the *Work-Bench*, and its other half projects over the hither Edge of it. It hath three or four Angular Notches on its Fore-end to reſt and hold the Shank of a *Punch* ſteady when the End of the *Punch* is ſcrewed in the *Hand-Vice*, and the *Hand-Vice* held in the Left Hand, while the *Work-man* Files or Graves on it with his Right Hand.

Inſtead of Faſtning the *Tach* to the *Bench*, I *Saw* a ſquare piece out of the further half of the *Tach*, that it may not be too wide for the Chaps of the *Vice* to take and ſcrew that narrow End into the Chaps of the *Vice*, becauſe it ſhould be leſs cumberſome to my *Work-Bench*.

¶. 10. *Of Furniſhing the* Work-Bench.

The *Work-man* hath all his great *Files* placed in Leather Nooſes, with their Handles upwards, that he may readily diſtinguiſh the *File* he wants from another *File*. Theſe Nooſes are nailed on a Board that Caſes the Wall on his Right Hand, and as near his *Vice* as Convenience will admit, that he may the readier take any *File* he wants.

He hath alſo on his Right Hand a Tin Pot, of about a Pint, with ſmall *Files* ſtanding in it, with their

their Handles downwards, that their Blades may be the readier ſeen. Theſe ſmall *Files* are called *Watch-makers Files*, and the *Letter-Cutter* hath occaſion to uſe theſe of all Shapes, *viz. Flat, Pillar, Square, Triangular, Round, Half-Round, Knife-Files, &c.*

He alſo provides a ſhallow ſquare Box, of about five Inches long, and three Inches broad, to lay his ſmall Inſtruments in; as, his *Gages*, his *Liner*, ſome common *Punches, &c.* This Box he places before him, at the further ſide of the *Work-Bench.*

He alſo provides a good *Oyl-Stone*, to ſharpen his *Gravers* and *Sculpters* on. This he places at ſome diſtance from the *Vice*, on his Left Hand.

§. 13. ¶. 1. *Of* Letter-Cutting.

The *Letter-Cutter* does either Forge his *Steel-Punches*, or procures them to be forged; as I ſhewed, *Numb.* 1. *Fol.* 8, 9, 10. in *Vol.* I. *&c.* But great care muſt be taken, that the Steel be ſound, and free from Veins of Iron, Cracks and Flaws, which may be diſcerned; as I ſhewed in *Numb.* 3. *Vol.* I. For if there be any Veins of Iron in the Steel, when the Letter is Cut and Temper'd, and you would Sink the *Punch* into the Copper, it will batter there: Or it will Crack or Break if there be Flaws.

If there be Iron in it, it muſt with the Chiſſel be ſplit upon a good Blood-Red-Heat in that place, and the Iron taken or wrought out; and then with another, or more Welding Heat, or Heats, well doubled up, and laboured together, till the Steel become a ſound entire piece. This Operation *Smiths* call *Well Currying of the Steel.* If

If there be Flaws in it, you muſt alſo take good Welding Heats, ſo hot, that the contiguous ſides of the Flaws may almoſt Run: for then, ſnatching it quickly out of the Fire, you may labour it together till it become cloſe and ſound.

Mr. *Robinſon*, a *Black-Smith* of *Oxford*, told me a way he uſes that is ingenious, and ſeems rational: For if he doubts the Steel may have ſome ſmall Flaws that he can ſcarce diſcern, he takes a good high Blood-Red Heat of it, and then twiſts the Rod or Bar (as I ſhewed, *Numb.* 3. *Vol.* I.) which Twiſting winds the Flaws about the Body of the Rod, and being thus equally diſpoſed, more or leſs, into the Out-ſides of the Rod, according as the Poſition of the Flaw may be, allows an equal Heat on all ſides to be taken, becauſe the Out-ſides heat faſter than the In-ſide; and therefore the Out-ſides of the Steel are not thus ſo ſubject to Burn, or Run, as if it ſhould be kept in the Fire till the Middle, or In-ſide of it ſhould be ready to Run. And when the Steel is thus well welded, and ſoundly laboured and wrought together with proper Heats, he afterwards reduces it to Form.

Now, that I may be the better underſtood by my Reader as he reads further, I have, in *Plate* 10. at *Fig.* G deſcribed the ſeveral Parts of the *Punch*; which I here explain.

G The Face.

a a, *b b* The Thickneſs.

a b, *a b* The Heighth.

a c, *b c*, *b c* The Length of the Shank, about an Inch and three quarters long.

c c c The Hammer-End. This

This is no ſtrict Length for the Shank, but a convenient Length; for ſhould the Letter Cut on the Face be ſmall, and conſequently, the Shank ſo too, and the Shank much longer, and it (as ſeldom it is) not Temper'd in the middle, it might, with Punching into Copper, bow in the middle, either with the weight of the Hammer, or with light reiterated Blows: And ſhould it be much ſhorter, there might perhaps Finger-room be wanting to manage and command it while it is Punching into the Copper. But this Length is long enough for the biggeſt Letters, and ſhort enough for the ſmalleſt Letters.

The Heighth and Thickneſs cannot be aſſign'd in general, becauſe of the diverſity of Bodies, and Thickneſs of Letters: Beſides, ſome Letters muſt be Cut on a broad Face of Steel, though, when it is Cut, it is of the ſame Body; as all Letters are, to which *Counter-Punches* are uſed; becauſe the Striking the *Counter-Punch* into the Face of the *Punch* will, if it have not ſtrength enough to contain it, break or crack one or more ſides of the *Punch*, and ſo ſpoil it. But if the Letter be wholly to be Cut, and not Counter-Punch'd, as I ſhall hereafter hint in general what Letters are not, then the Face of the *Punch* need be no bigger, or, at leaſt, but a ſmall matter bigger than the Letter that is to be cut upon it.

Now, If the Letter be to be Counter-punch'd, the Face of the *Punch* ought to be about twice the Heighth, and twice the Thickneſs of the Face of the *Counter-Punch*; that ſo, when the *Counter-Punch* is ſtruck juſt on the middle of the Face of the *Punch*, a con-

convenient Subſtance, and conſequently, Strength of Steel on all its Sides may be contained to reſiſt the Delitation, that the Sholder or Beard of the *Counter-Punch* ſinking into it, would elſe make.

If the *Letter-Cutter* be to Cut a whole Set of *Punches* of the ſame Body of *Roman* and *Italica*, he provides about 240 or 260 of theſe *Punches*, becauſe ſo many will be uſed in the *Roman* and *Italica Capitals* and *Lower-Caſe*, *Double-Letters*, *Swaſh-Letters*, *Accented Letters*, *Figures*, *Points*, *&c.* But this number of *Punches* are to have ſeveral Heighths and Thickneſſes, though the Letters to be Cut on them are all of the ſame Body.

What Heighth and Thickneſs is, I have ſhewed before in this §, but not what Body is; therefore I ſhall here explain it.

By Body is meant, in *Letter-Cutters*, *Founders* and *Printers* Language, the Side of the Space contained between the Top and Bottom Line of a Long Letter. As in the Draft of Letters, the divided Line on the Left Hand of A is divided into forty and two equal Parts; and that Length is the Body, thus: J being an Aſcending and Deſcending Letter, *viz.* a long Letter, ſtands upon forty two Parts, and thereſore fills the whole Body.

There is in common Uſe here in *England*, about eleven Bodies, as I ſhewed in §. 2. ¶. 2. of this Volumne.

I told you even now, that all the *Punches* for the ſame Body muſt not have the ſame Heighth and Thickneſs: For ſome are Long; as, J j Q, and ſeveral others; as you may ſee in the Drafts of Letters: and theſe long Letters ſtand upon the whole Heighth of the Body. The

The Aſcending and Deſcending Letters reach from the Foot-Line, up to the Top-Line; as all the Capital Letters are Aſcending Letters, and ſo are many of the Lower-Caſe Letters; as, b d f, and ſeveral others. The Deſcending Letters are of the ſame Length with the Aſcending Letters; as, g p q and ſeveral others. Theſe are contained between the Head-Line and the Bottom-Line. The Short Letters are contained between the Head-Line and the Bottom-line. Theſe are three different Sizes of Heighth the *Punches* are made to, for Letters of the ſame Body. But in proper place I ſhall handle this Subject more large and diſtinctly.

And as there is three Heighths or Sizes to be conſidered in Letters Cut to the ſame Body, ſo is there three Sizes to be conſidered, with reſpect to the Thickneſſes of all theſe Letters, when the *Punches* are to be Forged: For ſome are m thick; by m thick is meant m *Quadrat* thick, which is juſt ſo thick as the Body is high: Some are n thick; that is to ſay, n *Quadrat* thick, *viz.* half ſo thick as the Body is high: And ſome are *Space* thick; that is, one quarter ſo thick as the Body is high; though Spaces are ſeldom Caſt ſo thick, as ſhall be ſhewed when we come to *Caſting:* and therefore, for diſtinction ſake, we ſhall call theſe Spaces, Thick Spaces.

The firſt three Sizes fit exactly in Heighth to all the Letters of the ſame Body; but the laſt three Sizes fit not exactly in Thickneſs to the Letters of the ſame Body; for that ſome few among the Capitals are more than m thick, ſome leſs than m thick, and more than n thick; and ſome leſs than n thick, and more

more than Space thick; yet for Forging the *Punches*, theſe three Sizes are only in general Conſidered, with Exception had to Æ Æ Q, and moſt of the Swaſh Letters; which being too thick to ſtand on an m, muſt be Forged thicker, according to the Work-man's Reaſon.

After the Work-man has accounted the exact number of Letters he is to Cut for one Set, he conſiders what number he ſhall uſe of each of theſe ſeveral Sizes in the *Roman*, and of each of theſe ſeveral Sizes in the *Italick*; (for the *Punches* of *Romans* and *Italicks*, if the Body is large, are not to be Forged to the ſame ſhape, as ſhall be ſhewed by and by) and makes of a piece of Wood one Pattern of the ſeveral Sizes that he muſt have each number Forged to. Upon every one of theſe Wooden Patterns I uſe to write with a Pen and Ink the number of *Punches* to be Forged of that Size, leſt afterwards I might be troubled with Recollections.

I ſay (for Example) He conſiders how many long Letters are m thick, how many long Letters are n thick, and how many long Letters are Space thick, in the *Roman*; and alſo conſiders which of theſe muſt be Counter-punch'd, and which not: For (as was ſaid before) thoſe Letters that are to be Counter-punch'd are to have about twice the Heighth and twice the Thickneſs of the Face of the *Counter-Punch*, for the Reaſon aforeſaid. But the Letters not to be Counter-punch'd need no more Subſtance but what will juſt contain the Face of the Letter; and makes of theſe three Sizes three Wooden Patterns, of the exact Length, Heighth and Thickneſs that the Steel *Punches* are to be Forged to. He

He alſo counts how many are Aſcendents and Deſcendents, m-thick, n-thick, and Space thick; ſtill conſidering how many of them are to be Counter-punch'd, and how many not; and makes Wooden Patterns for them.

The like he does for ſhort Letters; and makes Wooden Patterns for them, for Steel *Punches* to be Forged by.

And as he has made his Patterns for the *Roman*, ſo he makes Patterns for the *Italick* Letters alſo; for the ſame ſhap'd *Punches* will not ſerve for *Italick*, unleſs he ſhould create a great deal more Work to himſelf than he need do: For *Italick Punches* are not all to be Forged with their ſides ſquare to one another, as the *Romans* are; but only the higheſt and loweſt ſides muſt ſtand in Line with the higheſt and loweſt ſides of the *Roman*; but the Right and Left Hand ſides ſtand not parallel to the Stems of the *Roman*, but muſt make an Angle of 20 Degrees with the *Roman* Stems: ſo that the Figure of the Face of the *Punch* will become a *Rhomboides*, as it is called by *Geometricians*, and the Figure of this Face is the Slope that the *Italick* Letters have from the *Roman*, as in proper place ſhall be further ſhewed. Now, ſhould the *Punches* for theſe Letters be Forged with each ſide ſquare to one another, the *Letter-Cutter* would be forced to ſpend a great deal of Time, and take great pains to File away the ſuperfluous Steel about the Face of the Letter when he comes to the Finiſhing of it, eſpecially in great Bodied Letters. Yet are not all the *Italick* Letters to be Forged on the Slope; for the *Punches* of ſome of them, as the

m n,

m n, and many others, may have all, or, at leaſt, three of their ſides, ſquare to one another, though their Stems have the common Slope, becauſe the ends of their Beaks and Tails lie in the ſame, perpendicular with the Outer Points of the Bottom and Top of their Stems, as is ſhewed in the Drafts of Letters.

Though I have treated thus much on the Forging of Punches, yet muſt all what I have ſaid be underſtood only for great Bodied *Punches*; *viz.* from the *Great Primer*, and upwards. But for ſmaller Bodies; as *Engliſh*, and downwards, the *Letter-Cutter* generally, both for *Romans* and *Italicks*, gets ſo many ſquare Rods of Steel, Forged out of about two or three Foot in Length, as may ſerve his purpoſe; which Rods he elects as near his Body and Sizes as his Judgment will ſerve him to do; and with the edge of a Half-round File, or a Cold-Chiſſel, cuts them into ſo many Lengths as he wants *Punches*. Nay, many of theſe Rods may ſerve for ſome of the ſmall Letters in ſome of the greater Bodies; and alſo, for many of their *Counter-Punches*.

Having thus prepared your *Punches*, you muſt Neal them, as I ſhewed in *Numb.* 3. *Vol.* I.

¶. 2. *Of* Counter-Punches.

The *Counter-Punches* for great Letters are to be Forged as the *Letter-Punches*; but for the ſmaller Letters, they may be cut out of Rods of Steel, as aforeſaid. They muſt alſo be well Neal'd, as the *Punches*. Then muſt one of the ends be Filed away on

on the out-ſide the Shank, to the exact ſhape of the in-ſide of the Letter you intend to Cut. For Example, If it be *A* you would Cut; This *Counter-Punch* is eaſie to make, becauſe it is a Triangle; and by meaſuring the In-ſide of the Angle of *A* in the Draft of Letters, as you were taught, §. 12. ¶. 6. you may make on your Standing *Gage-Plate* a *Gage* for that Angle: So that, let the Letter to be Cut be of what Body you will, from the leaſt, to the biggeſt Body, you have a Standing *Gage* for this *Counter-Punch*, ſo oft as you may have occaſion to Cut A.

The *Counter-Punch* of *A* ought to be Forged Triangularly, eſpecially towards the Punching End, and Tryed by the *A Gage*, as you were taught to uſe the Square, *Numb.* 3. *Vol.* I. Yet, for this and other Triangular *Punches*, I commonly reſerve my worn out three ſquare Files, and make my *Counter-Punch* of a piece of one of them that beſt fits the Body I am to Cut.

Having by your *A-Gage* fitted the Top-Angle and the Sides of this *Counter-Punch*, you muſt adjuſt its Heighth by one of the three *Face-Gages* mentioned in §. 12. ¶. 5. *viz.* by the Aſcending *Face-Gage*; for *A* is an Aſcending Letter. By Adjuſting, I do not mean, you muſt make the *Counter-Punch* ſo high, as the Depth of the Aſcending *Face-Gage*; becauſe in this Letter here is to be conſidered the Top and the Footing, which ſtrictly, as by the large Draft of *A*, make both together five ſixth Parts of a thin Space: Therefore five ſixth Parts muſt be abated in the Heighth of your *Counter-Punch*, and it muſt be but four thin Spaces, and one ſixth part of a thin Space

Space high, becauſe the Top above the *Counter-Punch*, and the Footing below, makes five ſixth Parts of a thin Space, as aforeſaid.

Therefore, to meaſure off the Width of four thin Spaces and one ſixth Part of a thin Space, lay three thin Spaces, or, which is better, the Letter e, which is three thin Spaces, as aforeſaid; and . which is one thin Space and one ſixth part of a thin Space, upon one another; for they make together, four thin Spaces, and one ſixth part of a thin Space; and the thickneſs of theſe two Meaſures ſhall be the Heighth of the *Counter-Punch*, between the Footing and the Inner Angle of *A*. And thus, by this Example, you may couple with proper Meaſures either the whole Forty two, which is the whole Body, or any number of its Parts, as I told you before.

This Meaſure of four thin Spaces and one ſixth part of a thin Space is not a Meaſure, perhaps, uſed more in the whole Set of Letters to be Cut to the preſent Body, therefore you need not make a *Standing Gage* for it; yet a preſent *Gage* you muſt have: Therefore uſe the *Sliding Gage* (deſcribed in §. 12. ¶. 4. and *Plate* 10. at B.) and move the Socket *c ċ* on the Beam *a a*, till the Edge of the Sholder of the Square of the Socket at the under-ſide of the Beam ſtands juſt the Width of four thin Spaces and one ſixth part of a thin Space, from the Point of the Tooth *b*; which you may do by applying the Meaſure aforeſaid juſt to the Square and Point of the Tooth; for then if you Screw down the Screw in the upper ſide of the Sliding Socket, it will faſten the Square at that diſtance from the Point of the Tooth.

Tooth. And by again applying the ſide of the Square to the Foot of the Face of the *Counter-Punch*, you may with the Tooth deſcribe a ſmall race, which will be the exact Heighth of the *Counter-Punch* for *A*. But *A* hath a Fine ſtroak within it, reaching from Side to Side, which by the large Draft of *A*, you may find that the middle of this croſs ſtroak is two Thin Spaces above the bottom of this *Counter-Punch*; and with your common *Sliding-Gage* meaſure that diſtance as before, and ſet off that diſtance alſo on the Face of your *Counter-Punch*. Then with the edge of a Fine *Knife-File*, File ſtraight down in that race, about the depth of a Thin Space, or ſomewhat more; So ſhall the *Counter-Punch* for *A* be finiſht. But you may if you will, take off the Edges or Sholder round about the Face of the *Counter-Punch*, almoſt ſo deep as you intend to ſtrike it into the *Punch:* for then the Face of the *Counter-Punch* being Filed more to a Point, will eaſier enter the *Punch* than the broad Flat-Face.

But note, That if it be a very Small Bodied *A* you would make, the Edge of a Thin *Knife-File* may make too wide a Groove: In this caſe you muſt take a peece of a well-Temper'd broken Knife, and ſtrike its Edge into the Face of the *Counter-Punch*, as aforeſaid.

¶. 3. *Of Sinking the* Counter-Punches.

Having thus finiſht his *Counter-Punch*, he Hardens and Tempers it, as was taught *Numb.* 3. *fol.* 57, 58. *Vol.* I. And having alſo Filed the Face of his Punch he

he intends to cut his *A* upon, pretty Flat by gueſs, he Screws the Punch upright, and hard into the Vice: And ſetting the Face of his *Counter-Punch* as exactly as he can, on the middle of the Face of his Punch, he, with an Hammer ſuitable to the Size of his *Counter-Punch*, ſtrikes upon the end of the *Counter-Punch* till he have driven the Face of it about two Thin Spaces deep into the Face of the Punch. So ſhall the *Counter-Punch* have done its Office.

But if the Letter to be *Counter-Puncht* be large, as *Great Primmer*, or upwards, I take a good high Blood red Heat of it, and Screw it quickly into the Vice; And having my *Counter-Punch* Hard, not Temper'd, becauſe the Heat of the Punch ſoftens it too faſt: And alſo having before-hand the *Counter-Punch* Screwed into the *Hand-Vice* with its Shank along the Chaps, I place the Face of the *Counter-Punch* as before, on the middle of the Face of the Punch, and with an Hammer drive it in, as before.

Taking the Punch out of the Vice, he goes about to Flat and Smoothen the Face in earneſt; for it had been to no purpoſe to Flat and Smoothen it exactly before, becauſe the Sinking of the *Counter-Punch* into it, would have put it out of Flat again.

But before he Flats and Smoothens the Face of the Punch, He Files by gueſs the ſuperfluous Steel away about the Face of the Letter, *viz.* ſo much, or near ſo much, as is not to be uſed when he comes to finiſh up the Letter, as in this preſent Letter *A*, which ſtanding upon a Square Face on the Punch, meets in an Angle at the Top of the Letter. Therefore the Sides of that Square muſt be Filed away to

to an Angle at the Top of the Face of the Punch. But great care muſt be taken, that he Files not more away than he ſhould: For he conſiders that the left hand Stroak of *A* is a Fat Stroak, and that both the left-hand and the right-hand Stroak too, have Footings, which he is careful to leave Steel enough in their proper places for.

The reaſon why theſe are now Fil'd thus away, and not after the Letter is finiſht, is, Becauſe in the Flatting the Face there is now a leſs Body of Steel to File away, than if the whole Face of the Punch had remain'd intire: For though the following ways are quick ways to Flatten the Face, yet conſidering how tenderly you go to Work, and with what Smooth Files this Work muſt be done, the riddance made will be far leſs when a broad Face of *Steel* is to be Flatned, than when only ſo much, or very little more than the Face of the *Letter* only is to be Flatned.

To Flat and Smoothen the Face of the Punch, he uſes the *Flat-Gage*, (deſcribed §. 12. ¶. 3. and *Plate* 10. at A.) thus, He fits one convex corner of the Shank of the Punch, into the Concave corner of the *Flat-Gage*, and ſo applies his *Flat-Gage-Punch* and all to the Face of the *Uſing-File*, and lets the *Counter-Puncht* end, *viz.* the Face of the Punch Sink down to the Face of the *Uſing-File:* And then keeping the convex Corner of the Shank of the Punch cloſe and ſteddy againſt the Concave corner of the *Flat-Gage*, and preſſing with one of his Fingers upon the then upper end of the Punch, *viz.* the Hammer-end, he alſo at the ſame time, preſſes the

the lower end of the Punch, *viz.* The Face againſt the *Uſing-File*, and thruſts the *Flat-Gage* and *Punch* in it ſo oft forwards, till the extuberant Steel on the Face, be Rub'd or Fil'd away: which he knows partly by the alteration of colour and Fine Furrows made by the *Uſing-File* on the Face of the Punch, and partly by the falling away of the parts of the Face that are not yet toucht by the *Uſing-File:* So that it may be ſaid to be truly Flat: which he knows, when the whole Face of the Punch touches upon the Flat of the *Uſing-File*, or at leaſt, ſo much of the Face as is required in the Letter: For all Counter-Puncht-Letters, as aforeſaid, muſt have a greater Face of Steel than what the bare Letter requires: for the reaſon aforeſaid.

Another way I uſe is thus. After I have Fil'd the Face as true as I can by gueſs, with a *Rough-Cut-File*, I put the Punch into an Hand-Vice, whoſe Chaps are exactly Flat, and ſtraight on the upper Face, and ſink the Shank of the Punch ſo low down in the Chaps of the Hand-Vice, that the low ſide of the Face of the Punch may lye in the ſame Plain with the Chaps; which I try with the Liner. For the Liner will then ſhew if any of the Sides ſtand higher than the Plain of the Chaps: Then I Screw the Punch hard up, and File off the riſing ſide of the Punch, which brings the Face to an exact Level: For the Face of the Chaps being Hard Steel, a File cannot touch them, but only take off the aforeſaid Riſing parts of the Face of the Punch, till the *Smooth-File* has wrought it all over exactly into the ſame Plain with the Face of the Chaps of the *Hand-Vice.* Some

Some *Letter-Cutters* work them Flat by Hand, which is not only difficult, but tedious, and at the beſt, but done by gueſs.

The inconvenience that this Tool is ſubject to, is, That with much uſing its Face will work out of Flat. Therefore it becomes the Workman to examine it often, and when he finds it faulty to mend it.

When they *File* it Flat by Hand, they Screw the Shank of the Punch perpendicularly upright into the Chaps of the Vice, and with a *Flat-Baſtard-Cut-File*, of about Four Inches long, or if the Punch be large, the File larger, according to diſcretion, and File upon the Face, as was ſhewn *Numb.* I. *fol.* 15, 16. Then they take it out of the Vice again, and holding up the Face Horizontally between the Sight and the Light, examine by nice obſerving whether none of its Angles or Sides are too high or too low. And then Screwing it in the Vice again, as before, with a *Smooth-Cut-File*, he at once both Files down the Higher Sides or Angles, and Smoothens the Face of the Punch. But yet is not this Face ſo perfectly Flatned, but that perhaps the middle of it riſes more or leſs, above the Sides: And then he Screws it in his *Hand-Vice*, and leans the Shank of the Punch againſt the Tach, pretty near upright, and ſo as he may beſt command it, and with a *Watch-Makers Half-Round-Sharp-Cut-File*, Files upon it with the Flat-Side of his File; But ſo that he ſcarce makes his forward and backward Stroaks longer than the breadth of the Face of his Punch, leſt in a long Stroak, the hither or farther end of his File ſhould Mount or Dip, and there-

therefore keeps his File, with the Ball of his Finger upon it, cloſe to the Face of the Punch. Then with the Liner he examines how Flat the Face of the Punch is, and if it be not yet Flat, as perhaps it will not be in ſeveral Trials, he again reiterates the laſt proceſs with the *Small-Half-Round-File*, till it be Flat. But he often Files croſs the Furrows of the File, as well becauſe it makes more riddance, as becauſe he may better diſcern how the File bears on the Face of the Punch.

When it is Flat, he takes a Small well-worn Half-Round-File, and working (as before) with the *Sharp-Cut-File*, he Smoothens the Face of the Punch.

Having thus Flatted the Face of the Punch, and brought the Letter to ſome appearance of Form, He Screws the Punch in the Hand-Vice, but not with the Shank perpendicular to the Chaps, but ſo as the Side he intends to File upon may ſtand upwards and aſlope too, and make an Angle with the Chaps of the Hand-Vice. And holding the Hand-Vice ſteddy in his left hand, he reſts the Shank of the Punch pretty near its Face upon the Tach: and then with a ſmall *Flat-File*, called a *Pillar-File*, in his right hand, holding the Smooth Thin Side of it towards the Footing of the Stem, he Files that Stem pretty near its due Fatneſs, and ſo by ſeveral reiterated proffers, leſt he ſhould File too much of the Stem away, he brings that Stem at laſt to its true Fatneſs. Then he meaſures with the Aſcending *Face-Gage*, the Heighth of the Letter: For though the *Counter-Punch* was imagin'd (as

(as aforeſaid) to be made to an exact Heighth for the inſide of the Letter; yet with deeper or ſhallower Sinking it into the *Punch*, the inſide oft proves higher or lower: Becauſe, as aforeſaid, the Superficies of the Face of the *Counter-Punch* is leſs than the true meaſure. But as it runs Sholdering into the Shank of the *Counter-Punch* the Figure or Form of the inſide becomes bigger than the inſide of the Letter ought to be. Therefore the deeper this Sholdering Shank is ſunk into the Face of the *Punch*, the higher and broader will the Form of the inſide of the Letter be, and the ſhallower it is Sunk in, the Shorter and Narrower by the Rule of Contraries.

He meaſures, as I ſaid, with the Aſſending Face-Gage, and by it finds in what good Size the Letter is. If it be too high, as moſt commonly it is, becauſe the Footing and Top are yet left Fat, then with ſeveral proffers he Files away the Footing and Top, bringing the Heighth nearer and nearer ſtill, conſidering in his Judgment whether it be propereſt to File away on the Top or Footing, till at laſt he fits the Heighth of the Letter by the Aſſending *Face-Gage*.

But though he have fitted the Heighth of the Letter, yet if the *Counter-Punch* were made a little too little, or Sunk a little too ſhallow, not only the Footing will prove too Fat, but the Triangle above the Croſs-ſtroke of *A* will be too ſmall; or if too big, the Footing and part of the Top will be Filed away, when it is brought to a due Heighth, and then the Letter is Spoil'd, unleſs it be ſo deep Sunk, that

that by working away the Face, as aforeſaid, he can regain the Footing and Top through the Slope-ſholdering of the *Counter-Punch*, and alſo keep the inſide of the Letter deep enough.

But if the Footing be too *Fat* or the Triangle of the Top too little in the Inſide, he uſes the Knife-backt Sculpter, and with one of the edges or both, that proceeds from the Belly towards the Point of the Sculpter (which edges we will for diſtinction ſake call *Angular edges*) he by degrees and with ſeveral proffers Cuts away the Inſide of the Footing, or opens the Triangle at the Top or both, till he hath made the Footing lean enough, and the Triangle big enough.

But if he works on the Triangle of the Top, he is careful not to Cut into the Straight of the Inſide lines of the Stems, but to keep the Inſides of that Triangle in a perfect ſtraight line with the other part of the Inſide of the Stem.

The ſmall arch of a Circle on the Top of *A* is Fil'd away with a Sizable Round-File. And ſo for all other Letters that have Hollows on their Outſides; he fits himſelf with a ſmall File of that ſhape and Size that will fit the Hollow that he is to work upon: For thus the Tails of Swaſh Letters in Italick Capitals are Fil'd with half Round Files Sizable to the Hollows of them. But I inſtead of Round or Half-Round Files, in this Caſe, beſpeak Pillar Files of ſeveral Thickneſſes, and cauſe the *File-maker* to Round and Hatch the Edges: which renders the File ſtrong and able to endure hard leaning on, without Breaking, which Round or Half-Round Files will not Bear.

I need

I need give no more Examples of Letters that are to be Counter-punched: And for Letters that need neither Counter-punching or Graving, they are made as the Out-ſides of *A*, with Files proper to the ſhapes of their Stroaks.

¶. 4. *Of Graving and Sculping the Inſides of* Steel Letters.

The *Letter-Cutter* elects a *Steel Punch* or *Rod*, a ſmall matter bigger than the Size of the Letter he is to Cut; becauſe the Topping or Footing Stroaks will be ſtronger when they are a little Bevell'd from the Face. The Face of theſe Letters not being to be Counter-punched are firſt Flatned and Smoothed, as was ſhewed, ¶. 3. Then with the proper *Gage*, *viz.* the Long, the Aſcending, or elſe the Short *Face-Gage*, according as the Letter is that he intends to Cut, He meaſures off the exact Heighth of the Letter, Thus; He firſt Files one of the Sides of the Face of the *Punch* (*viz.* that Side he intends to make the Foot of his Letter) exactly ſtraight; which to do, he ſcrews his *Punch* pretty near the bottom end, with its intended Foot-ſide uppermoſt, aſlope into one end of the Chaps of his *Hand-Vice*. So that the Shank of the *Punch* lies over the Chaps of the *Hand-Vice*, and makes an Angle of about 45 Degrees with the Superficies of the Chaps of it: Then he lays the under ſide of the Shank of his *Punch* aſlope upon his *Tache*, in one of the Notches of it, that will beſt fit the ſize of his *Punch*, to keep it ſteady; and ſo Files the Foot-Line of the *Punch*.

But

But he Files not athwart the ſides of his *Punch*; for that might make the Foot-Line Roundiſh, by a Mounting and Dipping the Hand is prone to; as I ſhewed, *Vol.* I. *Fol.* 15, 16. But he holds his File ſo as the Length of it may hang over the Length of the Shank of the *Punch*, and dip upon it at the Face of the *Punch*, with a Bevel, or Angle, of about 100 Degrees with the Face of the *Punch*. This Angle you may meaſure with the *Beard-Gage*, deſcribed in *Plate* 10. *Fig.* C. at *k*. Then Filing with the File in this Poſition, the Foot-Line will be made a true ſtraight Line. But yet he examines it too by applying the *Liner* to it; and holding the *Punch* and *Liner* thus to the Light; If the *Liner* touches all the way on the Foot-Line, he concludes it true; if not, he mends it till it do.

Then he uſes his proper *Steel-Gage*, and places the Sholder of it againſt the Shank of the *Punch* at the Foot-Line; and preſſing the Sholder of the *Steel-Gage* cloſe againſt the Foot-Line, he, with the Tooth of the *Gage* makes a Mark or Race on the ſide of the Face, oppoſite to the Foot-line: And that Mark or Race ſhall be from the Foot-Line, the Bounds of the Heighth of that Letter.

Then on the Face he draws or marks the exact ſhape of the Letter, with a Pen and Ink if the Letter be large, or with a ſmooth blunted Point of a Needle if it be ſmall: Then with ſizable and proper ſhaped and Pointed Sculptors and Gravers, digs or Sculps out the Steel between the Stroaks or Marks he made on the Face of the *Punch*, and leaves the Marks ſtanding on the Face.

If

If the Letter be great he is thus to Sculp out, he then, with a Graver, Cuts along the Inſides of the drawn or marked Stroaks, round about all the Hollow he is Cutting in. And having Cut about all the ſides of that Hollow, he Cuts other ſtraight Lines within that Hollow, cloſe to one another (either parallel or aſlope, it matters not) till he have filled the Hollow with ſtraight Lines; and then again, Cuts in the ſame Hollow, athwart thoſe ſtraight Lines, till he fill the Hollow with Thwart Lines alſo. Which ſtraight Lines, and the Cuttings athwart them, is only to break the Body of Steel that lies on the Face of the *Punch* where the Hollow muſt be; that ſo the Round-Back'd Sculptor may the eaſier Cut through the Body of the Steel, in the Hollow, on the Face of the *Punch*; even as I told you, *Numb.* 4. *Vol.* I. §. 2. the Fore-Plain makes way for the Fine Plains.

The *Letter-Cutter* does not expect to perform this Digging or Sculping at one ſingle Operation; but, having brought the Inſide of his Letter as near as he can at the firſt Operation, he, with the flat ſide of a Well-worn, Small, Fine-Cut, Half-round File, Files off the Bur that his Sculptors or Gravers made on the Face of the Letter, that he may the better and nicelier diſcern how well he has begun. Then he again falls to work with his Sculptors and Gravers, mending, as well as he can, the faults he finds; and again Files off the Bur as before, and mends ſo oft, till the Inſide of his Letter pleaſes him pretty well. But before every Mending he Files off the Bur, which elſe, as aforeſaid, would obſcure and hide the true ſhape of his Stroaks. Having

Having well ſhaped the Inſide Stroaks of his Letter, he deepens the Hollows that he made, as well as he can, with his Sculptors and Gravers: And the deeper he makes theſe Hollows, the better the Letter will prove. For if the Letters be not deep enough, in proportion to their Width, they will, when the Letter comes to be Printed on, Print Black, and ſo that Letter is ſpoiled.

How deep theſe Hollows are to be, cannot be well aſſerted, becauſe their Widths are ſo different, both in the ſame Letter, and in ſeveral Letters: Therefore he deepens them according to his Judgment and Reaſon. For Example, O muſt be deeper than A need be, becauſe the Hollow of O is wider than the Hollow of A; A having a Croſs Stroak in it; and the wider the Hollow is, the more apt will the wet Paper be to preſs deeper towards the bottom in Printing. Yet this in General for the Depth of Hollows; You may make them, if you can, ſo deep as the *Counter-Punch* is directed to be ſtruck into the Face of the Punch. See ¶. 3. of this §.

Having with his Gravers and Sculptors deepned them ſo much as he thinks convenient, he, with a *Steel Punch*, pretty near fit to the ſhape and ſize of the Hollow, and Flatted on its Face, Flattens down the Irregularities that the Gravers or Sculptors made, by ſtriking with a proper Hammer, upon the Hammer-end of the *Punch*, with pretty light blows. But he takes great care, that this *Flat-Punch* be not at all too big for the Hollow it is to be ſtruck into, leſt it force the ſides of the Stroaks of the Letter out of their ſhape: And therefore alſo it is, that he ſtrikes but

but eaſily, though often, upon the end of the *Flat-Punch.*

Having finiſhed the Inſide, he works the Outſides with proper Files; as I ſhewed before, in Letter A; and ſmoothens and Polliſhes the Outſide Stroaks and Face with proper worn-out ſmall *Watch-makers* Files.

The Inſide and Outſide of the Face thus finiſhed, he conſiders what Sholdering the Shank of the *Punch* makes now with the Face, round about the Letter. For, as the Shank of the Letter ſtands farther off the Face of any of the Stroaks, the Sholdering will be the greater when the Letter is firſt made; becauſe the Outſides of the Letter, being only ſhaped at firſt with Fine Small Files, which take but little Steel off, they are Cut Obtuſely from the Shank to the Face, and the Steel of the Shank may with Rougher Files afterwards, be Cut down more Tapering to the Shank. For the Sholder of the Shank, as was ſaid before in this ¶, muſt not make an Angle with the Face, of above 100 Degrees; becauſe elſe they would be, firſt, more difficult to Sink into Copper; And Secondly, The broad Sholders would more or leſs (when the Letter is Caſt in ſuch Matrices) and comes to the Preſs, be ſubject, and very likely to be-ſmear the Stroaks of the Letter; eſpecially, with an Hard Pull, and too wet Paper; which ſqueezes the Face of the Letter deep into the Paper, and ſo ſome part of the Broad Sholdering of the Letter, receiving the Ink, and preſſing deep into the Paper, ſlurs the Printed Paper, and ſo makes the whole Work ſhew very naſty and un-beautiful.

For

For theſe Reaſons it is, that the Shank of the *Punch*, about the Face, muſt be Filed away (at leaſt, ſo much as is to be Sunk into Copper) pretty cloſe to the Face of the Letter; yet not ſo as to make a Right Angle with the Face of the Letter, but an Obtuſe Angle of about 100 Degrees: For, ſhould the Shank be Filed away to a Right Angle, *viz.* a Square with the Face, if any Footing or Topping be on the Letter, theſe fine Stroaks will be more ſubject to break when the *Punch* is Sunk into Copper, than when the Angle of the Face and Shank is augmented; becauſe then thoſe fine Stroaks ſtand upon a ſtronger Foundation. Therefore he uſes the *Beard-Gage*, and with that examines round about the Letter, and makes the Face and Shank comply with that.

Yet Swaſh-Letters, eſpecially Q, whoſe Swaſhes come below the Foot-Line, and whoſe Length reaches under the Foot-Line of the next Letter, or Letters in Compoſing, ought to have the Upper Sholder of that Swaſh Sculped down ſtraight, *viz.* to a Right Angle, or Square with the Face; at leaſt, ſo much of it as is to be Sunk into Copper: Becauſe the Upper Sholder of the Swaſh would elſe be ſo broad, that it would ride upon the Face of the next Letter. Therefore the Swaſh-Letters being all Long Letters, the lower end of the Swaſhes reach as low as the Bottom-Line; which cannot be Filed Square enough down from the Head-Line, unleſs the Steel the Swaſh ſtands on, ſhould be Filed from end to end, the length of the whole Shank of the *Punch*, which would be very tedious; and beſides, would make

make that part of the Shank the Swaſh ſtands on ſo weak, that it would ſcarce endure Striking into the Copper. Therefore, as I ſaid before, the Upper Sholder of the Swaſh ought to be Sculped down: Yet I never heard of any *Letter-Cutters* that had the knack of doing it; but that they only Filed it as ſtraight down as they could, and left the *Letter-Kerner*, after the Letter was Caſt, to Kern away the Sholdering. Yet I uſe a very quick way of doing it; which is only by Reſting the Back of a Graver at firſt, to make way; and afterwards a Sculptor, upon the Shank of the *Punch*, at the end of the Swaſh, one while; and another while on the Shank, at the Head, that the Swaſh may be Sculped down from end to end: and Sculping ſo, Sculp away great Flakes of the Steel at once, till I have Cut it down deep enough, and to a Right Angle.

Then he Hardens and Tempers the Punch; as was ſhewed, *Numb.* 3. *Vol.* I. *Fol.* 57, 58.

But though the *Punch* be Hardned and Temper'd, yet it is not quite finiſhed: for, in the Hardning, the *Punch* has contracted a Scurf upon it; which Scurf muſt be taken off the Face, and ſo much of the ſides of the Shank as is to be Sunk into Copper. Some *Letter-Cutters* take this Scurf off with ſmall ſmooth Files, and afterwards with fine Powder of *Emerick*. The *Emerick* they uſe thus. They provide a Stick of Wood about two Handful long, and about a *Great-Primer*, or *Double-Pica* thick: Then in an Oyſter-ſhell, or any ſleight Concave thing, they powr a little Sallad-Oyl, and put Powder of *Emerick* to it, till it become of the Conſiſtence of Batter made

made for Pan-cakes. And ſtirring this Oyl and *Emerick* together, ſpread or ſmear the aforeſaid Stick with the Oyl and *Emerick*, and ſo rub hard upon the Face of the *Punch*, and alſo upon part of the Shank, till they have taken the Scurf clean off.

Mr. *Walberger* of *Oxford* uſes another way. He makes ſuch an Inſtrument as is deſcribed in *Plate* 10. at H, which we will, for diſtinction ſake, call the *Joynt-Flat-Gage*. This Inſtrument conſiſts of two Cheeks about nine Inches long, as at b, and are faſtned together at one end, as the Legs of a *Carpenter*'s Joynt-Rule are in the Centre, as at *c*, but with a very ſtrong Joynt; upon which Centre, or Joynt, the Legs move wider, or cloſer together, as occaſion requires. Each Leg is about an Inch and a quarter broad, and an Inch and three quarters deep; *viz.* ſo deep as the Shank of the *Punch* is long. At the farther end of the Shank b (as at *d*) is let in an Iron Pin, with an Head at the farther end, and a ſquare Shank, to reach almoſt through a ſquare Hole in the Shank b, that it twiſts not about; and at the end of that Square, a round Pin, with a Male-Screw made on it, long enough to reach through the Shank a, and about two Inches longer, as at *e*; upon which Male-Screw is fitted a Nut with two Ears, which hath a Female-Screw in it, that draws and holds the Legs together, as occaſion requires a bigger or leſs *Punch* to be held in a proper Hole. Through each of the adjoyning Inſides of the Legs are made, from the Upper to the Lower Side, ſix, ſeven, or eight Semi-Circular Holes (or more or leſs, according to diſcretion) exactly Perpendicular to

to the upper and under Sides of each Leg, marked *a a a a, b b b b.* Each of theſe Semicircular Holes is, when joyned to its Match, on the other Leg to make a Circular Hole; and therefore muſt be made on each Leg, at an equal diſtance from the Centre. Theſe Holes are not all of an equal Size, but different Sizes: Thoſe towards the Centre ſmalleſt, *viz.* ſo ſmall, that the *Punch* for the ſmalleſt Bodied Letters may be pinched faſt in them; and the biggeſt Holes big enough to contain, pinch and hold faſt the *Punches* for the great Bodied Letters. The upper and under ſides of this *Joynt-Flat-Gage* is Faced with an Iron Plate, about the thickneſs of an Half Crown, whoſe outer Superficies are both made exactly Flat and Smooth.

When he uſes it, he chuſes an Hole to fit the Size of the *Punch*; and putting the Shank of the *Punch* into that Hole, Sinks it down ſo low, till the Face of the *Punch*, ſtands juſt Level, or rather, above the Face of the *Joynt-Flat-Gage:* Then with a piece of an Hone, wet in Water, rubs upon the Face of the *Punch*, till he have wrought off the Scurf. At laſt, with a Stick and Dry *Putty*, Poliſhes it.

I like my own way better than either of the former: For, to take off the Scurf with Small Files ſpoils the Files; the Face of the *Punch* being Hard, and the Scurf yet Harder: And beſides, endangers the wronging the Face of the *Punch.*

The *Joynt-Flat-Gage* is very troubleſome to uſe, becauſe it is difficult to fit the Face of the *Punch*, to lie in the Plain of the Face of the *Gage*; eſpecially, if, in making the Letter, the Shank be Filed Tapering,

ing, as it moſt times is. For then the Hammer-end of the *Punch* being bigger than the Face-end, it will indeed Pinch at the Hammer-end, whilſt the Face-end ſtands unſteady to Work on. But when the *Punch* is fitted in, it is no way more advantagious for Uſe, than the Chaps of the *Hand-Vice* I mentioned in ¶. 3. of this §.

Wherefore, I fit the *Punch* into the Chaps of the *Hand-Vice*, as I ſhewed in the aforeſaid ¶. and with a fine ſmooth Whet-ſtone and Water, take the Scurf lightly off the Face of the *Punch*; and afterwards, with a fine ſmooth Hone and Water, work down to the bare bright Steel. At laſt, drying the *Punch* and Chaps of the *Hand-Vice* with a dry Rag, I poliſh the Face of the *Punch* with Powder of Dry *Brick* and a Stick, as with *Putty*.

¶. 5. *Some Rules he conſiders in uſing the* Gravers, Sculptors, Small Files, *&c.*

1. When he is Graving on the Inſide of the Stroak, either to make it Finer or Smoother, he takes an eſpecial care that he place his Graver or Sculptor ſo, as that neither of its Edges may wrong another Stroak of the Letter, if they chance (as they often do) to ſlip over, or off an extuberant part of the Stroak he is Graving upon. And therefore, I ſay, he well conſiders how he is to manage the edges of his Graver. For there is no great danger of the point of his Graver after the inſide Stroaks are form'd, and the Hollows of the Letter ſomewhat deepned; but in the edges there is: For the point in

in working lies always below the Face of the Letter, and therefore can, at moſt, but ſlip below the Face, againſt the ſide of the next Stroak; but the edges lying above the Face of the Letter, may, in a ſlip, touch upon the Side and Face of the next Stroak, and wrong that more or leſs, according as the force of the Slip was greater or ſmaller. And if that Stroak it jobs againſt were before wholly finiſhed, by that job the whole Letter is in danger to be ſpoiled; at the beſt, it cannot, without Filing the Letter lower, be wrought out; which ſometimes is a great part of doing the Letter anew: For he takes ſpecial care that neither any dawk, or the leaſt extuberant bunching out be upon the inſide of the Face of the Stroak, but that the inſide of the Stroak (whether it be Fat or Lean) have its proper Shape and Proportion, and be purely ſmooth and clean all the way.

If on the inſide of the Stroak the Graver or Sculptor have not run ſtraight and ſmooth on the Stroak, but that an Extuberance lies on the Side, that Extuberance cannot eaſily be taken off, by beginning to Cut with the Edge of the Graver or Sculptor juſt where the Extuberance begins: Therefore he fixes the Point of his Graver or Sculptor in the Bottom of the Hollow, juſt under the Stroak where the Extuberance is, and leans the Edge of his Graver or Sculptor upwards; ſo as in forcing the Point of the Graver or Sculptor forwards, at the Bottom of the Hollow, the Edge of the Graver or Sculptor may ſlide tenderly along, and take along with it a very ſmall, nay, inviſible Chip of the moſt Prominent Part of the Extuberance; and ſo, by this Proceſs reittera-

ted

ted often, he, by ſmall Degrees, Cuts away the Extuberant part of the Stroak.

2. He is careful to keep his Gravers and Sculptors always Sharp, by often Sharpning them on the Oyl-Stone, which for that purpoſe he keeps ready at hand, ſtanding on the Bench: For if a Graver or Sculptor be not ſharp, it will neither make riddance, or Cut ſmooth; but inſtead of Cutting off a ſmall Extuberancy, it will rather ſtick at it, and dig into the Side of the Stroak.

3. He Files very tenderly with the Small Files, eſpecially with the Knife-Files, as well becauſe they are Thin and Hard, not Temper'd, and therefore would ſnap to pieces with ſmall violence; as alſo, leſt with an heavy hand he ſhould take away too much at once of that Stroak he is working upon.

§. 14. ¶. 1. *Some Rules to be obſerved by the* Letter-Cutter, *in the Cutting* Roman, Italick, *and the* Black Engliſh Letter.

1. The Stem and other Fat Stroaks of Capital *Romans* is five Parts of forty and two (the whole Body:) Or, (which is all one) one ſixth part of the Heighth of an Aſcending Letter (as all Capitals are Aſcendents) as has been ſaid before. *Albertus Durer* took his Meaſure from the Heighth of Capitals, and aſſigned but one tenth part for the Stem.

2. The Stem, and other Fat Stroaks of Capitals *Italick*, is four parts of forty and two, (the Body.)

3. The Stem, and other Fat Stroaks of Lower-Caſe *Roman*, is three and an half parts of forty and two, (the Body.)

4. The

4. The Stem, and other Fat Stroaks of Lower-Caſe *Italick*, is three parts of forty and two, (the Body.)

5. Of *Engliſh*, the Short Letters ſtand between nine parts of the Bottom-Line, and nine parts from the Top-Line; *viz.* upon three and thirty parts of forty and two, (the Body.)

6. The Stem of *Engliſh* Capitals is ſix parts of forty and two, (the Body.)

7. The Stem of *Engliſh* Lower-Caſe Letters is four parts of forty and two, (the Body.)

¶. 2. *Of Terms relating to the Face of Letters, and their Explanation.*

The Parts of a *Punch* are already deſcribed in §. 13. ¶. 1. of this Volumne; and ſo is the Body: But the ſeveral Terms that relate to the Face of Letters are not yet defined. Now therefore you muſt note, that the Body of a Letter hath four principal Lines paſſing through it (or at leaſt imagined to paſs through it) at Right Angles to the Body; *viz.* The Top-Line, The Head-Line, The Foot-Line, and The Bottom-Line.

Between two of theſe Lines is contained the Heighth of all Letters.

Theſe are called *Lines*, becauſe the Tops, the Heads, the Feet and the Bottoms of all Letters (when Complicated by the *Compoſitor*) ſtand ranging in theſe imagin'd Lines, according as the Heighth and Depth of each reſpective Letter properly requires.

The

The Long Letters are (as I told you in §. 13. ¶. 1. of this Volumne) contained between the Top and Bottom-Lines, The Aſcending Letters are contained between the Top and Foot-Lines, The Deſcending Letters are contained between the Head and Bottom-Lines, and The Short Letters are contained between the Head and Foot-Lines.

Through what Parts of the Body all theſe Lines paſs, you may ſee by the Drafts of Letters, and the following Deſcriptions.

What the Long Letters, Aſcending Letters, and Short Letters are, I ſhewed in the afore-cited ¶. Therefore I ſhall now proceed to particular Terms relating to the Face. As,

1. The Topping, is the ſtraight fine Stroak or Stroaks that lie in the Top-Line of Aſcending Letters: In *Roman* Letters they paſs at Right Angles through the Stems; but in *Italicks*, at Oblique Angles to the Stems; as you may ſee in the Drafts of Letters, B, *B*, H, *H*, I, *I*, *&c.*

2. The Footing, is the ſtraight fine Stroak or Stroaks that lie in the Foot-Line of Letters, either Aſcending or Deſcending. In *Romans* they paſs at Right Angles through the Stem, but in *Italicks*, at Oblique Angles; as you may ſee in B, *B*, H, *H*, I, *I*, *&c.*

3. The Bottom-Footing, is the ſtraight fine Stroaks that lie in the Bottom-Line of Deſcending Letters. In *Romans* they paſs at Right Angles through the Stem; but in *Italicks* at Oblique Angles; as you may ſee p, *p*, q, *q*.

4. The

4. The Stem is the ſtraight Fat Stroak of the Letter: as in B, *B*, the ſtraight Stroak on the Left Hand is the Stem; and I, *I*, is all Stem, except the Footing and Topping.

5. Fat-Stroaks. The Stem or broad Stroak in a Letter is called Fat; as the Right Hand Stroak in A, and part of the great Arch in B, are Fat Stroaks.

6. Lean Stroaks, are the narrow fine Stroaks in a Letter; as the Left Hand Stroak of A, and the Right Hand Stroak of V are Lean.

7. Beak of Letters, is the fine Stroak or Touch that ſtands on the Left Hand of the Stem, either in the Top-Line, as b d h, *&c.* or in the Head-Line, as i, m, n, *&c.* Yet f, g, ſ, *f*, *g*, *ſ*, have Beaks on the Right Hand of the Stem.

8. Tails of Letters, is a Stroak proceeding from the Right Hand Side of the Stem, in the Foot-Line; as a d t u: and moſt *Italick* Lower-Caſe Letters have Tails: As alſo have moſt Swaſh Letters. But ſeveral of their Tails reach down to the Bottom-Line.

9. Swaſh Letters are *Italick* Capitals; as you ſee in *Plate* 15.

Thus much of *Letter-Cutting*. The next *Exerciſes* ſhall (God willing) be upon *Making Matrices, Making Molds, Caſting and Dreſſing of Letters*, &c.

F I N I S.

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Plate 11

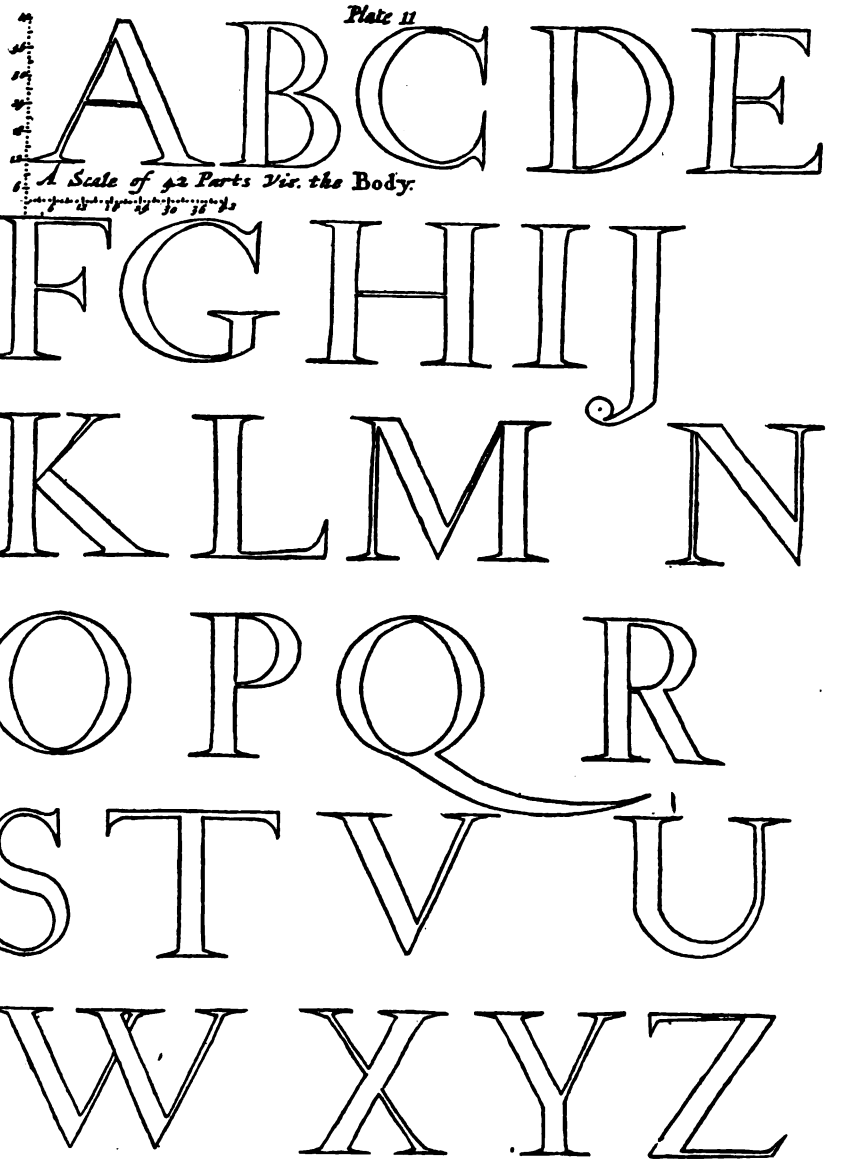

Plate 12.

Æabcdef

A Scale of 42 Parts viz the Body.

ghijklmn

opqrſstv

uwxyz&

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1234567890

Plate 13.

Plate 14.

Plate 15.

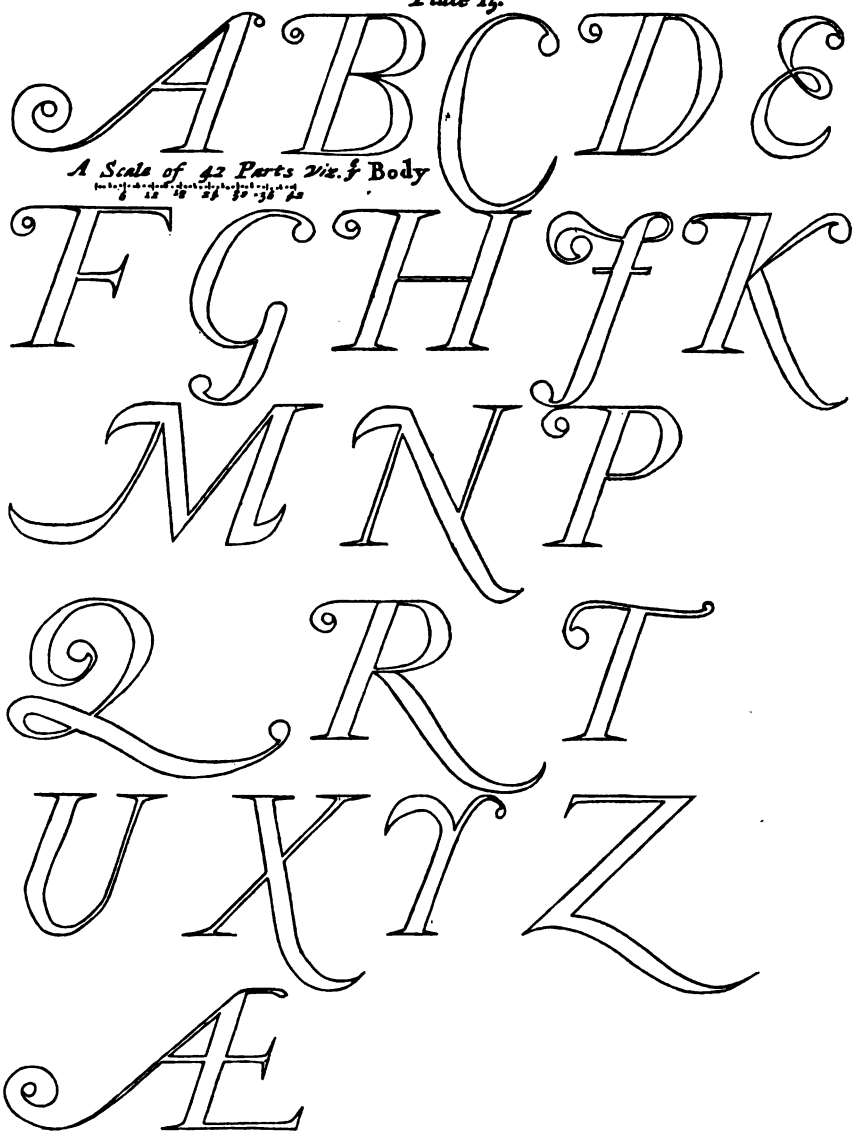


Plate 16.

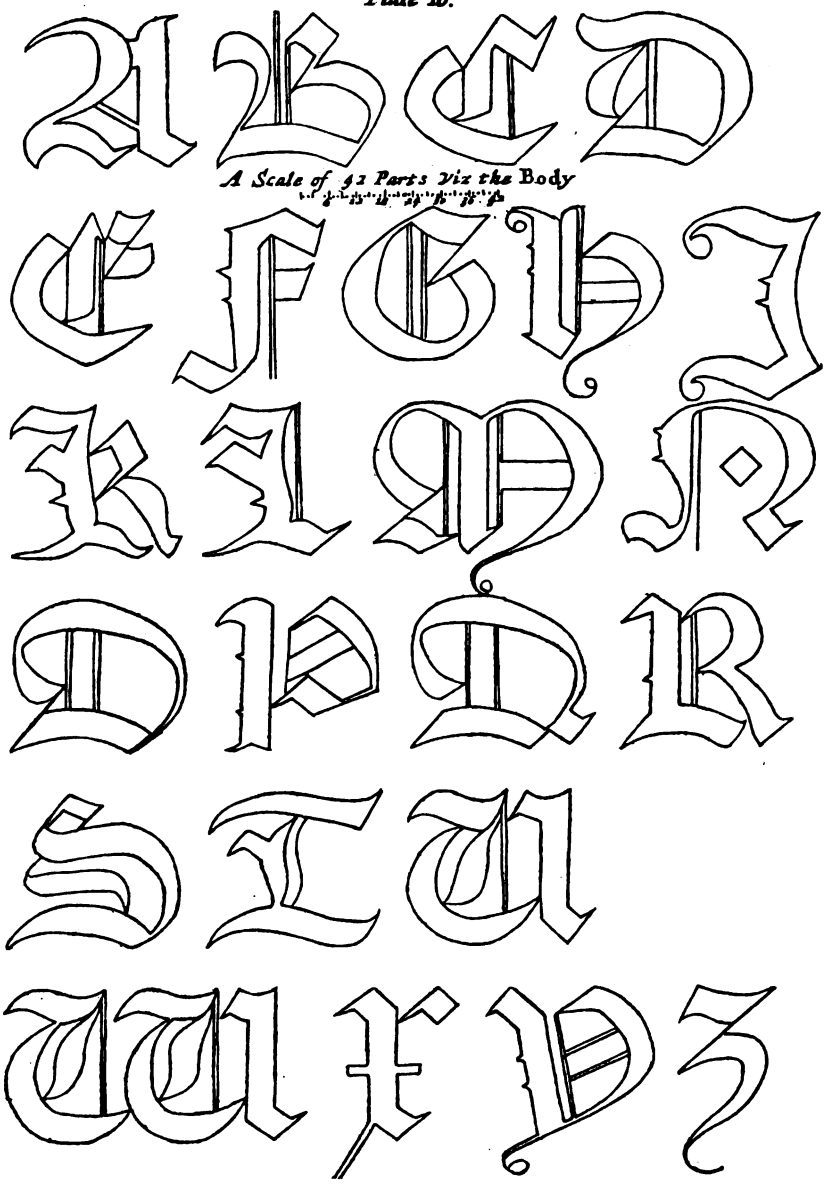
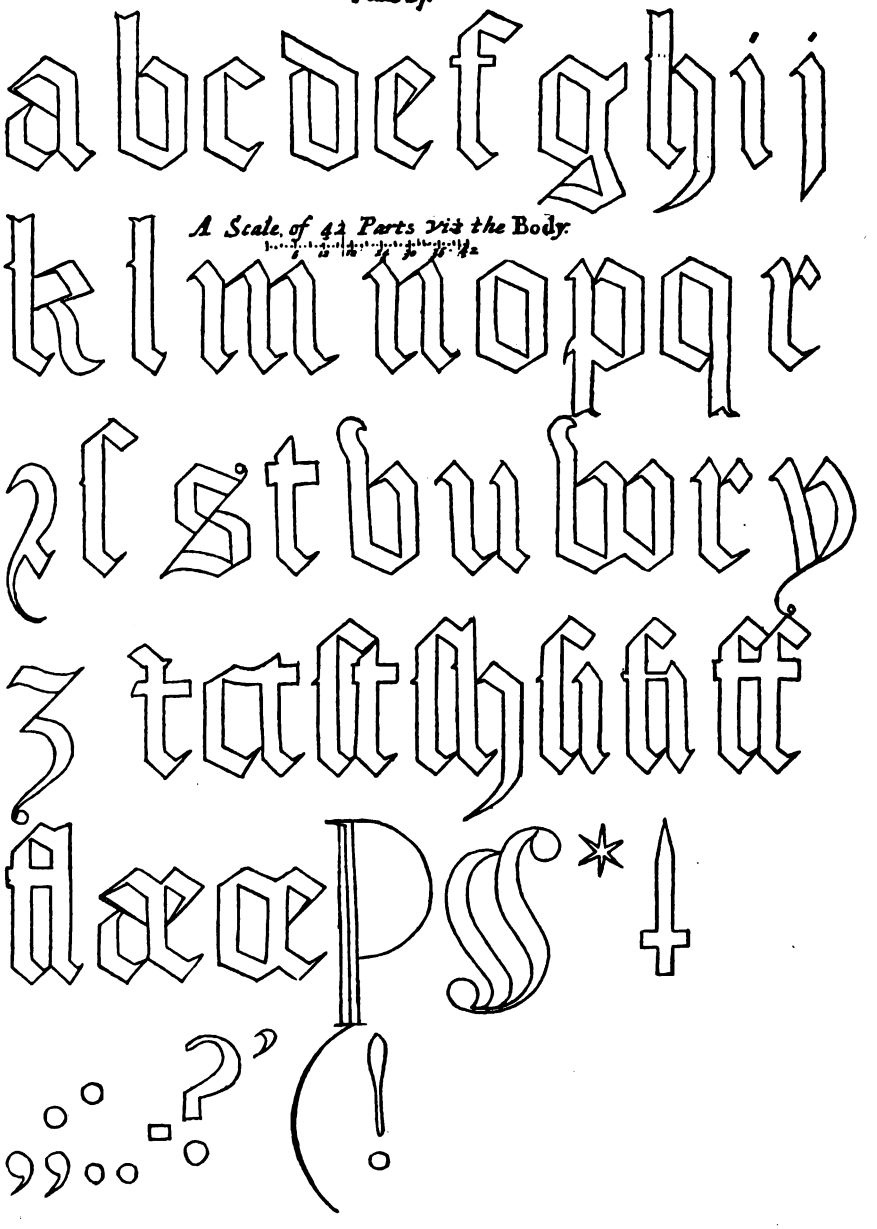


Plate 27.



MECHANICK EXERCISES:

Or, the Doctrine of

Handy-works.

Applied to the ART of

Mold-Making, Sinking the *Matrices*, Casting and Dreſſing of

Printing-Letters.

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§. 15. ¶. 1. *Of making the* Mold.

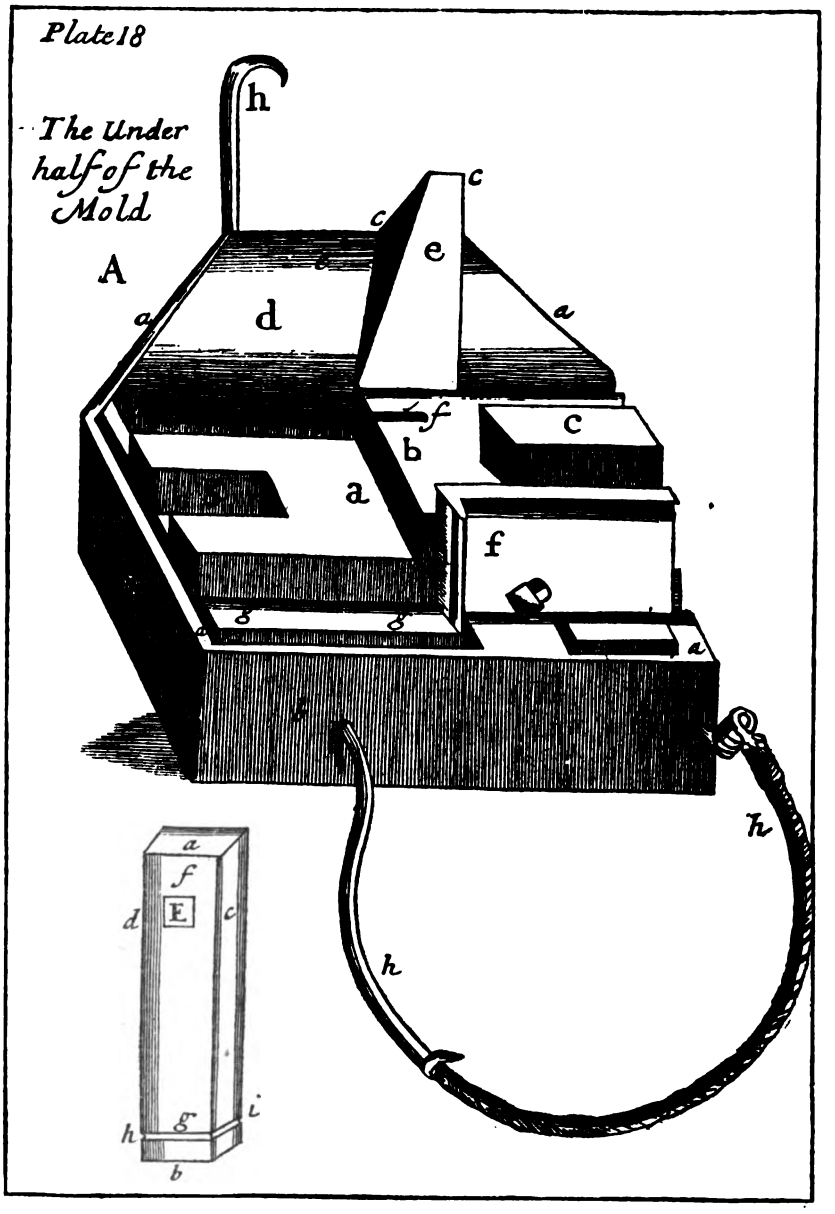
THE *Steel Punches* being thus finiſh'd, as afore was ſhewed, they are to be ſunk or ſtruck into pieces of *Copper*, about an Inch and an half long, and one quarter of an Inch deep; but the thickneſs not aſſignable, becauſe of the different thickneſſes in Letters, as was ſhewed in §. 2. and ſhall further be ſhewed, when I come to the ſinking and juſtifying

ſtifying of *Matrices.* But before theſe *Punches* are ſunk into *Copper*, the *Letter-Founder* muſt provide a *Mold* to juſtifie the *Matrices* by: And therefore it is proper that I deſcribe this *Mold* to you before I proceed any farther.

I have given you in Plate 18. at A, the Draft of one ſide or half of the *Mold*; and in Plate 19. at B, its Match, or other half, which I ſhall in general thus deſcribe.

Every *Mold* is made of two parts, an under, and an upper Part; the under part is delineated at A, in Plate 18, the upper part is marked B, in Plate 19, and is in all reſpects made like the under part, excepting the *Stool* behind, and the *Bow*, or *Spring* alſo behind; and excepting a ſmall roundiſh *Wyer* between the *Body* and *Carriage*, near the *Break*, where the under part hath a ſmall rounding *Groove* made in the Body. This *Wyer*, or rather *Half-Wyer* in the upper part makes the *Nick* in the *Shank* of the Letter, when part of it is received into the Grove in the under part.

Theſe two parts are ſo exactly fitted and gaged into one another, (*viz.* the *Male Gage*, marked C in Plate 19, into the *Female-Gage* marked g, in Plate 18.) that when the upper part of the *Mold* is properly placed on, and in the under part of the *Mold* both together, makes the entire *Mold*, and may be ſlid backwards for Uſe ſo far, till the Edge of either of the Bodies on the middle of either *Carriage* comes juſt to the Edge of the *Female-Gages*, cut in each *Carriage:* And they may be ſlid forwards ſo far, till the Bodies on either *Carriage* touch each other. And the ſliding of theſe two parts of the *Mold* backwards, makes



makes the *Shank* of the Letter thicker, becauſe the Bodies in each part ſtand wider aſunder; and the ſliding them forwards makes the *Shank* of the Letter thinner, becauſe the Bodies on each part of the *Mold* ſtand cloſer together.

This is a general Deſcription of the *Mold*; I come now to a more particular Deſcription of its parts.

a The *Carriage.*
b The *Body.*
c The *Male-Gage.*
d e The *Mouth-Piece.*
f i The *Regiſter.*
g The *Female-Gage.*
h The *Hag.*
a a a a The *Bottom Plate.*
b b b The *Wood* the *Bottom Plate* lies on.
c c e The *Mouth.*
d d The *Throat.*
e d d The *Pallat.*
f The *Nick.*
g g The *Stool.*
h h g The *Spring* or *Bow.*

I have here given you only the Names of the parts of the *Mold*, becauſe at preſent I purpoſe no other Uſe of it, than what relates to the ſinking the *Punches* into the *Matrices*: And when I come to the caſting of Letters, You will find the Uſe and Neceſſity of all theſe Parts.

¶ 2. *Of*

¶ 2. *Of the* Bottom-Plate.

The *Bottom Plate* is made of *Iron*, about two Inches and three quarters long, and about the ſame breadth; its thickneſs about a *Brevier*: It is planiſht exactly flat and ſtreight: It hath two of its *Fore-Angles*, as *a a* cut off either ſtraight or rounding, according to the pleaſure of the Work-man.

About the place where the middle of the *Carriage* lies, is made a Hole about a *Great Primmer* ſquare, into which is rivetted on the upper ſide a Pin with a Sholder to it, which reaches about half an Inch through the under ſide of the *Bottom Plate*. This *Pin* on the under ſide the *Bottom Plate* is round, and hath a *Male-Screw* on its end. This *Pin* is let through a Hole made in the Wood of the *Mold* to fit it; ſo that when a ſquare *Nut*, with a *Female-Screw* in it, is turned on the *Male-Screw*, it may draw and faſten the *Half Mold* firm to the Wood.

The Hind ſide of the *Carriage* lies on this *Bottom-Plate*, parallel to the Hind ſide of it, and about a *Two-Lin'd-Engliſh* within the Hind Edge of it; and ſo much of this *Bottom-Plate* as is between the *Regiſter* and the left hand end of the *Carriage* (as it is poſited in the Figure) is called the *Stool*, as *g g* in the under half of the *Mold*, becauſe on it the lower end of the *Matrice* reſts; but on the upper half of the *Mold* is made a ſquare Notch behind in the *Bottom-Plate*, rather within than without the Edge of the *Carriage*, to reach from the *Regiſter*, and half an Inch towards the left hand (as it is poſited in the Figure) that

that the upper part of the fore-ſide of the *Matrice* may ſtand cloſe to the *Carriage* and *Body*.

¶ 3. *Of the* Carriage.

On the *Bottom-Plate* is fitted a *Carriage*, (as *a*) This *Carriage* is almoſt the length of the *Bottom-Plate*, and about a *Double Pica* thick, and its Breadth the length of the Shank of the Letter to be caſt.

This *Carriage* is made of *Iron*, and hath its upper ſide, and its two narrow ſides filed and rubed upon the uſing *File*, exactly ſtraight, ſquare and ſmooth, and the two oppoſite narrow ſides exactly parallel to each other.

On one end of the *Carriage*, as at g, is made a long *Notch* or *Slit*, which I call the *Female-Gage*: It is about a *Double Pica* wide, and is made for the *Male-Gage* of the other part of the *Mold* to fit into, and to ſlide forwards or backwards as the thickneſs of the Letter to be caſt may require.

¶ 4. *Of the* Body.

Upon the *Carriage* is fitted the *Body*, as at b. This *Body* is alſo made of *Iron*, and is half the length of the *Carriage*, and the exact breadth of the *Carriage*; but its thickneſs is alterable, and particularly made for every intended *Body*.

About the middle of this *Body* is made a ſquare Hole, about a *Great Primmer*, or *Double Pica* ſquare; and directly under it is made through the *Carriage* ſuch another Hole exactly of the ſame ſize.

¶ 5. *Of*

¶ 5. *Of the* Male-Gage.

Through theſe two Holes, *viz.* That in the *Body*, and that in the *Carriage*, is fitted a ſquare *Iron Shank* with a *Male-Screw* on one End, and on the other End an Head turning ſquare from the ſquare *Shanck* to the farther end of the *Body*, as is deſcribed at c; but is more particularly deſcribed apart at B in the ſame Plate, where B may be called the *Male-Gage*: For I know no diſtinct Name that *Founders* have for it, and do therefore coyn this:

a The *ſquare Shanck.*

b The *Male-Screw.*

This *ſquare Shanck* is juſt ſo long within half a *Scaboard* thick as to reach through the *Body*, *Carriage*, and another ſquare Hole made through the *Bottom-Plate*, that ſo when a *ſquare Nut* with a *Female-Screw* in it is turned on that *Pin*, the *Nut* ſhall draw and faſten the *Body* and *Carriage* down to the *Bottom-Plate.*

The Office of the *Male-Gage* is to fit into, and ſlide along the *Female-Gage.*

¶ 6. *Of the* Mouth-Piece.

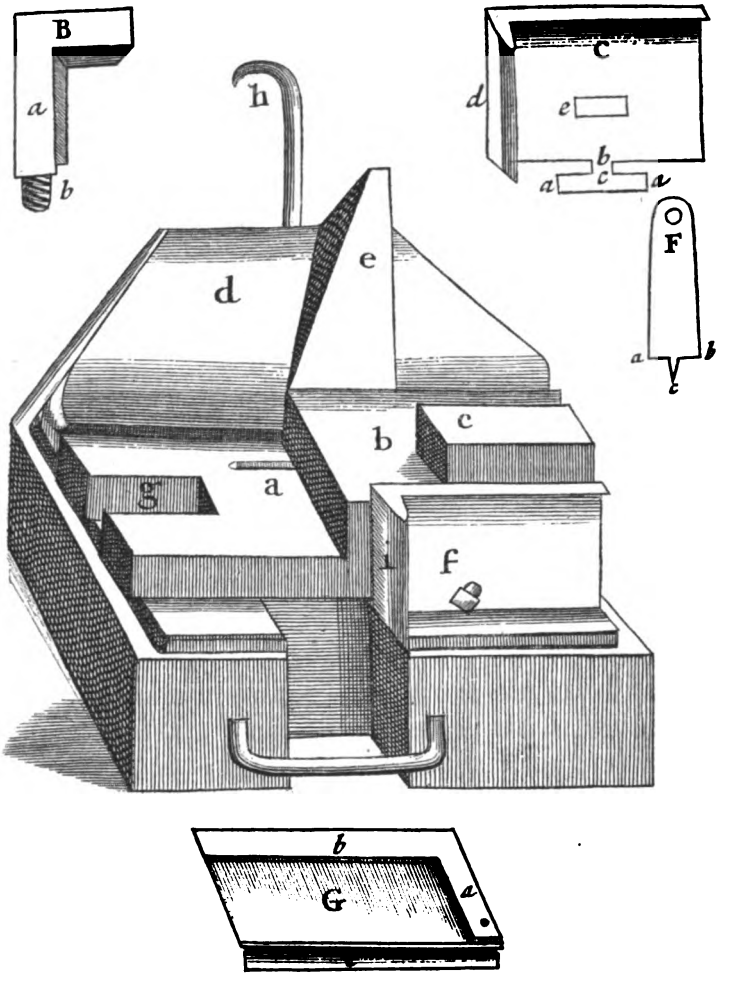
Cloſe to the *Carriage* and *Body* is fitted a *Mouth-Piece* marked d e. *Letter-Founders* call this altogether a *Mouth-Piece*: But that I may be the better underſtood in this preſent purpoſe, I muſt more nicely diſtinguiſh its parts, and take the Freedom to elect Terms for them, as firſt,

c c e The *Mouth.*

d The

Plate 19.

The Upper half of the Mold



d The *Palate*.
c c e *d* The *Jaws*.
d d The *Throat*.
Altogether (as aforeſaid) the *Mouth-Piece*.

The *Mouth-Piece* hath its *Side* returning from the *Throat* filed and rubb'd on the *Uſing File* exactly ſtraight and ſquare to its *Bottom-ſide*, becauſe it is to joyn cloſe to the Side of the *Carriage* and *Body*; but its upper Side, *viz.* the *Palate* is not parallel to the *Bottom*, but from the Side *d d*, *viz.* the *Throat* falls away to the *Mouth* e, making an *Angle* greater or ſmaller, as the *Body* that the *Mold* is made for is bigger or leſs: For ſmall *Bodies* require but a ſmall *Mouth*, becauſe ſmall *Ladles* will hold Metal enough for ſmall Letters; and the ſmaller the *Ladle*, the finer the *Geat* of the *Ladle* is; and fine *Geats* will eaſier hit the *Mouth* (in a Train of Work) than the courſe *Geats* of Great *Ladles*: Therefore it is that the *Mouth* muſt be made to ſuch a convenient Width, that the *Ladle* to be uſed and its *Geat*, may readily, and without ſlabbering, receive the Metal thrown into the *Mold*.

But again, if the *Mouth-Piece* be made too wide, *viz.* the *Jaws* too deep at the *Mouth*, though the *Geat* of the *Ladle* does the readier find it, yet the *Body* of the *Break* of the *Letter* will be ſo great, that firſt it heats the *Mold* a great deal faſter and hotter; and ſecondly, it empties the *Pan* a great deal ſooner of its Metal, and ſubjects the Workman ſometime to ſtand ſtill while other Metal is melted and hot: Therefore Judgment is to be uſed in the width of the *Mouth*; and though there be no Rule for the width of it; yet this in general for ſuch *Molds* as I make

make, I obſerve that the *Orifice* of the *Throat* may be about one quarter of the Body for ſmall Bodies; but for great Bodies leſs, according to Diſcretion, and the *Palate* about an Inch and a quarter long from the *Body* and *Carriage*. The reaſon that the *Orifice* of the *Throat* is ſo ſmall, is, becauſe the Subſtance at the end of the *Shanck* of the Letter ought alſo to be ſmall, that the *Break* may eaſier break from the *Shanck* of the Letter, and the leſs ſubject the *Shanck* to bowing; for the bowing of a Letter ſpoils it; and the reaſon why the *Palate* is ſo long, is, that the *Break* being long, may be the eaſier finger'd and manag'd in the breaking.

If it be objected, that ſince the ſmalneſs of the *Break* at the end of the *Shanck* of the Letter is ſo approvable and neceſſary for the reaſon aforeſaid, then why may not the *Break* be made much more ſmaller yet? The Anſwer will be, No; becauſe if it be much ſmaller than one quarter of the Body, Metal enough will not paſs through the *Throat*, to fill both the *Face* and *Shanck* of the Letter, eſpecially if the Letter to be caſt prove thin.

Near the *Throat* and *Jaw* is made ſtraight down through the *Palate* a ſquare Hole (as at *k*.) This ſquare Hole hath all its Sides on the *Upper-Plain* of the *Palate* opened to a *Bevel* of about 45 Degrees, and about the depth of a thick *Scaboard*. Into this ſquare *Hole* is fitted a ſquare *Pin* to reach through it; and within half a *Scaboard* through a ſquare *Hole*, made juſt under it in the *Bottom-Plate* which the *Mouth-Piece* lies upon. On the upper end of this ſquare *Pin* is made a ſquare *Sholder*, whoſe under ſides are filed *Bevil* away, ſo as the

to comply and fall juſt into the *Bevil* made on the *Palate* aforeſaid, and on the under end of the *Pin* is made a *Male-ſcrew* long enough to contain a ſquare *Nut*, with a *Female-ſcrew* in it about a *Pica* or *Engliſh* thick, which *Nut* being twiſted about the *Pin* of the *Male-ſcrew*, draws and faſtens the *Mouth-piece* cloſe down to the *Bottom-Plate*, and alſo cloſe to the *Carriage* and *Body* of the *Mold*.

Note, that the ſquare *Hole* made in the *Bottom-Plate* to receive the ſquare *Shanck* of the *Pin*, muſt be made a little wider than juſt to fit the ſquare *Shanck* of the *Pin*, becauſe the *Mouth-piece* muſt be ſo placed, that the end of the *Jaw* next the *Throat* muſt lie juſt even with the *Body* it is to be joyned to; and alſo that the *Throat* of the *Mouth-piece* may be thruſt perfectly cloſe to the Sides of the *Carriage* and *Body*: And when Occaſion requires the *Shanck* of the Letter to be lengthned, it may be ſet farther off the *Carriage*, that an *Aſidue*, or ſometimes a thin *Plate* of *Braſs* may be fitted in between the *Carriage* and the *Throat* of the *Mouth-piece*, as ſhall farther be ſhewed when I come to juſtifie the *Mold*.

¶ 7. *Of the* Regiſter.

Behind the *Mold* is placed the *Regiſter*, as at *f i h*, which I have alſo placed apart in the aforeſaid Plate, as at C, that it may the more perſpicuouſly be diſcerned, and a more particular account of its parts be given, which are as follows:

C *a a b c d e* The *Regiſter*.

a a The *Sholders*.

b c The

b c The *Neck.*

d The *Cheek* returning ſquare from the Plate of the *Regiſter*, and is about an *Engliſh* thick.

e The *Screw Hole.*

It is made of an *Iron* Plate about a *Brevier* thick; its upper Side is ſtraight, but its under Side is not: For at *a a* projects downwards a ſmall piece of the ſame Plate, which we may call the *Sholders*, of the Form you ſee in the Figure. Theſe *Sholders* have two ſmall *Notches* (as at *b c*) filed in them below the *Range* on the under ſide of the *Regiſter*, which we will call the *Neck*, and is juſt ſo wide as the *Bottom-Plate* is thick. This *Neck* is ſet into a ſquare *Notch*, filed ſo far into the *Bottom-Plate*, that the flat inſide of the *Regiſter* may ſtand cloſe againſt the hind ſide of the *Carriage* and *Body*; and this *Notch* is filed ſo wide on the left Hand, that when the ſide *b* of the *Neck* ſtands cloſe againſt the left-hand Side of this *Notch* (as it is poſited in the Figure) the *Cheek* of the *Regiſter* ſtands juſt even with the Edge of the *Body*. And this *Notch* is alſo filed ſo wide on the right-Hand Side, that when the *Neck* at *c* ſtands cloſe againſt the right-hand Side of the *Notch*, the *Cheek* of the *Regiſter* may remove an m, or an m and an n from the edge of the *Body* towards the right hand: And the *Sholders a a* are made ſo long, that when either Side of the *Neck* is thruſt cloſe againſt its correſponding ſide in the *Notch* of the *Bottom-Plate*, the upper Edge of the oppoſite *Sholder* ſhall hook or bear againſt the under ſide of the *Bottom-Plate*, and keep the whole *Regiſter* ſteady, and directly upright to the Surface of the *Bottom-Plate.*

In

In the Plate of the *Regiſter*, is made a long ſquare Hole, as at *e*, juſt wide enough to receive the *Pin* of a *Male-ſcrew*, with a *Sholder* to it, which is to fit into a *Female-ſcrew*, made in the Edge of the *Carriage*, that when the *Male-ſcrew* is turned about in the *Female-ſcrew* in the *Carriage*, it ſhall draw the *Sholder* of the ſaid *Male-ſcrew* hard againſt the upper and under Sides of the ſquare Hole in the Plate of the *Regiſter*, cloſe to the ſide of the *Carriage* and *Body*.

The reaſon why the Hole in the Plate of the *Regiſter* is made ſo long, is that the *Cheek* of the *Regiſter* may be ſlid forwards or backwards as occaſion requires; as ſhall be ſhewn when I come to juſtifying the *Mold*.

¶ 8. *Of the* Nick.

In the upper half of the *Mold*, at about a *Pica* diſtance from the *Throat*, is fitted into the under ſide of the *Body* the *Nick*: It is made of a piece of *Wyer* filed flat a little more than half away. This *Nick* is bigger or leſs, as the Body the *Mold* is made for is bigger or leſs; but its length is about two *m*'s. It is with round *Sculptors* let exactly into the under ſide of the *Body*.

In the under half of the *Mold*, is made at the ſame diſtance from the *Throat*, on the upper ſide of the *Body*, a round *Groove*, juſt fit to receive the *Nick* in the upper half.

¶ 9 *Of*

¶ 9. *Of the* Bow *or Spring.*

This is a long piece of hard *Iron Wyer*, whoſe Diameter is about a *Brevier* thick, and hath one end faſtned into the Wood of the under half of the *Mold*, as at *h*; but it is ſo faſtned, that it may turn about in the Hole of the Wood it is put into: For the end of it being batter'd flat, a ſmall Hole is drilled through it, into which ſmall Hole the end of fine *Lute-ſtring Wyer*, or ſomewhat bigger is put, and faſtned by twiſting about half an Inch of the end of the *Lute-ſtring* to the reſt of the *Lute-ſtring*: For then a conſiderable Bundle of that *Wyer*, of about the Size of a Doublet Button, being wound behind the Hole, about the end of the *Spring*, will become a *Sholder* to it, and keep the end of the *Spring* from ſlipping through the Hole in the Wood: But this *Button* or *Sholder* muſt alſo be kept on by thruſting another piece of *Wyer* ſtiff into the Hole made on the end of the *Spring*, and crooking that *Wyer* into the Form of an S, that it ſlip not out of the Hole.

The manner how the *Spring* is bowed, you may ſee in the Figure: But juſt without the Wood is twiſted upon another *Wyer* about an *Engliſh* thick five or ſix turns of the *Wyer* of the *Spring*, to make the whole *Spring* bear the ſtronger at its point: For the Office of the *Spring* is with its Point at *g*, to thruſt the *Matrice* cloſe againſt the *Carriage* and *Body*.

¶ 10. *Of*

¶ 10. *Of the* Hooks, *or* Haggs.

Theſe are *Iron Wyers* about a *Long Primmer* thick: Their Shape you may ſee in the Figure: They are ſo faſtned into the Wood of the *Mold*, that they may not hinder the *Ladle* hitting the *Mouth*. Their Office is to pick and draw with their Points the *Break* and *Letter* out of the *Mold* when they may chance to ſtick.

¶ 11. *Of the* Woods *of the* Mold.

All the *Iron* Work aforeſaid of the *Mold* is fitted and faſtned on two Woods, *viz.* each half one, and each Wood about an Inch thick, and of the ſhape of each reſpective *Bottom-Plate*. The Wood hath all its Sides except the hind-ſide, about a *Pica* longer than the *Bottom-Plate*; but the hind-ſide lies even with the *Bottom-Plate*. The *Bottom-Plate*, as afore was ſaid in ¶ 2. of this §. hath an *Iron Pin* on its under ſide, about half an Inch long, with a *Male-ſcrew* on its end, which *Pin* being let fit into an Hole in the Wood does by a *Nut* with a *Female-ſcrew* in it draw, all the *Iron* Work cloſe and faſt to the Wood.

But becauſe the Wood is an Inch thick, and the *Pin* in the *Bottom-Plate* but half an Inch long, therefore the outer or under ſide of the Wood (as poſited in the Figure) hath a wide round Hole made in it flat at the Bottom, to reach within an *Engliſh*, or a *Great Primmer* of the upper ſide of the Wood. This round Hole is wide enough to receive the *Nut* with the *Female-*

male-ſcrew in it; and the *Pin* being now long enough to receive the *Female-ſcrew* at the wide Hole, the *Female-ſcrew* may with *round noſed Plyers* be turned about the *Male-ſcrew* on the *Pin* aforeſaid, till it draw all the *Iron* Work cloſe to the Wood.

The Wood behind on the upper half is cut away as the *Bottom-Plate* of that half is; and into the thickneſs of the Wood, cloſe by the right and left-hand ſide of this *Notch* is a ſmall ſquare *Wyer-ſtaple* driven, which we may call the *Matrice-Check*; for its Office is only to keep the *Shanck* of the *Matrice* from flying out of this *Notch* of the *Mold* when the *Caſter* is at Work. And the *Nuts* and *Screws* of the *Carriage* and *Mouth-piece*, &c. that lie under the *Bottom-Plate*, are with ſmall *Chiſſels* let into the upper ſide of the Wood, that the *Bottom-plates* may lie flat on it.

Sect. XVI. *Of juſtifying the* Mold.

ALthough the *Mold* be now made; nay, very well and Workman-like made, yet is it not imagin'd to be fit to go to work withal; as well becauſe it will doubtleſs Rag (as *Founders* call it; for which Explanation ſee the Table) as becauſe the Body, Thickneſs, Straightneſs, and length of the *Shanck* muſt be finiſht with ſuch great Nicety, that without ſeveral Proofs and Tryings, it cannot be expected to be perfectly true.

Therefore before the ſinking and juſtifying the *Matrices*, the *Mold* muſt firſt be *Juſtified*: And firſt, he juſtifies the *Body*, which to do, he caſts about twenty *Proofs* or Letters, as they are called, though it matters

matters not whether the *Shancks* have yet Letters on them or no. Theſe *Proofs* he ſets up in a *Compoſing-ſtick*, as is deſcribed in § 17. ¶ 2. Plate 19. at G, with all their *Nicks* towards the right Hand, and then ſets up ſo many Letters of the ſame *Body*, (which for Diſtinction-ſake we will call *Patterns*) that he will juſtifie his *Body* too, upon the *Proofs*, with all their *Nicks* alſo to the right Hand, to try if they agree in length with the ſame Number of Letters that he uſes for his *Pattern*; which if they do not, for very ſeldom they do, but by the Workman's fore-caſt are generally ſomewhat too big in the *Body*, that there may be Subſtance left to *Juſtifie* the *Mold*, and clear it from *Ragging*. Therefore the *Proofs* may drive out ſomewhat, either half a Line (which in *Founders* and *Printers* Language is half a *Body*) or a whole Line. (more or leſs.)

He alſo tries if the two ſides of the *Body* are parallel, *viz.* That the *Body* be no bigger at the *Head* than at the *Foot*; and that he tries by taking half the number of his *Proofs*, and turning the Heads of them lays them upon the other half of his *Proofs*, ſo that if then the *Heads* and *Feet* be exactly even upon each other, and that the Heads and Feet neither *drive out*, nor *get in*, (*Founders* and *Printers* Language, for which ſee the Table) the two ſides of the *Body* are parallel; but if either the *Head* or *Foot drives out*, the two ſides of the *Body* are not parallel, and muſt therefore be mended.

And as he has examin'd the Sides of the *Body* ſo alſo he examines the thickneſs of the Letter, and tries if the two Sides of the thickneſs be alſo parallel, which to

to do, he ſets up his *Prooves* in the *Compoſing-ſtick* with their *Nicks* upwards. Then taking half of the *Prooves*, he turns the *Heads* and lay the *Heads* upon the *Feet* of the other half of his *Prooves*, and if the *Heads* and *Feet* lies exactly upon each other and neither *drive-out* or *get-in* the two Sides of the thickneſſes are parallel. But if either the *Head* or *Foot drive-out* the two Sides of the thickneſſes are not parallel; and muſt therefore be mended.

Next, he conſiders whether the ſides of the *Body* be ſtraight, firſt by laying two Letters with their *Nicks* upwards upon one another, and holding them up in his Fingers, between his Eye and the Light, tries if he can ſee Light between them: For if the leaſt Light appear between them, the *Carriage* is not ſtraight. Then he lays the *Nicks* againſt one another, and holds them alſo againſt the Light, as before: Then he lays both the *Nicks* outward, and examines them that way, that he may find whether either or both of the *Carriages* are out of ſtraight.

But we will ſuppoſe now the *Body* ſomewhat too big, and that it drives out at the *Head* or *Foot*; and that the thickneſs *drives-out* at the *Head* or *Foot* and that the Sides of the *Body* are not ſtraight. Theſe are Faults enough to take the *Mold* aſunder: but yet if there were but one of theſe Faults it muſt be taken aſunder for that; by unſcrewing the *Male-Gage*, to take the *Body* off the *Carriage*, and the *Carriage* off the *Bottom-Plate*.

Having found where the Fault of one or both ſides of the *Body* is, he lays the *Body* down upon the *Uſing File*; and if the Fault be extuberant, he rubs the Extu-

Extuberancy down, by preſſing his Finger or Fingers hard upon the oppoſite ſide of the Body, juſt over the extuberant part; and ſo rubbing the Body hard forwards on the *Uſing-File*, and drawing it lightly backwards, he rubs till he has wrought down the extuberancy, which he examins by applying the *Lyner* to that ſide of the Body, and holding it ſo up between his Eye and the Light, tries whether or not the *Lyner* ride upon the part that was extuberant; which if it do, the extuberancy is not ſufficiently rub'd off, and the former Proceſs muſt again begin and be continued till the extuberancy be rub'd off. And if the Body were too big, he by this Operation works it down: Becauſe the extuberancy of the *Body* rid upon the *Carriage*, and bore it up.

And if the fault be a *Dawk*, or Hollow in the *Body*, then he Works the reſt of that ſide of the *Body* down to the bottom of the *Dawk*, which by applying the *Lyner* (as afore) he tryes, and this alſo leſſens the *Body*.

If the *Body* drive-out at *Head* or *Foot*, he lays the weight of his Fingers heavy at that ſide or end of the *Body* which is too thick, and ſo rubs that down harder.

If the thickneſs of the Letter, drive-out at *Head*, or *Foot*, he Screws the *Body* into the *Vice*, and with a flat ſharp *File*, files the *Side* down at the *Head*, or *Foot*. At the ſame time, if the *Shanck* of the Letter be not Square, he mends that alſo, and ſmooth-files it very well.

Then

Then he puts the *Mold* together again: And melting, (or laying aſide) his firſt *Proofs*, leſt they ſhould make him miſtake, he again *Caſts* about twenty New *Proofs*, and examins by them as before, how well he has mended the *Body*, and how near he has brought the *Body* to the ſize of the *Pattern*: For he does not expect to do it the *Firſt*, *Second*, or *Seventh* time; but mends on, on, on, by a little at a time, till at laſt it is ſo finiſht.

If the *Body* prove too ſmall, it is underlaid with a thick or a thin *Aſſidue*; or ſometimes a thin *Plate* of *Braſs*.

Then he examins the *Mouth-piece*, and ſees that the *Jaws* ſlide exactly true, upon every part of the *Pallat* without riding.

If the *Throat* of the *Mouth-piece* lie too low, as moſt commonly it is deſigned ſo to do; Then a *Plate* of *Braſs* of a proper thickneſs is laid under it to raiſe it higher.

He alſo Juſtifies the *Regiſters*, making their *Cheeks* truly Square. And Screwing them about an n from the Corner of the *Body*.

He tryes that the *Male* and *Female-Gages* fit each other exactly, and lie directly ſtraight along, and parallel to both the Sides of the *Carriage*.

All this thus performed he needs not (perhaps) take the *Mold* aſſunder again. But not having yet conſider'd, or examin'd the length of the *Shanck* of the Letter, he now does; and if it be ſomwhat too long (as we will ſuppoſe by forecaſt it is) then the *Body* and *Carriage* being Screwed together, and both the Halves fitted in their *Gages*, the Edges of the *Carri-*

Carriage and *Body* are thus together rub'd upon the *Uſing-File*, till the *Carriage* be brought to an exact length.

Having thus (as he hopes) finiſht the juſtifying of the *Mold*; and put it together, and Screwed it faſt up, he puts the two Halves together, and then Rubs or Slides them hard againſt one another, to try if he can perceive any little part of the *Body* Ride upon the *Carriage*, or *Carriage* ride upon the *Body*: To know which of them it is that Rides, or is extuberant, he uſes the *Liner*; applying it to both the Places, as well of the *Body* as the *Carriage*: where he ſees they have Rub'd or bore upon one another: And which of them that is extuberant, the Edge of the *Liner* will ſhew, by Riding upon it: And that part he Files upon with a ſmall flat and very fine *File*, by little and little, taking off the extuberancy, till the *Bodies* and *Carriages* lie exactly flat upon, and cloſe to one another: Which if they do not, the *Mold* will be ſure to *Rag*.

§. XVII. ¶ 1. *Of Sinking the* Punches *into the* Matrices.

THat the *Matrice*, and all its parts may be the better underſtood, as I ſhall have Occaſion to Name them, I have given you a *Draft* of the *Matrice* in Plate, 18 at E. and ſhall here explain its parts.

E The *Matrice*, wherein is Punched E, the *Face* of the *Letter*.

a The *Bottom* of the *Matrice*.

b The *Top* of the *Matrice*.

c The

c The *Right Side* of the *Matrice.*
d The *Left Side* of the *Matrice.*
f g The *Face* of the *Matrice.*
h i The *Leather Grove* of the *Matrice.*

In the *Back* or *Side* behind the *Matrice*, juſt behind E is filed in athwart the *Back*, from the right to the left Side a *Notch*, to ſettle and hold the point of the *Spring* or *Wyer* of the *Mold* in, that the *Matrice* fly or ſtart not back when it is at Work.

As I told you (in §. 11. ¶ 1.) that the *Punches* are to be made of ſeveral Thickneſſes, for reaſons there ſhewed; and that therefore the *Letter-Cutter* makes *Wooden Patterns* for his ſeveral Sizes of Thickneſſes as well as Heights; ſo now I am come to the *Sinking* of the *Punches* into the *Matrices*, I muſt tell you again that the *Letter-Cutter* or elſe the *Founder*, (either of which that *Sinks* them; for ſometimes it is a Task Incumbent on each of them) conſiders the Thickneſſes of all the *Punches* he has to *Sink*, though Heighth he need not conſider in *Sinking* the *Matrices*: For the *Matrices*, by reaſon of their length in *Copper* upwards and downwards, have Subſtance enough and to ſpare, for the longeſt Letters to be *Sunk* into them: Therefore I ſay, he only conſiders the ſeveral Thickneſſes of all the *Punches*, and makes *Wooden Patterns* for them, marking with a Pen and Inck the number of each ſize, on the *Pattern* as before he did for the *Steel-Punches*: But the *Patterns* he made for the *Steel Punches* will be too Thin for the *Copper Matrices*: Becauſe the *Steel Punches* by *Sinking* into the *Matrices*, ſtretch and force the Sides of the *Copper* out, and ſometimes crack them for want of Subſtance

ſtance; and at other times carry or force the Subſtance of the *Matrice* ſo low with their *Sholder* if the *Letter* be broad, that it creates a great Trouble to rub them *Flat*, (as it is called) becauſe it is done upon the *Uſing-File*.

Therefore he makes *Wooden Patterns* for every of the former ſiz'd *Punches*, ſo thick or rather an n thicker at the leaſt, then he made the *Wooden* Patterns, that the *Steel-Punches* were made to be *Forged* by, that there may be Subſtance enough on each-ſide the *Copper* to bear the dilating that the ſinking of the *Punch* into it will make, becauſe the *Counter-Puncht-Letters* are Thicker by their *Stems* and *Footing* or *Topping* than the *Counter-Punches* made for them need be.

Therefore (as before) for three ſizes of *Punches* to be *Counter-Puncht*, he made three ſeveral ſiz'd *Patterns*; ſo now for the ſeveral ſiz'd *Punches* that are to be *Sunk* into *Matrices*, he makes three ſeveral ſiz'd *Patterns* of *Wood* for the *Copper-Smith* to draw out *Rods* of *Copper* of thoſe ſeveral Sizes by, and each of them (as aforeſaid) an n, and for the Thick *Letters* an m (at leaſt) Thicker than the *Patterns* were made, for the *Steel-Punches* to be Forged to a ſize by.

In the Forging of theſe *Copper Rods*, he inſtructs the *Copper-Smith* to make Choice of the ſofteſt *Copper* he can get, that the *Steel-Punches* may run the leſs hazzard of breaking; and ſometimes (if too ſoft Temper'd) battering their Stroaks.

The *Roſe Copper* is commonly accounted the ſofteſt: But

But yet I have many times *Sunk Punches* indifferently into every ſort of *Copper*. Nay, even caſt *Copper*, which is generally accounted the Hardeſt: Becauſe *Copper*, as well (as ſome other Mettals) Hardens with Melting.

Theſe *Rods* of *Copper* are (as I told you in §. III. ¶ 1. to be Cut into ſmall Lengths, each about an Inch and an half long, and a *Great-Primmer* or *Double-Pica* deep; and for great Bodyed *Letters* a *Two-lin'd-Engliſh* deep; But their Thickneſs not aſſignable, becauſe of the Different Thickneſſes in *Letters*, both of the ſame and other *Bodies*, as in part I ſhewed, in §. II. and more fully in this preſent §. and ¶.

The reaſon why the *Copper-Rods* are Forg'd ſo deep, is, That the more ſubſtance of *Copper* may lie under the *Face* of the *Punch*: For if the *Rod* have not a convenient depth, the *Face* of the *Punch* in *Sinking*, does the ſooner ingage with the Hardneſs of the *Face* of the *Stake* it is *Sunk* upon: And having with a few Blows of the *Hammer*, ſoon hardned the *Copper* juſt under the *Face* of the *Punch*, as well the hardneſs of the ſmall (thus hardned) *Body* of *Copper* juſt under the *Face* of the *Punch*, as the Hardneſs of the *Face* of the *Stake* contribute a complycated aſſiſtance to the breaking or battering the *Face* of the *Punch*. But if the *Rod* be deep, the Subſtance of *Copper* between the *Face* of the *Punch* and the *Stake* is leſs hardned, and conſequently the *Punch* will *Sink* the eaſier, and deeper with leſs Violence.

But

But ſometimes it has happ'ned that for the *Sinking* one *Matrice* or two, I have been loath to trouble my ſelf to go to the *Copper-Smiths*, to get one Forg'd: and therefore I have made ſhift with ſuch *Copper* as I have had by me. But when it has not been ſo deep as I could have wiſht it, I have juſt entred the *Punch* into the *Matrice* upon the *Stake*, and to *Sink* it deep enough, I have laid it upon a good thick piece of *Lead*, which by reaſon of its ſoftneſs has not hardned the *Copper* juſt under the *Face* of the *Punch*; but ſuffered the *Punch* to do its *Office* with good Succeſs.

Having cut the *Copper-Rods*, into fit Lengths with a Cold *Chiſſel*, He files the end that is to ſtand upon the *Stool* of the *Mold* exactly ſquare, and the Right-ſide of the *Matrice*, that ſtands againſt the *Carriage* and *Body*, alſo exactly Square and ſmooth upon the *Uſing-File*. Then he places the filed end, or *Bottom* upon the *Stool*, with the *Face* of the *Matrice* towards the *Carriage* and *Body*, and the Right ſide of the *Matrice*, cloſe againſt the *Regiſter*: Then if the *Punch* to be ſunck be an aſcending Letter. He with a fine pointed *Needle*, makes a ſmall Race by the upper ſide of the *Carriage* upon the *Face* of the *Matrice*, and that Race is a mark for him, to ſet the top of the Aſcending *Letter* at, when he *Sinks* it into the *Matrice*: So that then placing the *Punch* upright upon the middle of the Thickneſs of the *Matrice*, the *Matrice* lying ſolid on the *Stake*: He with the *Face* of an *Hammer* fizable to the bigneſs of his *Punch*, cautiouſly knocks upon the *Hammer-end* of the *Punch*, with reiterated Blows, till he

he have driven the *Punch* deep enough into the *Matrice.*

But if it be a ſhort *Letter*, or a Deſcending *Letter*, and not Aſcending alſo: Then he elects any *Caſt-Letter* of the Thickneſs of the *Beard*, (as *Founders* and *Printers* call it) For which Explanation ſee the Table, and he lays that *Letter* upon the *Surface* of the *Carriage*, and then placing the *Bottom* of the *Matrice* to be *Sunk* as before, on the *Stool*, and againſt the *Regiſter*, He draws with a *Needle* as before, a race above the *Surface* of that *Letter*, againſt the *Face* of the *Matrice*, and that race is a Mark for him to place the *Head* of the *Letter* by. Then managing the *Punch* and *Hammer* as before was ſhewed, he *Sinks* the *Punch* into the *Matrice.*

But here ariſes a Queſtion, *viz.* How deep the *Punches* are to be *Sunk* into the *Matrices?* The Anſwer is, a Thick *Space* deep, though deeper even to an n would be yet better: Becauſe the deeper the *Punches* are *Sunk*, the lower does the *Beards* ſtand below the *Face*, and thoſe *Beards* when the *Caſt Letter* comes into the *Printers* Hands to be uſed, are the leſs ſubject to *Print*, as too oft they do both at *Head* or *Foot* of a *Page*, than when they lie ſo high that the ſoftneſs of the *Blankets*, and Hardneſs of a *Pull*, or elſe careleſneſs of Running the *Carriage* of the *Preſs* to a conſidered Mark they would be. But they are ſeldom *Sunk* any deeper then a thick Space: and the reaſon is, becauſe the breaking or battering the *Face* of the *Punch* ſhould not be to much hazarded.

The

The many *Punches* to be *Sunk* into *Matrices* for the ſame *Body*, are difficult to be *Sunk* of an equal depth. Therefore I always make a *Beard-Gage*, as is deſcribed in *Plate* 19 at F, where *a b* is a *Sholder* that reſts upon the *Face* of the *Matrice*, *c* is the *Point* or *Gage* that meaſures the depth of the *Sunken Punch*. So that when the *Point c* juſt touches the *Bottom*, and both the *Sholders a b* the *Face* of the *Matrice*, the *Punch* may be accounted well *Sunk* as to depth.

But though it be accounted well *Sunk* for a firſt Eſſay, yet can it not be reaſonably imagined it is well *Sunk* for good and all; as well becauſe in *Sinking* the *Punches* it has carryed ſome part of the *Surface* of the *Matrice* down below the *Face* of the *Matrice* into the *Body* of the *Copper*, as becauſe both the *Sides* are doubtleſs extorted, and one Side or Part of the *Punch Sunk* more or leſs deeper than the other. Wherefore I now come to

¶ 2. *Juſtifying the* Matrices.

Juſtifying of *Matrices* is, 1. to make the *Face* of the *Sunken* Letter, lie an exact deſigned depth below the *Face* of the *Matrice*, and on all its ſides equally deep from the *Face* of the *Matrice*. 2. It is to ſet or *Juſtifie* the *Foot-line* of the Letter exactly in *Line*. 3. It is to *Juſtifie* both the ſides, *viz.* the Right and left-ſides of a *Matrice* to an exact thickneſs.

Therefore to proceed Methodically, he firſt ſlightly Files down the *Bunchings* out that the *Punch* made

made in the Sides of the *Matrice*; And then ſlightly Files down all the *Copper*, on the *Face* of the *Matrice*, till the Hollow the *Punch* made becomes even with the whole *Face* of the *Matrice*.

Then he *Caſts* a *Proof-Letter* or two, and *Rubs* them: And with the Edge of a Knife cuts out what may remain in the bottom of the *Shanck* by reaſon of the un-even breaking, off of the *Break* that the ſquare bottom of the *Shanck* may not be born off the *Bottom-Ledge* of the *Lining-Stick*.

But having till now ſaid nothing of the *Lining-Stick*, it is proper before I proceed, to give a Deſcription of it: It is delineated in *Plate* 19 at G. Where G is the *Plain*, *a* the *Side-Ledge*, *b* the *Bottom-Ledge*, *c* the *Stilt*, all made of *Braſs*.

The *Plain* is exactly Flat, Straight, and Smooth, that the *Shancks* of the *Letter* being likewiſe ſo, may lie flat and ſolidly on it. Its depth between the *Bottom-Ledg*, and the fore edge is about the length of the *Shanck* of the Letter: But the whole *Plain* of *Braſs* is yet deeper; Becauſe the *Bottom-Ledge* is faſtned on it. The *Lining-Stick* is about two *Inches* long for ſmall Letters; but longer for Big-*Bodyed Letters*.

Both *Bottom* and *Side-Ledge*, is a thin piece of *Braſs*, from a *Scaboard* to a *Pica* thick, according as the *Body* whoſe *Face* and *Foot-line* is to be *Juſtified* in it is bigger or leſs. Theſe two *Ledges* is an Inſide Square exactly wrought, and with ſmall *Rivets* faſted on the *Side* edge, and on the *Bottom* edge.

The

The *Stilt* is a thin flat piece of *Braſs-Plate* about a *Scaboard* thick, and a *Double-Pica* broad: One of its edges is *Soldered* to the under-ſide of the *Plain*, about a *Double-Pica* within the fore-edge of the *Plain*, that the *Lining-Stick* (when ſet by with *Proof-Letters* in it) may not lie flat on its *Bottom*; but have its fore edge *Tilted* up, that the *Letters* in it may reſt againſt the *Bottom-Ledge*.

Having cut the *Notch* in the *Break* of the *Letters* as aforeſaid, He *Rubs* every ſide of them on the *Stone*, with two or three hard *Rubs*, to take off the ſmall *Rags* that may happen on the *Shanck* of the *Letter*, notwithſtanding the *Mold* is imagined to be very truly made and *Juſtified*.

The *Stone* is commonly a whole *Grind-Stone*, about eighteen Inches diameter, having both its ſides truly *Rub'd* flat and ſmooth, by *Joſtling* it (as *Maſons* call it) upon another broad long and flat Stone with *Sand* and *Water*. It muſt have a fine, but very ſharp *Greet*. Now to return.

He places a Quadrat of the ſame *Body*, on the *Plain* of the *Lining-ſtick*, and againſt the *Side-Ledge* of it He ſets up three or four old m's of the ſame *Body*: Then ſets up his *Proof-Letter* or *Letters*, and after his *Proof-Letter* three or four old m's more of the ſame *Body*; and being very careful that the *Foot* of the *Shanck* of the Letter ſtands full down againſt the *Bottom-Ledge* of the *Lining-ſtick*, He applies the edge of the *Liner* to the *Faces* of all theſe Letters: And if he finds that the edge of the *Liner* juſt touch (and no more) as well all the parts of his *Proof-Letters*

ters as they do upon his old *Letters*, He concludes his *Matrice* is *Sunk* to a true *Height againſt Paper*.

But he ſeldom hopes for ſo good luck; but does more likely expect the *Matrice* is *Sunk* too deep or too ſhallow, and awry on the right and left-ſide, or on the top or bottom of the *Line*, for all or any of theſe Faults the *Liner* will eaſily diſcover. Therefore I ſhall ſhew you how he *Juſtifies* a *Matrice* that is too *High againſt Paper*.

We will ſuppoſe the *Face* of the *Punch* is *Sunk* flat and ſtraight down into the *Matrice*; but yet it is a little too deep *Sunk*. Therefore he conſiders how much it is too deep: If it be but a little too deep, perhaps when the *Face* of the *Matrice* ſhall be made exactly flat (for yet it is but *Rough-Filed*) it may be wrought down to be juſt of an *Height againſt Paper*. But if the *Punch* be *Sunk* ſo much too deep that the ſmoothing the flat of the *Face* on the *Uſing-File* will not work it low enough; then with a *Baſtard-cut flat-File*, he takes off (according to his Diſcretion) ſo much *Copper* from the *Face* of the *Matrice* as will make it ſo much nearer as he thinks it wants to the *Face* of the Letter. But yet conſiders that the *Face* of the *Matrice* is yet to ſmoothen on the *Uſing-File*, and therefore he is careful not to take too muck off the *Face* of the *Matrice* with the *Rough-File*.

He is alſo very careful that when he is to *File* upon the *Face* of the *Matrice*, to *Screw* the *Face* of it Horizontally flat in the *Vice*: And that in *Filing* upon it, he keeps his *File* directly Horizontal, as was

was ſhewed, *Numb.* 1. *Fol.* 15, 16. *Vol.* 1. For if he let his right or left-Hand dip, the *File* will in its Natural Progreſs take too much off the ſide it dips upon, and conſequently the *Face* of the Letter on that ſide will lie ſhallower from the *Face* of the *Matrice* then it will on the oppoſite ſide. The like caution he makes, in *Filing* between the *Top* and *Bottom* of the *Matrice* on the *Face*. For if he *Files* away too much *Copper* toward the *Top* or *Bottom*, the *Face* of the *Letter* on its *Top* or *Bottom-Line*, will lie on that end ſhallower from the *Face* of the *Matrice*.

Then he conſiders by his *Proof-Letters* how much too thick the right or left ſide of the *Matrice* is.

I told you in § 11. ¶ 4. that the Angle the *Sholder* made with the *Face* of the *Letter*, is about 100 Degrees, which is 10 Degrees more then a *right Angle* or *Square*. So that if a *Letter* be *Caſt* and *Rub'd* juſt ſo thick that the *Liner* when applied to the *Shanck* of the *Letter* reaches juſt to the *Sholder*, there will be an *Angle* of 10 Degrees, contained between the edge of the *Liner* and the *Straight Line* that proceeds from the *Sholder* at the *Shanck*, to the outer-edge of the *Face* of the *Letter*. And if two *Letters* be thus *Caſt* and *Rub'd* and *Set* together, the *Angle* contained between their *Shancks*, and the outer-edge of the *Face* of the *Letter* will be 20 Degrees, which is too wide by half for the *Faces* of two *Letters* to ſtand aſſunder. Therefore the ſides of the *Matrice* muſt be ſo *Juſtified*, that when the *Shancks* of two *Letters* ſtand cloſe together, the *Angle* between

tween both the *Shancks*, and the adjacent outer-edges of the *Faces* of the *Letters* may both make an *Angle* of about 10 Degrees as aforeſaid, which is a convenient diſtance for two *Letters* to ſtand aſſunder at the *Face*. But to do which, If the right-ſide be too thick, the *Regiſter* of the under-half of the *Mold*, being (as I ſaid) hard ſcrew'd, ſo as to ſtand about an n off the edge of the *Body* towards the right hand; He places the *Foot* of the *Matrice* on the *Stool*, and the right-ſide of the *Matrice* cloſe againſt the *Regiſter*, and obſerves how much too thick that ſide of the *Matrice* is: For ſo much as the right-hand edge of the *Orifice* of the *Matrice* ſtands on the left hand ſide of the *Body*, ſo much is the right ſide of the *Matrice* too thick, and muſt by ſeveral offers be *Filed* away with a *Baſtard-Cut-File*, not all at once, leaſt (ere he be aware) he makes that ſide of the *Matrice* too thin, which will be a great dammage to the *Matrice*, and cannot be mended but with a *Botch*, as ſhall in proper place be ſhewed.

Having by ſeveral proffers wrought the right-ſide of the *Matrice* thus near its thickneſs, he proceeds to *Juſtifie* the left-ſide alſo. But this ſide muſt be *Juſtified* by the upper half of the *Mold*; By turning the top of the *Matrice* downwards, and placing the left-ſide of it (now the right-ſide) againſt the *Regiſter*, and works away the left-ſide in all reſpects as he did the right-ſide; ſtill being very cautious he takes not to much *Copper* away at once.

To *Juſtifie* the *Letter* in *Line* he examins the *Proof-Letter* (yet ſtanding in the *Lining-Stick*) and applies the

the *Liner* to the *Foot-line*: And if the *Liner* touch all the way upon the *Foot-line* of the *Proof-Letter* and the *Foot-Line* of all the old m's, that *Matrice* is *Juſtified* in *Line*. But this alſo very rarely happens at firſt, for by deſign it is generally made to ſtand too low in *Line*: Becauſe the *Bottom* of the *Matrice* may by ſeveral proffers be *Filed* away till the *Letter* ſtand exactly in *Line*. But ſhould he take too much off the *Bottom* of the *Matrice*, it cannot be made to ſtand lower without another *Botch*.

Nor does he reckon that this firſt Operation, or perhaps ſeveral more ſuch, ſhall *Juſtifie* the *Matrice* in *Line*. But after bringing both the ſides of the *Matrice* thus near, and alſo bringing the *Matrice* thus near the *Line*. He *Caſts* another *Proof-Letter* or two, and *Rubbing* all the ſides of their *Shancks*, as before was ſhew'd, he tries by *Rubbing* the *Letters* how near he has brought the thickneſs of both the ſides: For when the ſides of the *Matrice* are brought juſt to ſuch a thickneſs, that the *Shanck* of the *Letter* (*Caſt* in the *Mold*) *Rubs* flat half way up beyond the *Beard* towards the *Face* of the *Letter*, the *Matrice* is of a convenient thickneſs, and there the *Angle* from the *Beard* of the *Shanck*, to the outer-edge of two *Letters* ſet together, will make an *Angle* of about 10 degrees as aforeſaid, which being about one third part of a *thin-Space* is a convenient diſtance for the adjacent edges of two *Letters* to ſtand aſſunder: But yet *Founders* ſometimes to *Get in* or *Drive out*, *Caſt* the *Letters* thinner or thicker, and conſequently their *Faces* ſtand cloſer or wider aſſunder

der, which is unseemly when the *Letter* comes to be *Printed.*

Then he sets the *Proof-Letters* in the *Lining-Stick,* between four or five old m's as before, and with the *Liner* examins again how well these *Proof-Letters* stand in *Line* with the old m's, which if they do not, he Reiterates the former Operations so oft, till the sides and *Line* of the *Matrice* is *Justified,* and at every Operation *Casts* new *Proof-Letters* to examine the thickness of both the Sides, and how well the *Matrice* is *Justified* to *Stand in Line.*

The *Matrice* being now *Justified,* he *Files* a *Leather-Groove* round about it, *viz* a *Notch* (made propereſt with a three square *File*) within about a thick *Scaboard* of the top of the *Matrice,* to tie the *Leather* fast to.

He also *Files* another *Notch* in the back-side of the *Matrice* athwart it, to rest the point of the *Wyer* or *Spring* in. But this *Notch* must by no means be made before the *Matrice* be *Justified* to its true *Height against Paper*: Because when this *Notch* is made, the *Punch* cannot again be struck in the *Matrice*; For that the *Matrice* will not lie solid on the *Stake* in that place.

¶ 3. *Of* Botching-Matrices, *to make them serve the better.*

Matrices are sometimes either through a careless, or sometimes through an unlucky stroak or two of the *File* made too thin. And sometimes the *Foot* of the *Matrice* is too much taken away, and the Letter by that

that means ſtands too high in *Line*: And ſometimes the *Face* of the *Matrices* is too much taken away; So that the Letter will not ſtand *High enough againſt Paper*.

To remedy all or any part of theſe inconveniencies, *Founders* are forced to make *Botches* on the *Matrice*: As firſt, If the *Matrice* be too thin on the right or left ſide, or both; They prick up that ſide, by laying the *Matrice* flat on the *Work-Bench*, with the thin ſide upwards, and holding the point of a *Punch-Graver* aſlope upon the thin ſide, with an *Hammer* drive the point into the thin ſide of the *Matrice*, and ſo raiſe a *Bur* upon that ſide; which *Bur* (though it thicken not the *Matrice*, yet it) makes the ſide of the *Matrice* ſtand off the *Regiſter*, and conſequently is equevalent to thickning it.

The higher this *Bur* is raiſed, the better is the *Matrice Botcht*; becauſe the thin fine points thus raiſed (if not pretty well flatted into the Subſtance of the *Bur*) will quickly either wear off by the preſſure of the *Regiſter* againſt them, or elſe flatten into the *Body* of the *Bur*, and both ways makes the *Matrice* again too thin.

Sometimes they do not *Botch* the *Matrice* thus for this fault; but only Paſte a piece of Paper, or a Card, (according as it may want thickneſs) againſt the thin ſide of the *Matrice* and ſo thicken it.

But to mend the ſides I uſe another Expedient, *viz.* by Soldering a piece of *Plate-Braſs* againſt its thin ſide or ſides, which is much better than *Botching* it.

Second-

Secondly, If the *Matrice* be filed away too much at the *Foot*, they knock it up with the *Pen* of the *Hammer*; and ſtretch it between the *Foot* and the *Orifice* of the *Matrice*, and then *Juſtifie* it again in *Line*. Or a piece may be *Soldered* under the *Foot*.

Thirdly, If the *Face* of the *Matrice* be too much taken away, and either the *Punch* ſpoiled or the *Notch* in the back of the *Matrice* made ſo, as it cannot be *Sunken* deeper, they raiſe a *Bur* on the *Face*, as they did on the thin ſides, to keep the *Matrice* off the *Carriages* and *Bodies* which Lengthens the height of the Letter *againſt Paper* ſo much as is the height of the raiſed *Bur*. But of all the *Botches* this is the worſt, becauſe the *Beard* lies now nearer the *Face*: And the hollow ſtanding off of the *Face* of the *Matrice* from the *Carriages* and *Bodies*, ſubjects the Mettal to run between them, and ſo peſters the Workman to get the Letter out of the *Mold* and *Matrice*.

Sect. XVIII, *Of ſetting up the* Furnance.

HAving *Juſtified* the *Mold* and *Matrice*, we come now to *Caſting* of *Letters*: But yet we have neither *Furnance*, *Mettal*, or *Ladle*. Wherefore it is the *Founders* care, firſt to provide theſe.

The *Furnance* I have deſcribed in Plate 20. It is built of Brick upright, with four ſquare ſides and a Stone on the top, in which Stone is a wide round hole for the *Pan* to ſtand in.

a b c d The ſquare Stone at the top, covering the whole *Furnance*. This is indeed the *Furnance*.

a d, b c The breadth two Foot and one Inch.

a b, c d The Length two Foot three Inches. Into the Breadth and Length about the whole Stone, is let in even with the top of the Stone a ſquare *Iron Band* two Inches deep, and a quarter and half quarter of an Inch thick to preſerve the Edges of the Stone from battering.

e The round hole the *Pan* ſtands in, which hath an *Iron Plate* let into it eight Inches diameter, an Inch and half broad and one quarter of an Inch thick.

This *Iron*-Plate fits the *inſide* of the *Hole* ſo far as it is Circular, and conſequently is a *Segment* of a *Circle*. But where the *Smoak-vent* breaks off the Circularity of the Stone, there ends this Plate of *Iron*, that the Smoak may have the freer vent. Its Office alſo is to preſerve the Edge of the *Hole* from battering, with the oft taking out and putting in the *Iron Pan*.

f The *Funnel* ſeven Inches high, and five Inches wide.

g The *Stoke-Hole* four Inches wide, and ſix Inches long.

h h The height of the *Furnance* two Foot ten Inches.

i The *Air-Hole* juſt underneath the Hearth to let in Air that the Fire may burn the freer.

k The *Aſh-Hole* where the Aſhes that fall from the Hearth are taken away.

l m n o The

l m n o The *Bench* two Foot broad, three Foot long, and two Foot eight Inches high. The *Bench* is to empty the Letters out of the *Mold* upon, as the *Founder Caſts* them.

The *Hearth* lies ſeven Inches below the top of the round *Hole*, and hath under it another round *Iron-Ring* of the ſame demenſions with the firſt, on which ſtraight *Iron-Bars* are faſtened that the *Fire* is laid on.

In the round *Iron-Ring* (or rather Segment) on the top of the *Furnance* is ſet the *Pan*, which is either a *Plate Ladle*, or a ſmall *Caſt-Iron Kettle* that ſinks into it within two Inches of the *Brims* of the *Pan*.

¶ 2. *Of making* Mettal.

The Mettal *Founders* make *Printing Letters* of, is *Lead* hardned with *Iron*: Thus they chuſe *ſtub-Nails* for the beſt *Iron* to Melt, as well becauſe they are aſured *ſtub-Nails* are made of good ſoft and tough *Iron*, as becauſe (they being in ſmall pieces of *Iron*) will Melt the ſooner.

To make the *Iron Run*, they mingle an equal weight of *Antimony* (beaten in an Iron-Morter into ſmall pieces) and *ſtub-Nails* together. And preparing ſo many Earthen forty or fifty pounds *Melting-Pots* (made for that purpoſe to endure the *Fire*) as they intend to uſe: They *Charge* theſe Pots with the mingled *Iron* and *Antimony* as full as they will hold.

Every

Every time they Melt *Mettal*, they build a new *Furnance* to melt it in: This *Furnance* is called an *Open Furnance*; becauſe the Air blows in through all its ſides to Fan the *Fire*: They make it of Bricks in a broad open place, as well becauſe the Air may have free acceſs to all its ſides, as that the Vapours of the *Antimony* (which are Obnoxious) may the leſs offend thoſe that officiate at the *Making* the *Mettal*: And alſo becauſe the Violent Fire made in the *Furnance* ſhould not endanger the Firing any adjacent Houſes.

They conſider before they make the *Furnance* how many Pots of *Mettal* they intend to Melt, and make the *Furnance* ſizable to that number: We will ſuppoſe *five Pots*. Therefore they firſt make a Circle on the Ground capable to hold theſe five *Pots*, and wider yet by three or four Inches round about: Then within this Circle they lay a Courſe of Bricks cloſe to one another to fill the Plain of that Platform, with their broad or flat ſides downwards, and their ends all one way, and on this Courſe of Bricks they lay another Courſe of Bricks as before, only the Lengths of this Courſe of Bricks lies athwart the Breadths of the other Courſe of Bricks: Then they lay a third Courſe of Bricks with their lengths croſs the Breadth of the ſecond Courſe of Bricks.

Having thus raiſed a Platform, they place theſe five *Pots* in the middle of it cloſe to one another, and then on the Foundation or Plat-form raiſe the *Furnance* round about by laying the Bricks of the firſt *Lay* end to end and flat, cloſe to one another:

On

On the ſecond *Lay*, they place the middle of a Brick over a *Joynt* (as *Brick-layers* call it) that is where the ends of two Bricks joyn together, and ſo again lay Bricks end to end till they *Trim* round the *Platform*. Then they lay a third *Lay* of Bricks, covering the *Joynts* of the ſecond *Lay* of Bricks as before: So is the Foundation finiſht.

Then they raiſe the Walls to the *Furnance* on this Foundation; But do not lay the ends of their Bricks cloſe together. But lay the ends of each Brick about three Inches off each other, to ſerve for *Wind-holes* till they *Trim* round about: Then they lay another *Lay* of Briks leaving other ſuch *Wind-holes* over the middle of the laſt *Lay* of Bricks, and ſo *Trim* as they work round either with half Bricks or Bats that the *Wind-holes* of the laſt *Lay* may be covered: And in this manner and order they lay ſo many *Lays* till the Walls of the *Furnance* be raiſed about three Bricks higher than the *Mouths* of the *Melting-Pots*, ſtill obſerving to leave ſuch *Wind-holes* over the middle of every Brick that lies under each *Lay*.

Then they fill the ſides of the *Furnance* round about the *Melting-Pots*, and over them with *Char-coal*, and *Fire* it at ſeveral *Wind-holes* in the bottom till it burn up and all over the *Furnance*, which a moderate Wind in about an Hours time will do: And about half an Hours time after they lay their Ears near the Ground and liſten to hear a *Bubling* in the *Pots*; and this they do ſo often till they do hear it. When they hear this *Bubling*, they conclude the *Iron* is melted: But yet they will let it ſtand, perhaps half an hour longer or more, according as they gueſs the

the Fire to be Hotter or Cooler, that they may be the more aſſured it is all throughly Melted. And when it is Melted the Melting *Pot* will not be a quarter full.

And in or againſt that time they make another ſmall *Furnance* cloſe to the firſt, (to ſet an *Iron Pot* in, in which they Melt *Lead*) on that ſide from whence the Wind blows; Becauſe the Perſon that Lades the *Lead* out of the *Iron-Pot* (as ſhall be ſhewed by and by) may be the leſs annoyed with the Fumes of the *Mettal*, in both *Furnances*. This *Furnance* is made of three or four *Courſe* of Bricks open to the windward, and wide enough to contain the deſigned *Iron Pot*, with room between it and the ſides to hold a convenient quantity of *Charcoal* under it, and about it.

Into this *Iron-Pot* they put for every three Pound of *Iron*, about five and twenty pounds of *Lead*. And ſetting Fire to the *Coals* in this little *Furnance* they Melt and Heat this *Lead* Red-hot.

Hitherto a Man (nay, a Boy) might officiate all this Work; But now comes Labour would make *Hercules* ſweat. Now they fall to pulling down ſo much of the ſide of the open *Furnance* as ſtands above the Mouth of that *Melting-Pot* next the *Iron-Pot*, And having a thick ſtrong *Iron Ladle*, whoſe *Handle* is about two Yards long, and the *Ladle* big enough to hold about ten Pounds of *Lead*, and this *Ladle* Red-hot that it chill not the *Mettal*, they now I ſay with this *Ladle* fall to clearing this firſt *Melting-Pot* of all the Coals or filth that lie on the top of the Melted *Mettal*: while another Man at the ſame time ſtand

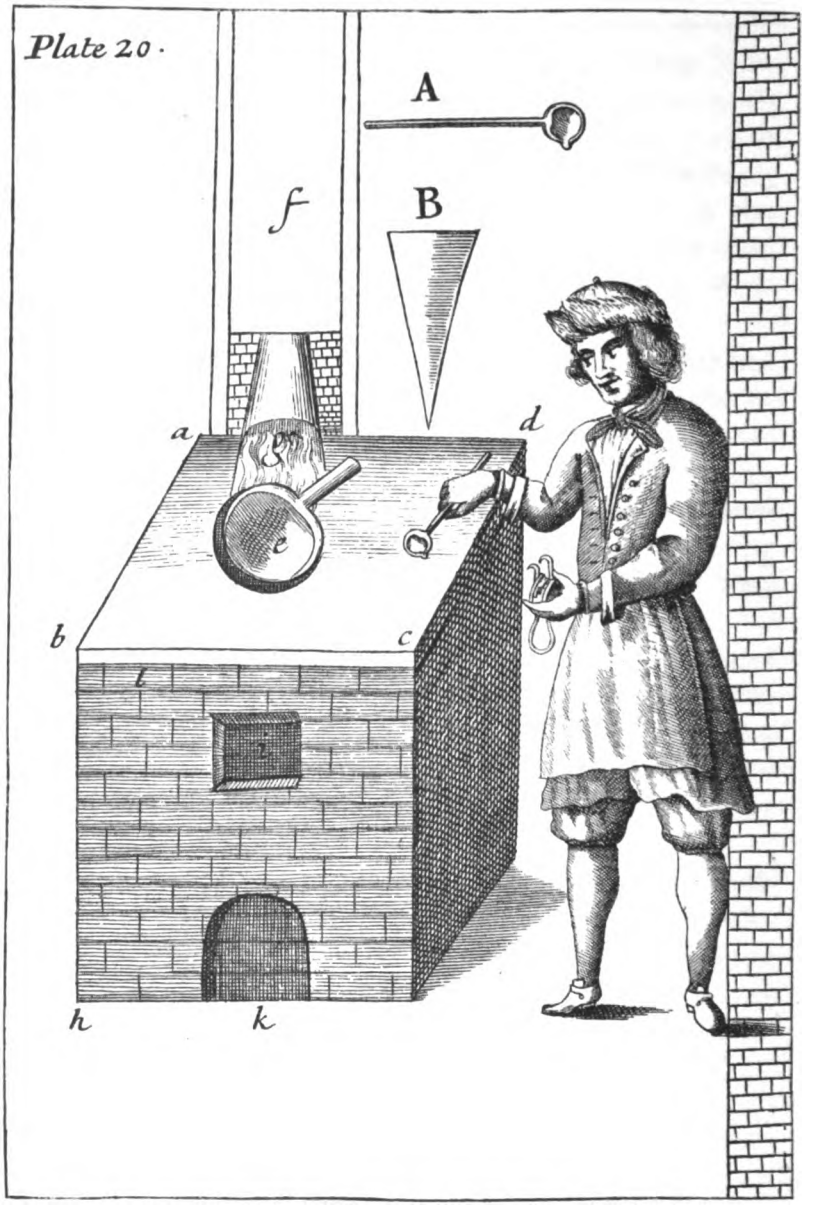
ſtands provided with a long ſtrong round *Iron Stirring Poot*; the *Handle* of which *Stirring Poot* is alſo about two Yards long or more, and the *Poot* it ſelf almoſt twice the length of the depth of the Melting *Pot*. This *Poot* is nothing but a piece of the ſame *Iron* turned to a ſquare with the Handle: And this *Poot* is alſo in a readineſs heated Red-hot.

Now one Man with the *Ladle Lades* the *Lead* out of the *Iron-Pot* into the Melting *Pot*, while the other Man with the *Poot* ſtirs and Labours the *Lead* and *Mettal* in the Melting *Pot* together till they think the *Lead* and *Mettal* in the Melting *Pot* be well incorporated: And thus they continue *Lading* and *Stirring* till they have near filled the Melting *Pot*.

Then they go to another next *Melting-Pot*, and ſucceſſively to all, and Lade and ſtir *Lead* into them as they did into the firſt. Which done the *Mettal* is made: And they pull down the *Walls* of the *Open Furnance*, and rake away the Fire that the *Mettal* may cool in the *Pots*.

Now (according to Cuſtom) is Half a Pint of Sack mingled with Sallad Oyl, provided for each Workman to Drink; intended for an Antidote againſt the Poyſonous Fumes of the *Antimony*, and to reſtore the Spirits that ſo Violent a Fire and Hard Labour may have exhauſted.

¶ 3. *Of*



¶ 3. *Of* Letter-Ladles.

Letter-Ladles differ nothing from other common *Ladles*, ſave in the ſize: Yet I have given you a Draft of one in Plate 20 at A. Of theſe the *Caſter* has many at Hand, and many of ſeveral ſizes that he may ſucceſſively chuſe one to fit the ſeveral ſizes of *Letters* he has to *Caſt*; as well in *Bodies* as in *Thickneſſes*.

§ XIX. ¶ 1. *Of* Caſting, Breaking, Rubbing, Kerning, *and ſetting up of* Letters.

BEfore the *Caſter* begins to *Caſt* he muſt kindle his *Fire* in the *Furnance*, to *Melt* the *Mettal* in the *Pan*. Therefore he takes the *Pan* out of the Hole in the Stone, and there lays in *Coals* and kindles them. And when it is well kindled, he ſets the *Pan* in again, and puts *Mettal* into it to *Melt*. If it be a ſmall *Bodyed-Letter* he *Caſts*, or a thin *Letter* of Great *Bodies*, his *Mettal* muſt be very hot; nay, ſometimes Red-hot to make the Letter *Come*. Then having choſe a *Ladle* that will hold about ſo much as the *Letter* and *Break* is, he lays it at the *Stoking-hole*, where the Flame burſts out to heat. Then he ties a thin Leather cut into ſuch a Figure as is deſcribed in Plate 20 at B with its narrow end againſt the *Face* to the *Leather-Groove* of the *Matrice*, by whipping a Brown Thred twice about the *Leather-Groove*, and faſtning the Thred with a Knot. Then he puts both Halves of the *Mold* together, and puts the

the *Matrice* into the *Matrice Cheek*, and places the *Foot* of the *Matrice* on the *Stool* of the *Mold*, and the broad end of the *Leather* upon the *Wood* of the upper half of the *Mold*, but not tight up, left it might hinder the *Foot* of the *Matrice* from *Sinking* close down upon the *Stool* in a train of Work. Then laying a little Rosin on the upper *Wood* of the *Mold*, and having his *Casting Ladle* hot, he with the bolling side of it Melts the Rosin; And when it is yet *Melted* presses the broad end of the *Leather* hard down on the *Wood*, and so fastens it to the *Wood*. All this is Preparation.

Now he comes to *Casting*. Wherefore placing the under-half of the *Mold* in his left hand, with the *Hook* or *Hag* forward, he clutches the ends of its *Wood* between the lower part of the *Ball* of his Thumb and his three hind-Fingers. Then he lays the upper half the *Mold* upon the under half, so as the *Male-Gages* may fall into the *Female-Gages*, and at the same time the *Foot* of the *Matrice* place it self upon the *Stool*. And clasping his left-hand Thumb strong over the upper half of the *Mold*, he nimbly catches hold of the *Bow* or *Spring* with his right-hand Fingers at the top of it, and his Thumb under it, and places the point of it against the middle of the *Notch* in the backside of the *Matrice*, pressing it as well forwards towards the *Mold*, as downwards by the *Sholder* of the *Notch* close upon the *Stool*, while at the same time with his hinder-Fingers as aforesaid, he draws the under-half of the *Mold* towards the *Ball* of his Thumb, and thrusts by the *Ball* of his Thumb the upper part towards his Fingers,

gers, that both the *Regiſters* of the *Mold* may preſs againſt both ſides of the *Matrice*, and his Thumb and Fingers preſs both Halves of the *Mold* cloſe together.

Then he takes the Handle of his *Ladle* in his right Hand, and with the *Boll* of it gives a ſtroak two or three outwards upon the *Surface* of the *Melted Mettal* to ſcum or cleer it from the Film or Duſt that may ſwim upon it. Then takes up the *Ladle* full of *Mettal*, and having his *Mold* as aforeſaid in his left hand, he a little twiſts the left-ſide of his *Body* from the *Furnance*, and brings the *Geat* of his *Ladle* (full of *Mettal*) to the *Mouth* of the *Mold*, and twiſts the upper part of his right-hand towards him to turn the *Mettal* into it, while at the ſame moment of Time he Jilts the *Mold* in his left hand forwards to receive the *Mettal* with a ſtrong *Shake* (as it is call'd) not only into the *Bodies* of the *Mold*, but while the *Mettal* is yet hot, running ſwift and ſtrongly into the very *Face* of the *Matrice* to receive its perfect Form there, as well as in the *Shanck*.

Then he takes the upper half of the *Mold* off the under half, by placing his right-Hand Thumb on the end of the *Wood* next his left-Hand Thumb, and his two middle Fingers at the other end of the *Wood*, and finding the Letter and *Break* lie in the under-Half of the *Mold* (as moſt commonly by reaſon of its weight it does) he throws or toſſes the Letter *Break* and all upon a Sheet of Waſte Paper laid for that purpoſe on the *Bench* juſt a little beyond his left-hand, and is then ready to *Caſt* another Letter as before,

fore, and alſo the whole number that is to be *Caſt* with that *Matrice.*

But ſometimes it happens that by a *Shake,* or too big a *Ladle,* the Mettal may ſpill or ſlabber over the *Mouth* of the upper Half of the *Mold,* ſo that the ſpilt *Mettal* ſticking about the out-ſides of the *Mouth,* may lift the Letter off the under half of the *Mold,* and keep it in the upper half. Therefore he with the point of the *Hag* in the Wood of the under half of the *Mold,* picks at the hollow in the fore part of the *Break* made by the *Shaking* out of the *Mettal,* and draws *Break* and *Letter* both out. It ſometimes ſticks in the under Half of the *Mold* by the ſame cauſe, and then he uſes the point of the *Hag* in the upper half of the *Mold,* to pick or hale it out, as before.

It alſo ſometimes ſticks when any of the Joynts of the *Mold* open never ſo little, the *Mettal* thus getting in between thoſe Joynts: But this fault is not to be indured, for before he can *Caſt* any more, this fault muſt be mended.

But beſides *Letters,* there is to be *Caſt* for a perfect *Fount* (properly a Fund) *Spaces* Thick and Thin, n *Quadrats,* m *Quadrats* and *Quadrats.* Theſe are not *Caſt* with *Matrices* but with *Stops* (as we may call them) Becauſe when theſe are *Caſt* they are all ſhorter than the *Shanck* of the Letter, that they may not *Print.* Therefore they take off the *Regiſter* of the under-Half *Mold,* and fit a piece of *Plate-Braſs* about a *Brevier* Thick and a *Brevier* longer than to reach to the edge of the *Body* in the place of the *Regiſter,* and drill a hole in this *Plate-Braſs* right againſt the

the Hole in the *Carriage* that the *Female-Screw* lies in: This Hole is made ſo wide that the *Male-Screw* which ſcrewed the *Regiſter* cloſe to the *Carriage* and *Body* may enter in at it, and ſcrew this *Plate-Braſs* cloſe to them, as it did the *Regiſter*: Then they make a mark with the point of a *Needle* on the *Plate-Braſs* juſt againſt the ſide of the Edge of the *Body*, and at this mark they double down the end of the *Plate-Braſs* inwards to make a perfect *Square* with the *inſide* of the whole *Plate*. This doubling down is called the *Stop* aforeſaid, and muſt be made juſt ſo thick as they deſign the Thin or Thick *Space* to be, and muſt have its Upper and Under-Edges filed ſo exactly to the *Body*, that it may lie cloſe upon the Under-*Carriage*, and juſt even ſo high as the upper-ſide of the *Body*. So that when the Upper-half of the *Mold* is placed on the under-Half, and *Mettal Caſt* in at the *Mouth* (as before) the *Mettal* ſhall deſcend no deeper between the two *Bodies* then juſt to his *Stop*: You muſt note that this *Stop* muſt be filed exactly true as to *Body* and *Thickneſs*: For if it be never ſo little too big in *Body*, the *Carriage* of the *Mold* will ride upon it and make the *Body* of the *Space* bigger. Or if the *Body* be never ſo little too little, the Hot *Mettal* will run beyond the *Stop*; both which Miſcarriages in making the *Stop*, ſpoil the *Space*.

If the *Space* be too ſhort, they File the end of the *Stop* ſhorter.

This *Brevier* thick *Plate* will be thick enough for *Stops* for the Thin or Thick *Spaces* of any Body though of *Great-Cannon*, and for the n *Quadrat Stop* of

of any Body under a *Great Primmer*. And for the m *Quadrat Stop* of all to a *Brevier* and all Bodies under it. But for *Stops* that require to be Thicker then a *Brevier*, inſtead of doubling the *Stop* inwards on the *Plate*, I *Solder* on the in-ſide of that end of the *Plate* a *Stop* full big enough in Body, and big enough in Thickneſs for the *Quadrat* I intend to make, and afterwards file and fit the *Stop* exactly as before.

When they *Caſt* theſe *Spaces* or *Quadrats*, this *Stop* is always ſcrewed faſt upon the *Carriage* of the under-Half *Mold* as aforeſaid. So that they only fit the upper half *Mold* on the under, and *Caſt* their Number almoſt twice as quick as they do the Letters in *Matrices*.

It is generally obſerved by *Work-men* as a Rule, That when they *Caſt Quadrats* they *Caſt* them exactly to the Thickneſs of a ſet Number of m's or *Body*, *viz.* two m's thick, three m's thick, four m's thick, *&c.* And therefore the *Stops* aforeſaid muſt all be filed exactly to their ſeveral intended thickneſſes, The reaſon is, that when the *Compoſiter* Indents any Number of Lines, he may have *Quadrats* ſo exactly *Caſt* that he ſhall not need to *Juſtifie* them either with *Spaces* or other helps.

¶ 2. *Some Rules and Circumſtances to be obſerved in* Caſting.

1. If the Letter be a ſmall *Body*, it requires a Harder *Shake* than a great *Body* does: Or if it be a thin Letter though of a greater *Body*, eſpecially ſmall

ſmall *i*, being a thin Letter its Tittle will hardly *Come*; So that ſometimes the *Caſter* is forced to put a little *Block-Tin* into his Mettal, which makes the Mettal Thinner, and conſequently have a freer flux to the *Face* of the *Matrice*.

2. He often examines the *Regiſters* of the *Mold*, by often *Rubbing* a *Caſt* Letter: For notwithſtanding the *Regiſters* were carefully *Juſtified* before, and hard ſcrewed up; yet the conſtant thruſting of both *Regiſters* againſt the ſides of the *Matrice*, may and often do force them more or leſs to drive backwards. Or a fall of one half or both Halfs of the *Mold*, may drive them backwards or forwards: Therefore he examins, as I ſaid, how they *Rub*, whether too Thick or too Thin. And if he ſee Cauſe, mends the *Regiſters*, as I ſhew'd § 5. ¶ 2.

Or if the *Matrice* be *Botcht*, as I ſhew'd you § 5. ¶ 3. then thoſe *Botches* (being only ſo many fine points riſing out of the Body of the *Copper* of the *Matrice*) may with ſo many reiterated preſſures of the *Regiſters* againſt them, flatten more and more, and preſs towards the Body of the *Matrice*, and conſequently make the Letter Thinner: Which if it do, this muſt be mended in the *Matrice* by re-raiſing it to its due Thickneſs.

3. He pretty often examins, as I ſhew'd in § 5. ¶ 2. how the Letters ſtand in *Line*: For when great Numbers are *Caſt* with one *Matrice*, partly by preſſing the point of the *Wyer* againſt the *Bottom-Sholder* of the *Notch* in the back-ſide of the *Matrice*, and partly by the ſoftneſs of the matter of his *Matrice* and hardneſs of the *Iron-ſtool*, the *Foot* of the *Matrice* (if it

it wear not) may batter ſo much as to put the Letter out of Line. This muſt be mended with a *Botch*, *viz.* by knocking up the *Foot* of the *Matrice*, as I ſhew'd § 5. ¶ 3.

A Work-man will *Caſt* about four thouſand of theſe Letters ordinarily in one day.

¶ 3. *Of* Breaking *off* Letters.

Breaking off is commonly Boys-work: It is only to *Break* the *Break* from the *Shanck* of the *Letter*. All the care in it is, that he take up the *Letter* by its Thickneſs, not its *Body* (unleſs its Thickneſs be equal to its Body) with the fore Finger and Thumb of his right Hand as cloſe to the *Break* as he can, leſt if when the *Break* be between the fore-Finger and Thumb of his left Hand, the force of *Breaking* off the *Break* ſhould bow the *Shanck* of the *Letter*.

¶ 4. *Of* Rubbing *of* Letters.

Rubbing of *Letters* is alſo moſt commonly Boys-work: But when they do it, they provide *Finger-ſtalls* for the two fore-Fingers of the right-Hand: For elſe the Skin of their Fingers would quickly rub off with the ſharp greet of the Stone. Theſe *Finger-ſtalls* are made of old *Ball-Leather* or *Pelts* that *Printers* have done with: Then having an heap of one ſort of *Letters* lying upon the Stone before them, with the left-Hand they pick up the *Letter* to be *Rub'd*, and lay it down in the *Rubbing* place with one

one of its ſides upwards they clap the Balls of the fore-Finger and middle-Finger upon the fore and hinder-ends of the *Letter*, and *Rubbing* the *Letter* pretty lightly backwards about eight or nine Inches, they bring it forwards again with an hard preſſing *Rub* upon the *Stone*; where the fore-Finger and Thumb of the left-Hand is ready to receive it, and quickly turn the oppoſite ſide of the *Letter*, to take ſuch a *Rub* as the other ſide had.

But in *Rubbing* they are very careful that they preſs the Balls of their Fingers equally hard on the *Head* and *Foot* of the *Letter*. For if the *Head* and *Foot* be not equally preſt on the *Stone*, either the *Head* or *Foot* will *Drive out* when the *Letters* come to be *Compoſed* in the *Stick*; So that without *Rubbing* over again they cannot be *Dreſt*.

¶ 5. *Of* Kerning *of* Letters.

Amongſt the *Italick-Letters* many are to be *Kern'd*, ſome only on one ſide, and ſome both ſides. The *Kern'd-Letters* are ſuch as have part of their *Face* hanging over one ſide or both ſides of their *Shanck*: Theſe cannot be *Rub'd*, becauſe part of the *Face* would *Rub* away when the whole ſide of the *Shanck* is toucht by the *Stone*: Therefore they muſt be *Kern'd*, as *Founders* call it: Which to do, they provide a ſmall Stick bigger or leſs, according as the *Body* of the *Letter* that is to be *Kern'd*. This *Kerning-ſtick* is ſomewhat more than an Handful long, and it matters not whether it be ſquare or round: But if it be ſquare the Edges of it muſt be pret-

ty

ty well rounded away, leſt with long uſage and hard Cutting they Gall the Hand. The upper ſide of this *Kerning-Stick* is flatted away ſomewhat more than the length of the *Letter*, and on that flat part is cut away a flat bottom with two ſquare ſides like the *Sides* or *Ledges* of the *Lining-ſtick* to ſerve for two *Sholders*. That ſide to be *Kern'd* and *ſcrap'd*, is laid upwards, and its oppoſite ſide on the bottom of the *Kerning-ſtick* with the *Foot* of the *Letter* againſt the bottom *Sholder*, and the ſide of the *Letter* againſt the ſide *Sholder* of the *Kerning-ſtick*.

He alſo provides a *Kerning-Knife*: This is a pretty ſtrong piece of a broken Knife, about three Inches long, which he fits into a Wooden-Handle: But firſt he breaks off the Back of the Knife towards the Point, ſo as the whole edge lying in a ſtraight-line the piece broken off from the back to the edge may leave an angle at the point of about 45 Degrees, which irregular breaking (for ſo we muſt ſuppoſe it) he either *Grinds* or *Rubs* off on a *Grind-ſtone*. Then he takes a piece of a Broom-ſtick for his Handle, and ſplits one end of it about two Inches long towards the other end, and the ſplit part he either Cuts or Raſps away about a *Brevier* deep round about that end of the Handle. Then he puts about an Inch and an half of his broken blade into the ſplit or ſlit in the Handle, and ties a four or five doubled Paper a little below the Raſped part of the Handle round about it, to either a *Pica* or *Long-Primmer* thick of the ſlit end of the Handle. This *Paper* is ſo ordered that all its ſides round about ſhall ſtand equally diſtant from all the

the Raſped part of the Handle: For then ſetting the other end of the Handle in Clay, or otherwiſe faſtening it upright, when *Mettal* is poured in between the Raſped part of the Handle and the Paper about it, that *Mettal* will make a ſtrong *Ferril* to the *Handle* of the *Knife*. The irregularities that may happen in *Caſting* this *Ferril* may be Raſped away to make it more handy and Handſome.

Now to return again where I left off. Holding the Handle of the *Kerning-ſtick* in his left-Hand, He lays the ſide of the *Letter* to be *Kern'd* upwards with the *Face* of the *Letter* towards the end of the *Kerning-ſtick*: the ſide of the *Letter* againſt the ſide *Sholder* of the *Kerning-ſtick*, and the *Foot* of the *Letter* againſt the bottom *Sholder* of the *Kerning-ſtick*, and laying the end of the Ball of his left-Hand Thumb hard upon the *Shanck* of the *Letter* to keep its *Side* and *Foot* ſteddy againſt the *Sholders* of the *Kerning-ſtick*, he with the *Kerning-Knife* in his right-Hand cuts off about one quarter of the *Mettal* between the *Beard* of the *Shanck* and the *Face* of the *Letter*. Then turning his *Knife* ſo as the back of it may lean towards him, he ſcrapes towards him with the edge of the *Knife* about half the length of that upper-ſide, *viz.* about ſo much as his Thumb does not cover: Then he turns the *Face* of the *Letter* againſt the lower *Sholder* of the *Kerning-ſtick*, and ſcraping fromwards him with a ſtroak or two of his *Knife* ſmoothens that end of the *Letter* alſo.

If the other ſide of the *Letter* be not to be *Kern'd* it

it was before *Rub'd* on the *Stone*, as was ſhewed in the laſt ¶: But if it be to be *Kern'd*, then he makes a little hole in his *Kerning-ſtick*, cloſe to the lower *Sholder* of it and full deep enough to receive all that part of the *Face* of the *Letter* that hangs over the *Shanck*, that the *Shanck* of the *Letter* may lie flat and ſolid on the bottom of the *Kerning-ſtick*, and that ſo the *Shanck* of the *Letter* bow not when the weight of the Hand preſſes the edge of the *Kerning-Knife* hard upon it. Into this hole he puts (as before ſaid) ſo much of the *Face* of the *Letter* as hangs over the ſide of the *Shanck*, and ſo ſcrapes the lower end of the *Letter* and *Kerns* the upper end, as he did the former ſide of the *Letter*.

¶ 6. *Of* Setting up, *or* Compoſing Letters.

I deſcribed in § 5. ¶ 2. the *Lining-ſtick*, But now we are come to *Setting up*, or *Compoſing* of *Letters*. The *Founder* muſt provide many *Compoſing-ſticks*; five or ſix dozen at the leaſt. Theſe *Compoſing-ſticks* are indeed but long *Lining-ſticks*, about ſeven or eight and twenty Inches long *Handle* and all: Whereof the *Handle* is about three Inches and an half long: But as the *Lining-ſtick* I deſcribed was made of *Braſs*: So theſe *Compoſing-ſticks* are made of *Beech-Wood*.

When the Boy *Sets* up *Letters* (for it is commonly Boys Work) The *Caſter Caſts* about an hundred *Quadrats* of the ſame *Body* about half an Inch broad at leaſt, let the *Body* be what it will, and of the

the length of the whole *Carriage*, only by placing a flat *Braſs* or *Iron Plate* upon the *Stool* of the *Mold* cloſe againſt the *Carriage* and *Body*, to ſtop the *Mettal* from running farther.

The Boy (I ſay) takes the *Compoſing-ſtick* by the *Handle* in his left-Hand, claſping it about with his four Fingers, and puts the *Quadrat* firſt into the *Compoſing-ſtick*, and lays the Ball of his Thumb upon it, and with the fore-Finger and Thumb of his right-Hand, aſſiſted by his middle Finger to turn the *Letter* to a proper poſition, with its *Nick* upwards towards the bottom ſide of the *Compoſing-ſtick*; while it is coming to the *Stick*, he at the ſame time lifts up the Thumb of his left-Hand, and with it receives and holds the *Letter* againſt the fore-ſide of the *Quadrat*, and after it, all the *Letters* of the ſame ſort, if the *Stick* will hold them, If not he *Sets* them in ſo many *Sticks* as will hold them: Obſerving to *Set* all the *Nicks* of them upwards, as aforeſaid. And as he *Set* a *Quadrat* at the beginning of the *Compoſing-ſtick*, ſo he fils not his *Stick* ſo full, but that he may *Set* another ſuch *Quadrat* at the end of it.

¶ 7. *Some Rules and Circumſtances to be obſerved in* Setting *up* Letters.

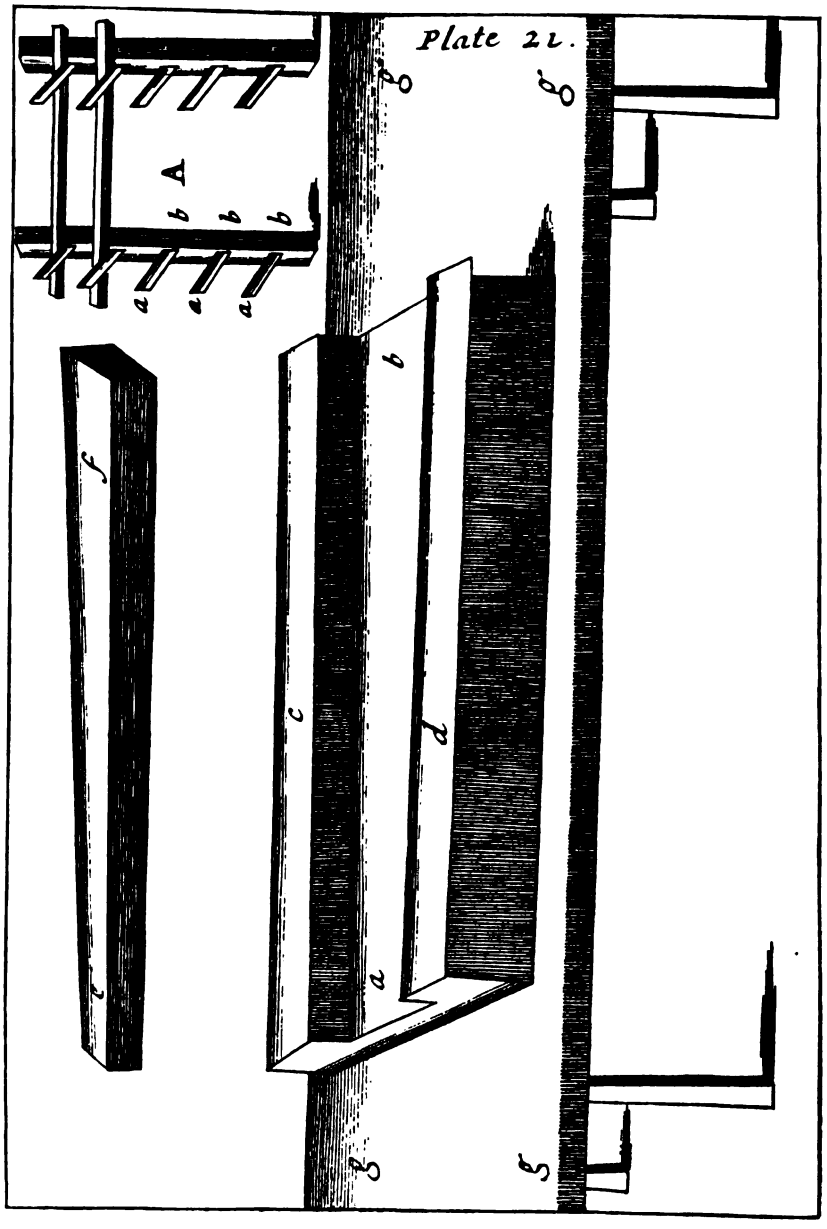
1. If they *Drive* a little out at *Head* or *Foot*, ſo little as not to require new *Rubbing* again, then he holds his Thumb harder againſt the *Head* or *Foot*, ſo as to draw the *Driving* end inward: For elſe when they come to *Scraping*, and *Dreſſing* the *Hook* of the *Dreſ-*

Dreſſing-Hook drawing Square, will endanger the middle or ſome other part of *Letters* in the *Stick* to *Spring* out: And when they come into the *Dreſſing-block*, the *Knots* of the *Blocks* drawing alſo ſquare ſubject them to the ſame inconvenience. And if they *Drive* out at the *Head*, the *Feet* will more or leſs ſtand off one another: So that when the *Tooth* of the *Plow* comes to *Dreſs* the *Feet*, it will more or leſs job againſt every *Letter*, and be apt to make a bowing at the *Feet*, or at leaſt make a *Bur* on their ſides at the *Feet*.

2. When *Short-Letters* are begun to be *Set* up in a *Stick*, the whole *Stick* muſt be fill'd with *Short-Letters*: Becauſe when they are *Dreſſing*, the *Short Letters* muſt be *Bearded* on both ſides the *Body*: And ſhould *Short-Letters* or *Aſcending* or *Deſcending* or *Long* ſtand together, the *Short* cannot be *Bearded* becauſe the *Stems* of the *Aſcending* or *Deſcending* or *Long-Letters* reach upon the *Body* to the *Beard*: So that the *Short-Letters* cannot be *Bearded*, unleſs the *Stems* of the other *Letters* ſhould be ſcraped off.

3. When *Long-Letters* are begun to be *Set* up in the *Stick*, none but ſuch muſt fill it, for the reaſon aforeſaid.

4. If any *Letters Kern'd* on one ſide be to be *Set* up, and the *Stems* of the ſame *Letters* reach not to the oppoſite *Beard* as ſ or f, in *Setting* up theſe or ſuch like *Letters*, every next *Letter* is turned with its *Nick* downwards, that the *Kern* of each *Letter* may lie over the *Beard* of its next. But then they muſt be all *Set* up again with a *Short-Letter*



Letter between each, that they may be *Bearded.*

As every *Stick-full* is ſet up, he ſets them by upon the *Racks*, ready for the *Dreſſer* to *Dreſs*, as ſhall be ſhewed in the next §.

The *Racks* are deſcribed in *Plate* 21. at A. They are made of Square *Deal Battens* about ſeven Inches and an half long, as at *a b a b a b*, and are at the ends *b b b* let into two upright *Stiles*, ſtanding about ſixteen Inches and an half aſſunder, and the fore-ends of the *Racks* mounting a little, that when *Sticks* of *Letters* is *Set* by on any two parallel *Racks*, there may be no danger that the *Letters* in them ſhall ſlide off forward; but their *Feet* reſt againſt the *Bottom-Ledges* of the *Compoſing-ſticks*. They ſet by as many of theſe *Sticks* with *Letter* in them, as will ſtand upon one another between every two *Rails*, and then ſet another pile of *Sticks* with *Letter* in them before the firſt, till the length of the *Rail* be alſo filled with *Sticks* of *Letter* before one another. They ſet all the *Sticks* of *Letters* with their ends even to one another with the *Faces* of the *Letter* forwards.

This *Frame of Racks* is always placed near the *Dreſſing-Bench*, that it may ſtand convenient to the *Letter-Dreſſers* Hand.

§ 20. ¶ 1. *Of* Dreſſing *of* Letters.

THere be ſeveral Tools and Machines uſed to the *Dreſſing* of *Letters*: And unleſs I ſhould deſcribe them to you firſt, you might perhaps in my following diſcourſe not well underſtand me:

me: Wherefore I ſhall begin with them: They are as follows.

1. The *Dreſſing-Sticks.*
2. The *Bench, Blocks* and its Appurtenances.
3. The *Dreſſing-Hook.*
4. The *Dreſſing-Knife.*
5. The *Plow.*
6. The *Mallet.*

Of each of theſe in order.

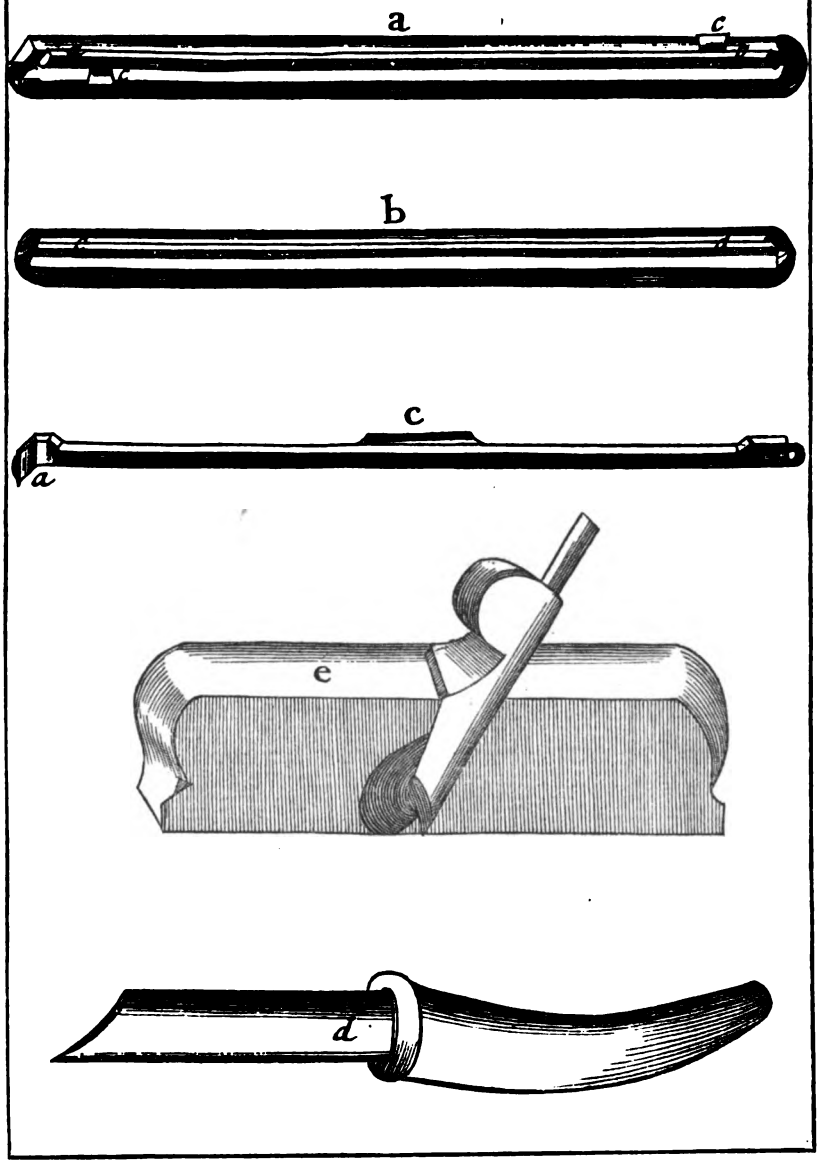
¶ 2. *Of the* Dreſſing-Sticks.

I need give no other Deſcription of the *Dreſſing-ſticks*, than I did in the laſt § and ¶ of the *Compoſing-Sticks*: Only they are made of hard Wood, and of greater Subſtance, as well becauſe hard Wood will work ſmoother than ſoft Wood, as becauſe greater Subſtance is leſs Subject to warp or ſhake than ſmaller Subſtance is. And alſo becauſe hard Wood is leſs Subject to be penetrated by the ſharpneſs of the *Bur* of the *Mettal* on the *Letters* than the ſoft.

¶ 3. *Of the* Block-Grove, *and its* Appurtenances.

The *Block-Grove* is deſcribed in *Plate* 21. *a b* The *Groove* in which the *Blocks* are laid, two Inches deep, and ſeven Inches and an half wide at one end, and ſeven Inches wide at the other end: One of the *Cheeks* as *c* is three Inches and an half broad at one end, and three Inches broad at the other end, and the other *Cheek* three Inches broad the whole Length

Plate 22.



Length: The Length of theſe *Cheeks* are two and twenty Inches.

The *Wedge e f* is ſeven and twenty Inches and an half long, two Inches broad at one end, and three Inches and an half broad at the other end; And two Inches deep.

g g g g The *Bench* on which the *Dreſſing-Blocks* are placed, are about ſixteen Inches broad, and two Foot ten Inches high from the Floor. The *Bench* hath its farther Side, and both ends, railed about with ſlit Deal about two Inches high, that the *Hook*, the *Knife*, and *Plow*, &c. fall not off when the Work-man is at Work.

The *Blocks* are deſcribed in *Plate* 21 at a b: They are made of hard Wood. Theſe *Blocks* are ſix and twenty Inches long, and each two Inches ſquare. They are *Male* and *Female*, a the *Male*, b the *Female*: Through the whole Length of the *Male-Block* runs a *Tongue* as at *a b*, and a *Groove* as at *c d*, for the *Tongue* of the *Plow* to run in; This *Tongue* is about half an Inch thick, and ſtands out ſquare from the upper and under ſides of the *Block*. About three Inches within the ends of the *Block* is placed a *Knot* as at *c c*: Theſe *Knots* are ſmall ſquare pieces of *Box-wood*, the one above, and the other below the *Tongue*.

The *Female Block* is ſuch another *Block* as the *Male Block*, only, inſtead of a *Tongue* running through the length of it a *Groove* is made to receive the *Tongue* of the *Male-Block*, and the *Knots* in this *Block* are made at the contrary ends, that when the *Face* of a *Stick* of *Letter* is placed on the *Tongue*

Tongue the *Knot* in the *Male-Block* ſtops the *Stick* of *Letter* from ſliding forwards, while the other *Knot* in the *Female-Block* at the other end, by the knocking of a *Mallet* on the end of the *Block* forces the *Letter* between the *Blocks* forwards, and ſo the whole *Stick* of *Letters* between theſe two *Knots* are ſcrewzed together, and by the *Wedge e f* in *Plate* 21 (alſo with the force of a *Mallet*) *Wedges* the two *Blocks* and the *Stick* of *Letter* in them alſo tight, and cloſe between the ſides of the two *Blocks*; that afterwards the *Plow* may more certainly do its Office upon the *Foot* of the *Letter*; as ſhall be ſhewed hereafter.

¶ 3 *Of the* Dreſſing-Hook.

The *Dreſſing-Hook* is deſcribed in *Plate* 21 at c. This is a long ſquare *Rod* of *Iron*, about two Foot long and a *Great-Primmer* ſquare: Its end *a* is about a *two-Lin'd Engliſh* thick, and hath a ſmall *Return* piece of *Iron* made ſquare to the under-ſide of the *Rod*, that when the whole *Dreſſing-Hook* is laid along a *Stick* of *Letter*, this *Return piece* or *Hook* may, when the *Rod* is drawn with the *Ball* of the Thumb, by the *Knot* on the upper ſide of it at c, draw all the *Letter* in the *Stick* tight and cloſe up together, that the *Stick* of *Letter* may be *Scraped*, as ſhall be ſhewed.

¶ 4 *Of*

¶ 4 *Of the* Dreſſing-Knife.

The *Dreſſing-Knife* is delineated at d in *Plate.* 21. It is only a ſhort piece of a *Knife* broken off about two Inches from the *Sholder*: But its Edge is *Baſil'd* away from the back to the point pretty ſuddenly to make it the ſtronger: The *Sprig* or *Pin* of the *Handle* is commonly let into an Hole drilled into a piece of the Tip of an Harts-horn, as in the Figure and is faſtned in with *Roſen*, as other *Knives* are into their *Handles*.

¶ 5 *Of the* Plow.

The *Plow* is delineated in *Plate* 21 at e: It is almoſt a common *Plain* (which I have already deſcribed in *Vol.* 1. *Numb.* 4. *Plate* 4. and § 2 to 9.) only with this diſtinction, that through the length of the *Sole* runs ſuch a *Tongue*, as does through the *Male-Block* to ſlide tight and yet eaſily through the *Groove* made on the top of the *Male-block*: Its *Blade* makes an *Angle* of 60 Degrees with the *Sole* of it.

§ 21. ¶ 1. *Of* Dreſſing *of* Letters.

THe *Letter Dreſſer* hath (as I told you before) his *Letter Set* up in *Compoſing-ſticks*, with their *Nicks* upwards, and thoſe *Sticks* ſet upon the *Racks*: Therefore he takes one *Stick* off the *Racks*, and placing the *Handle* of the *Compoſing-ſtick* in his left-hand, he

he takes the contrary end of the *Dreſſing-ſtick* in his right-hand, and laying the Back of the *Dreſſing-ſtick* even upon or rather a little hanging over the Back of the *Compoſing-ſtick*, that the *Feet* of the *Letter* may fall within the *Bottom-Ledge* of the *Dreſſing-ſtick*; He at the ſame time fits the *Side-Ledge* of the *Dreſſing-ſtick* againſt the farther end of the *Line* of *Letters* in the *Compoſing-ſtick*: And holding then both *Sticks* together, his left-Hand at the *Handle*-end of the *Compoſing-ſtick*, and his right-Hand within about two Handfuls of the *Handle*-end of the *Dreſſing-ſtick*, He turns his Hands, *Sticks* and all, outward from his left-Hand, till the *Compoſing-ſtick* lies flat upon the *Dreſſing-ſtick*, and conſequently the *Letters* in the *Compoſing-ſtick* is turned and laid upon the *Dreſſing-ſtick*.

Then he goes as near the Light as he can with the *Letters* in his *Dreſſing-ſtick*, and examins what *Letters Come not well* either in the *Face* or *Shanck*: So that then holding the *Dreſſing-ſtick* in his left-Hand, and tilting the *Bottom-Ledge* a little downward, that the *Feet* of the *Letter* may reſt againſt the *Bottom-Ledge*, and laying the Ball of his Thumb upon any certain Number of *Letters* between his *Body* and the *Letter* to be *Caſt out*, He with the *Foot* of a *Space* or ſome thin *Letter*, lifts up the *Letter* to be *Caſt out*, and lets it fall upon the *Dreſſing-Bench*: and thus he does to all the *Letters* in that *Stick* that are to be *Thrown out*.

Then taking again the *Dreſſing-Stick* in his left-Hand at or near the handle of it, he takes the *Dreſſing-Hook* at the *Knot*, between the fore-Finger and Thumb

Thumb of his right-Hand, and laying the *Hook* over the edge of the *Quadrat* at the farther end of the *Dreſſing-ſtick*, near the *bottom-Ledge* of it, he ſlips his right-Hand to the *Handle* of the *Dreſſing-ſtick*, and his left-Hand towards the middle of the *Dreſſing-ſtick*, ſo as the end of the Ball of his Thumb may draw by the farther end of the *Knot* on the *Dreſſing-Hook* the whole *Dreſſing-Hook*, and the *Hook* at the end of it the whole *Stick* of *Letter* cloſe together towards him; While at the ſame time he with his Fingers clutched about the *Stick* and *Letter*, and the Thumb-*ball* of his Hand preſſes the under flat of the *Hooking-ſtick* cloſe againſt the *Letter* and *Dreſſing-ſtick*, that the *Letter* in the *Stick* may lie faſt and manageable.

Then he takes the *Handle* of the *Dreſſing-Knife* in his right-Hand, and inclining the back of it towards his *Body*, that its *Baſil*-edge may *Cut* or *Scrap* the ſmoother, He *Scrapes* twice or thrice upon ſo much of the whole *Line* of *Letters* as lies between the outer-ſide of the *Dreſſing-Hook* and the *Face* of the *Letter*.

But if twice or thrice *Scraping*, have not taken all the *Bur* or irregularities off ſo much of the *Letter* as he *Scraped* upon, he *Scrapes* yet longer and oftner till the whole number of *Letters* in the *Dreſſing-ſtick* from end to end ſeems but one intire piece of *Mettal*.

Thus is that ſide of the fore-part (*viz.* that part towards the *Face*) of the *Shanck* of the *Body* finiſht.

To *Scrape* the other end of that ſide of the *Letter*

ter, viz. that towards the *Feet*; He turns the *Handle* of the *Stick* from him, and removing the *Dreſſing-Hook* towards the *Face* of the *Letter* which is already *Scraped*, he places his Thumb againſt the *Knot* of the *Dreſſing-Hook*, and preſſes it hard from him, that the *Hook* of the *Dreſſing-Hook* being now towards him, may force the whole *Stick* of *Letter* forwards againſt the *Side-Ledge* of the *Dreſſing-ſtick*; that ſo the whole *Line* in the *Stick* may lie again the faſter and more manageable: Then he *Scrapes* with the *Dreſſing-Knife* as before, till the end of the *Shanck* of the *Letter* towards the *Feet* be alſo *Dreſt*.

Then he lays by his *Dreſſing-Hook*, and keeping his *Dreſſing-ſtick* of *Letter* ſtill in his left-Hand, he takes a ſecond *Dreſſing-ſtick*, with its *Handle* in his right-Hand, and lays the *Side-Ledge* of it againſt the hither ſide of the *Quadrat* at the hither end of the *Dreſſing-ſtick*, and the *bottom-Ledge* of the ſecond *Stick* hanging a little over the *Feet* of the *Letter*, that they may be comprehended within the *bottom-Ledge* of the ſecond *Dreſſing-ſtick*; and ſo removing his left-Hand towards the middle of both *Dreſſing-ſticks*, and claſping them cloſe together, he turns both Hands outwards towards the left, till the *Letter* in the firſt *Dreſſing-ſtick* lie upon the ſecond *Dreſſing-ſtick*, and then the *Face* of the *Letter* will lie outwards toward the right-Hand, and the *Nicks* upwards. Then he uſes the *Dreſſing-Hook* and *Dreſſing-Knife* to *Scrape* this ſide the *Line* of *Letter*, as he did before to the other ſide of the *Line* of *Letter*: So ſhall both ſides be *Scraped* and *Dreſt*.

Having thus *Scraped* both the ſides, He takes the *Handle*

Handle of the *Dreſſing-ſtick* into his left-Hand, as before, and takes the *Male-block* into his right-Hand, and placing the *Tongue* of the *Block* againſt the *Face* of the *Letter* in the *Dreſſing-ſtick*, he alſo places the *Knot* of the *Block* againſt the farther ſide of the *Quadrat* at the farther end of the *Stick*, and ſo placing his right-Hand underneath the middle of the *Dreſſing-ſtick* and *Block*, he turns his Hand outwards towards the left, as before, and transfers the *Letter* in the *Dreſſing-ſtick* to the *Male-Block*: Yet he ſo holds and manages the *Block* that the *Shanck* of the *Letter* may reſt at once upon the ſide of the *Block* the *Knot* is placed in, and the *Face* of the *Letter* upon the *Tongue*.

When his *Stick* of *Letters* is thus transfer'd to the *Male-Block*, He claps the middle of the *Male-Block* into his left-Hand, tilting the *Feet* of the *Letter* a little upwards, that the *Face* may reſt upon the *Tongue*, and then takes about the middle of the *Female-Block* in his right-Hand, and lays it ſo upon the *Male-Block*, that the *Tongue* of the *Male-Block* may fall into the *Tongue* of the *Female-Block*, and that the *Knot* at the hither end of the *Female Block* may ſtand againſt the hither ſide of the *Quadrat* at the hither end of the *Line* of *Letters*: So that when the *Knot* of the *Male-Block* is lightly drawn towards the *Knot* of the *Female-Block*, or the *Knot* of the *Female-Block* lightly thruſt towards the *Knot* of the *Male-Block*, both *Knots* ſhall ſqueeze the *Letter* cloſe between them.

Then he graſps both *Blocks* with the *Letter* between them in both his Hands, and lays them in the

the *Block-Groove*, with the *Feet* of the *Letter* upwards, and the hither ſide of the hither *Block* againſt the hither *Cheek* of the *Block-Groove*. And putting the *Wedge* into the vacant ſpace between the *Blocks* and the further *Cheek* of the *Block-Groove*, he lightly with his right-Hand thruſts up the *Wedge* to force the *Blocks* cloſe together, and pinch the *Letter* cloſe between the *Blocks*.

Then with the *Balls* of the Fingers of both his Hands, he Patts gently upon the *Feet* of the *Letter*, to preſs all their *Faces* down upon the *Tongue*; which having done, he takes the *Mallet* in his right-Hand, and with it knocks gently upon the head of the *Wedge* to pinch the *Letter* yet cloſer to the inſides of the *Blocks*. Then he Knocks lightly and ſucceſſively upon the *Knot-ends* of both the *Blocks*, to force the *Letters* yet cloſer together. And then again knocks now pretty hard upon the head of the *Wedge*, and alſo pretty hard upon the *Knot-ends* of the *Blocks*, to *Lock* the *Letter* tight and cloſe up.

Then he places the *Tongue* of the *Plow* in the upper *Groove* of the *Block*; And having the *Tooth* of the *Iron* fitted in the *Plow*, ſo as to fall juſt upon the middle of the *Feet* of the *Letter*, he graſps the *Plow* in his right-Hand, placing his Wriſt-Ball againſt the *Britch* of it, and guiding the fore-end with his left-Hand, ſlides the *Plow* gently along the whole length of the *Blocks*; ſo as the *Tooth* of the *Iron* bears upon the *Feet* of the *Letter*: And if it be a ſmall *Letter* he *Plows* upon, the *Tooth* of the *Iron* will have cut a *Groove* deep enough through the length of the whole *Block* of *Letters*:

ters: But if the *Body* of the *Letter* be great, he reitterates his *Traverſes* two three or four times according to the Bigneſs of the *Body* of the *Letter*, till he have made a *Groove* about a *Space* deep in the *Feet* of the *Shancks* of the whole *Blocks* of *Letter*, and have cut off all the irregularities of the *Break*.

Then with a ſmall piece of *Buff* or ſome other ſoft *Leather*, he rubs a little upon the *Feet* of the *Letter* to ſmoothen them.

Then he unlocks the *Blocks* of *Letter*, by knocking with the *Mallet* upon the ſmall end of the *Wedge*, and firſt takes the *Wedge* from between the *Blocks* and *Cheeks*, and lays it upon the farther *Cheek*, and afterwards takes the *Blocks* with *Letter* in it near both ends of the *Blocks* between the Fingers and Thumbs of both his Hands, and turns the hithermoſt *Block* upon the hithermoſt *Cheek*, and with his Fingers and Thumbs again lifts off the upper *Block*, leaving the *Letter* on the undermoſt *Block* with its *Face* againſt the *Tongue*.

Then taking the *Block* with *Letter* in it in his left-Hand, he places the *Knot-end* from him, and takes the *Handle* of the *Dreſſing-ſtick* in his right-Hand, and lays the *Side-Ledge* of it againſt the hither ſide of the *Quadrat* at the hither end, and the *Bottom-ledge* againſt the *Feet* of the *Letter*, he graſps the *Handle* of the *Dreſſing-ſtick Block* and all in his left-Hand, and lays his right-Hand Thumb along the under ſide of the *Dreſſing-ſtick* about the middle, and with the Fingers of the ſame Hand graſps the *Block*, and turning his Hands, *Block*, and *Dreſſing-ſtick* to the right, transfers the *Letter* in the *Block* upon the *Dreſſing-ſtick*. Then

Then graſping the *Dreſſing-ſtick* by the *Handle* with his left-Hand, he with his right-Hand takes the *Dreſſing-Hook* by the *Knot*, and lays the inſide of the *Hook* of it againſt the farther ſide of the *Quadrat* at the farther end of the *Stick*, and drawing the *Hook* and *Letter* in the *Dreſſing-ſtick* with his left Thumb by the *Knot* cloſe up toward him, he reſting the *Stick* upon the *Dreſſing-bench* that he may *Scrape* the harder upon the *Beard* with the Edge of the *Dreſſing-Knife*, *Scrapes* off the *Beard* as near the *Face* as he dares for fear of ſpoiling it, and about a Thick *Space* deep at leaſt into the *Shanck*.

If the Bottom and Top are both to be *Bearded*, He transfers the *Letter* into another *Dreſſing-ſtick*, as hath been ſhewed, and *Beards* it alſo as before.

¶ 2. *Some Rules and Circumſtances to be obſerved in* Dreſſing *of* Letters.

1. The *Letter-Dreſſer* ought to be furniſht with three or four ſorts of *Dreſſing-ſticks*, which differ nothing from one another ſave in the Height of their *Ledges*. The *Ledges* of one pair no higher than a *Scaboard*. This pair of *Sticks* may ſerve to *Dreſs*, *Pearl*, *Nomparel*, and *Brevier*. Another pair whoſe *Ledges* may be a *Nomparel* high. And this pair of *Dreſſing-ſticks* will ſerve to *Dreſs Brevier*, *Long-Primmer*, and *Pica*: Another pair whoſe *Ledges* may be a *Long-Primmer* high: And theſe *Dreſſing-ſticks* may ſerve to *Dreſs Pica*, *Engliſh*, *Great-Primmer*, and *Double-Pica*. And if you will another pair of *Dreſſing-*

Dreſſing-ſticks, whoſe *Ledges* may be an *Engliſh* High: And theſe *Dreſſing-ſticks* may ſerve to *Dreſs* all big Bodyed *Letters*, even to the Greateſt.

2. As he ought to be furniſht with ſeveral ſorts of *Dreſſing-ſticks* as aforeſaid: So ought he alſo to be furniſht with ſeveral *Blocks*, whoſe *Knots* are to correſpond with the Sizes of the *Ledges* of the *Dreſſing-ſticks*, for the *Dreſſing* of ſeveral *Bodies* as aforeſaid.

3. He ought to be furniſht with three or four *Dreſſing-Hooks*, whoſe *Hooks* ought to be of the ſeveral Depths aforeſaid, to fit and ſuit with the ſeveral *Bodyed-Letters*.

4. He muſt have two *Dreſſing-Knives*, one to lie before the *Blocks* to *Scrape* and *Beard* the *Letter* in the *Sticks*, and the other behind the *Dreſſing-blocks* to uſe when occaſion ſerves to *Scrape* off a ſmall *Bur*, the *Tooth* of the *Plow* may have left upon the *Feet* of the *Letter*. And though one *Dreſſing-Knife* may ſerve to both theſe uſes: Yet when Work-men are in a Train of Work they begrutch the very turning the Body about, or ſtepping one ſtep forward or backward; accounting that it puts them out of their Train, and hinders their riddance of Work.

5. For every *Body* of *Letter* he is to have a particular *Plow*, and the *Tooth* of the *Iron* of each *Plow* is to be made exactly to a ſet bigneſs, the meaſure of which bigneſs is to be taken from the ſize of the *Break* that is to be *Plowed* away. For Example, If it be a *Pearl Body* to be *Plowed*, the breadth of the *Tooth* ought not to be above a thin *Scaboard*: Becauſe the *Break* of that *Body* cannot be bigger, for Reaſons I have

have given before; But the *Tooth* must be full broad enough, and rather broader than the *Break*, lest any of the irregularity of the *Break* should be left upon the *Foot* of the *Letter*. And so for every *Body* he fits the *Tooth* of the *Iron*, full broad enough and a little broader than the size of the *Break*. This is one reason why for every particular *Body* he ought to have a particular *Plow*. Another reason is.

The *Tooth* of this *Plow* must be exactly set to a punctual distance from the *Tongue* of the *Plow*: For if they should often shift *Irons* to the several *Stocks* of the *Plow*, they would create themselves by shifting more trouble than the price of a *Stock* would compensate.

A *Fount* of *Letter* being new *Cast* and *Dress*, the Boy *Papers* up each sort in a *Cartridge* by it self, and puts about an hundred Pounds weight, *viz.* a Porters Burthen into a *Basket* to be sent to the *Master-Printers*.

The *Steel-Punches* being now *Cut*, the *Molds* made, the *Matrices Sunk*, the *Letters Cast*, and *Dress*, the application of these *Letters* falls now to the task of the *Compositer*; whose *Trade* shall be (God willing) the Subject of the next *Exercises*.

F I N I S.