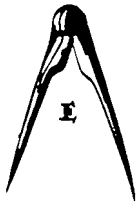
The Art of Joinery

Joseph Moxon

The Art Of Joinery



Published by Lost Art Press LLC in 2013
26 Greenbriar Ave., Fort Mitchell, KY 41017, USA
Web: http://lostartpress.com

Title: The Art of Joinery
Authors: Joseph Moxon, commentary by Christopher Schwarz
Publisher: Christopher Schwarz
Distribution: John Hoffman
Editor: Megan Fitzpatrick
Design & Layout: Linda Watts
Index: Suzanne Ellison
Cover: Christopher Schwarz

ISBN: 978-0-9850777-7-8

Printed and bound in the United States of America.

The Art Of Joinery

By Joseph Moxon

with commentary by Christopher Schwarz

Second Edition

Table of Contents

Introduction to the Second Edition v
The Art of Joinery, Edited with Commentary 1
The Plates 93
The Art of Joinery, Unedited 98
Select Plates from André Félibien 141
Index 153

Introduction to the Second Edition

Joseph Moxon's "Mechanick Exercises" is more than just a curiosity for historians of the craft of woodworking. The woodworking tools that Moxon describes and the processes he explains have remained remarkably unchanged during the intervening centuries. To be sure, we might now use fancier materials for some of our tools – investment-cast bronze, ductile iron, A2 steel. But a fore plane is still a fore plane, and it is still used in the same manner to make rough boards into smooth ones.

In fact, I consider Moxon to be an excellent introduction to many hand-tool aspects of woodworking. That is, if you can decipher his 17th-century English spellings and sentence structure that are odd to our 21st-century eyes.

The "Mechanick Exercises or the Doctrine of Handy-Works" was originally published in serial form beginning in 1678 in England. Moxon was a printer, cartographer, globe maker and maker of mathematical instruments. In addition to the art of joinery, the "Mechanick Exercises" included pamphlets on blacksmithing, house carpentry, bricklaying and drawing a sundial.

Moxon (1627-1691) is perhaps best known for his treatise on the "Whole Art of Printing," which features a long biography of his dealings, mostly as they relate to the world of printing. The version of "The Art of Joinery" in this book is adapted from the 1703 edition of "Mechanick Exercises," which was the first complete edition, and it has been reprinted by both the Early American Industries Association and The Astragal Press. Both of those editions are currently out of print and unavailable. The plates in this edition appear courtesy of the Early American Industries Association.

So I took the Astragal version and had the original text entered into a computer (the text is in the public domain). I then adapted Moxon's work into the text you have here. This slim book is an attempt to acquaint the modern woodworker with the earliest English-language text on woodworking, to update its language and spellings just enough so they're not distracting, and to provide some modern commentary and illustrations that will help amplify some of the processes Moxon describes.

It's important to mention that I am not an academic, and this book is not an attempt to provide a proper and scholarly annotated version of Moxon, a form of writing that many of us will remember from our days of

reading William Shakespeare in middle school. Instead, this book is a working woodworker's attempt to illustrate and explain Moxon's groundbreaking work in a way that you (who are also a woodworker, I hope) might be able to learn something useful for your own workshop practice.

As a result, I shortened Moxon's run-on sentences without (I hope) erasing their meaning. Usually this was accomplished not by removing words, but by adding semicolons or periods. I've added photographs and text to attempt to illustrate Moxon's words, so you can actually see a "dawk" or the "risings that bear against the tongue" and know instantly that they are "a gouge in the work" or "a high spot that needs to be removed."

I've also added a few words and phrases throughout Moxon's text. My words are in square brackets and Moxon's asides are in parentheses. After each of Moxon's 37 sections (actually 38, but more on that later), I have included my own commentary in sections titled "Analysis."

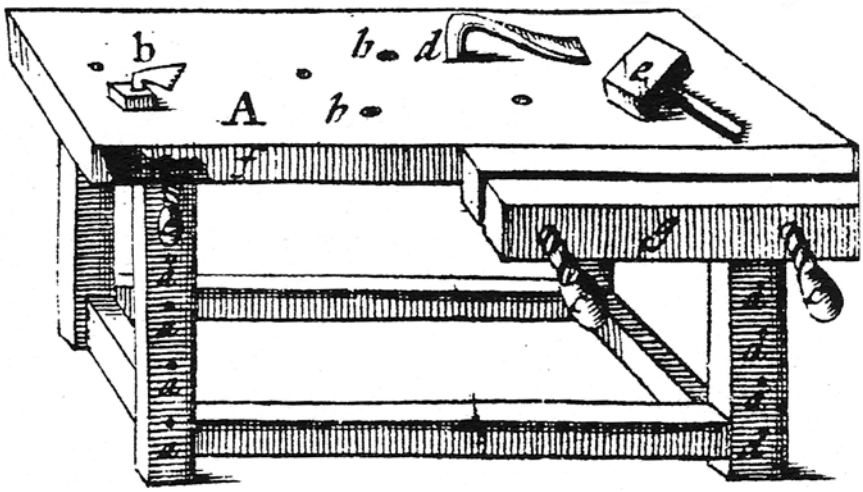
Since I published the first edition of this book in 2008, my research into early woodworking has continued, and so many of the analysis sections have been enlarged or revised, especially in the case of the workbench.

One of the criticisms of my first edition was that I didn't include the pure 17th-century text in the book so that the reader could analyze the original. And so we have reprinted the original text at the end of this volume with all the long "s" characters, italics and punctuation. We reset the text in a typeface named "Fell," which is adapted from early typefaces but has been "cleaned up" for lack of a better word. In essence, the makers of Fell sought only to correct damage that had occurred to the individual pieces of type as they were set and reset in a press.

Finally, at the end of the book, I have added an appendix: A selection of plates from André Félibien's "Principes de L'architecture" (1676), so you can see the similarities (and differences and omissions) between these two important works.

What you won't find anywhere in Moxon (or this book) are the so-called secrets to the craft that allow you to make a highboy in a week or sharpen your handplanes to razor sharpness with primitive and coarse abrasive technology. Those things aren't in Moxon.

Instead, what you'll find are the things you would find if you walked into a joiner's shop in 17th-century England and watched the joiners at work for a few weeks and got to ask them some questions over a small beer (just remember not to dump your drink in the glue pot).

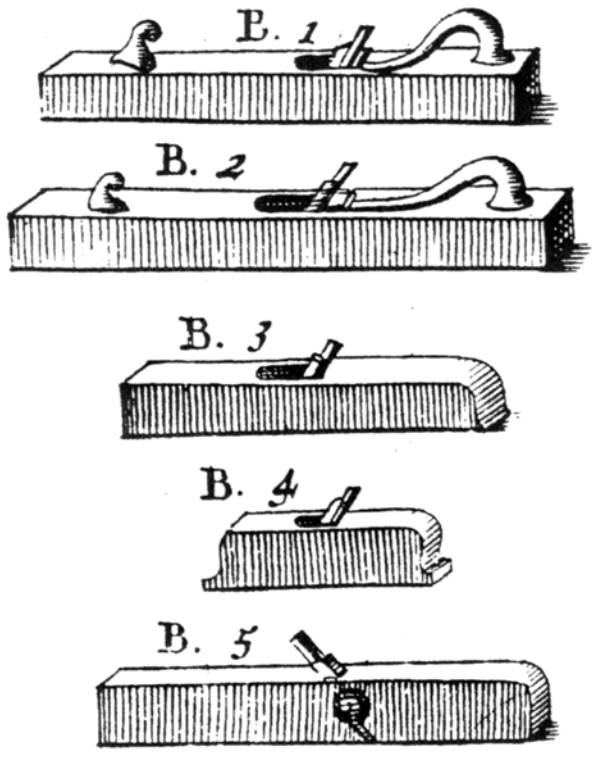


MOXON'S UNUSUAL WORKBENCH. The face vise is typically on the left end of the bench for right-handers (and Moxon wrote for right-handers). What gives? Read on.

But that information is more than useful enough and is surprisingly fresh in the 21st century. That's because so much of the modern way of teaching woodworking is based on machine work or on idiosyncratic ways of working with hand tools that have little to do with proper historical trade practice.

Another important thing to note: Moxon wasn't a woodworker, blacksmith or a turner (as far as we know), but his accounts of early workshop practice are what we have as a beginning point. And though I will point out a few modern "improvements" that have arrived in the last 330 years (metal-bodied planes, plow planes with several irons), this book is where how-to woodworking began.

– Christopher Schwarz


B. 1
B. 2
B. 3
B. 4
B. 5

The Art of JOINERY.

Definition.

Joinery is an art manual, whereby several pieces of wood are so fitted and joined together by straight line, squares, miters or any bevel, that they shall seem one entire piece.

Explanation.

By straight lines I mean that which in joiner's language is called a joint. That is, two pieces of wood are shot {that is, planed} or else they are pared; that is, the irregularities that hinder the closing of the two pieces are cut off with a paring chisel. They are shot or pared {as I said} to exactly straight, [so] that when they are set upon one another, light shall not be discerned betwixt them. This they call shooting of a joint or paring to a joint, because these two pieces are with glue commonly joined together, either to make a board broad enough for their purpose, or to clamp one piece of wood to the end of another piece of wood to keep it from casting or warping.

By squares, I mean the making of frames, for door cases or such like which is the framing of two pieces of wood, so as the four angles of the frame may comply with the square marked D [in Plate 4].

By miters are meant the joining of two pieces of wood, so as the joint makes half a square, and does comply with the miter square marked E [in Plate 4]. By bevel is meant any other angle: As frames that may be made of [a] pentagon, hexagon, octagon [and other] figures.

S.1. The Names of joiners tools described in Plate 4.

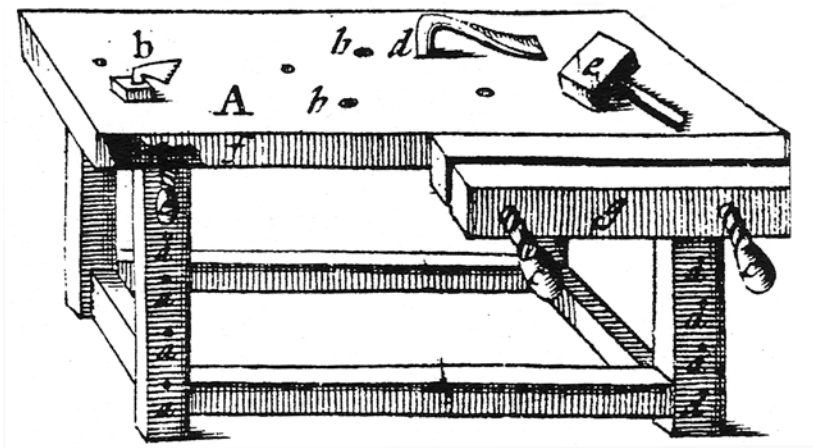
A. A Workbench. b. The hook in it, to lay boards or other stuff flat against, whilst [you] are trying or planing [them]. c. The bench screw {on its hither [left] side} to screw boards in while the edges of them are planed or shot.

And then the other edge of the board is set upon a pin or pins {if the board be so long as to reach the other leg} put into the holes marked "aaaa" down the legs of the bench. [These] pins may be removed into the higher or lower holes as the breadth of the board shall require. So then, the bench screw keeps the board close to the edge of the bench, and the pins in the leg keep it to its height, that it may stand steady whilst the other edge is worked upon. For in the shooting of a joint, if the board keeps not its exact position, but shakes or trembles under the plane, your joint will very hardly be truly straight. d. The holdfast, let pretty loose into round holes marked "bbbbbb," in the bench. Its office is to keep the work fast upon the bench whilst you either saw, tenon, mortise, or sometimes plane upon it. It performs this office with the knock of a hammer or mallet upon the head of it. [Here's how it functions]: [T]he beak of it being made crooked downwards [with] the end of the beak falling upon the flat of the bench, keeps the head of the holdfast above the flat of the bench. The hole in the bench [that] the shank is let into [is] bored straight down and [is] wide enough to let the holdfast play. The head of the holdfast being knocked, the point of the beak throws the shank aslope in the hole in the bench and presses its backside hard against the edge of the hole on the upper surfaces of the bench, and its fore-side hard against the opposite side of the under surfaces of the bench. And so [because of] the point of the beak, the shank of the holdfast is wedged between the upper edge and its opposite edge of the round hole in the bench. Sometimes a double screw is fixed to the side of the bench as at g; or sometimes its farther cheek [rear jaw] is laid on edge upon the flat [top] of the bench and fastened with a holdfast, or, sometimes, two [holdfasts] on the bench. c A mallet.

Analysis

Let's talk about Moxon's workbench because it seems a confusing and muddled drawing. It certainly looks like it was borrowed from André Félibien's "Principes de L'architecture" (1676) and then modified with the addition of an unusual double-screw vise on the right side of the bench.

Moxon's entire book is written for right-handers, yet he shows a bench that seems more suited for a left-hander at first glance. (He also later shows a plow plane drawn in reverse, so it might be easy to think that this bench is



MOXON'S WORKBENCH. From plate 4.

also drawn in reverse and that this is typical and no big deal for the period.) However, I think that when you look closely at the illustration and the text together, things start to make sense.

First, let's discuss Moxon's "bench screw." It is a single screw on the left side of the bench (look close, it's in shadow). This screw appears to pierce a typical French crochet or "hook" attached to the front edge of the benchtop. This vise works much like a small shoulder vise, typical on modern Scandinavian workbenches. The screw presses the work against the front edge of the benchtop. If the board is long and/or wide, the bottom edge rests on pins inserted into holes in the legs.

While that seems straightforward – once you decipher the murky drawing – the so-called "double screw" is more vexing. Here is Moxon's original text:

Sometimes a double Screw is fixed to the ſide of the Bench, as at g; or ſometimes its farther Cheek is laid an edge upon the flat of the Bench and faſtned with a Hold-Faſt, or, ſometimes, two on the Bench.

What is confusing about the text is how the double screw is attached to the front edge of the bench, as shown in the drawing. To do this as Moxon shows you likely would need two tapped holes in the benchtop, a feature I have seen on some early workbenches. But installing this "double Screw" into the bench while the rear jaw was still attached to the front jaw would be cumbersome (the two jaws would lock the screws). First removing the rear jaw would make the vise simple to install in the benchtop. (This sort of vise

METAL MOXON. Several manufacturers now make double-screw vises with wood or metal screws. If you have a tap and threadbox, these vises are easy to make yourself.

is shown in a detail drawing in A.-J. Roubo's "L'Art du menuisier," which appears 100 years after Moxon.) Yet Moxon shows both jaws in the plate.

What is more straightforward about Moxon's discussion of the double-screw is how it sometimes sits on the benchtop and is sometimes secured with a holdfast or two. Woodworking researchers Jennie Alexander and Peter Follansbee have long used a small double-screw on the bench much like a modern handscrew clamp. It holds work to be tenoned, or to be moulded or planed on edge (when the work is pushed against a metal bench hook or stop). Several years ago I began using this double-screw as a vise for dovetailing by fixing the rear jaw to the benchtop with holdfasts, just as Moxon advised. It works brilliantly.

Other aspects of the Moxon bench are typical of what you would find on an early workbench in a somewhat-French style. There is a metal planing stop emerging from the benchtop. Moxon calls this a bench hook. And though it indeed has a hook-like shape, the modern woodworker wouldn't call it a bench hook. That term is reserved for a wooden accessory used for handsawing.

These metal-made planing stops have become rare in modern shops. While one manufacturer still makes some in aluminum (which aren't worth fooling with), most woodworkers fashion their planing stops from wood. There

are two obvious downsides to the metal stops: They will damage your tools if they strike the metal stop, and the stops will mark the end grain of your work. Those marks aren't a big deal if you build 17th-century furniture where this tool mark is found, or 18th-century furniture where the end grain is covered by moulding. But if you like exposed joinery, a metal stop can be trouble.

I've used a couple variants of metal stops: A beautiful one made by a blacksmith and a serviceable one made by a second blacksmith who fashioned it out of a railroad spike. I couldn't much see the advantage of a metal stop compared to a wooden stop until I sharpened the teeth with a file. Both of them seemed to work fine when dealing with stock that is less than 6" wide. Both of them were tricky to use with wider stock.

Some early versions of this workbench accessory are actually made using nails that are driven through the wooden planing stop at a slight angle – so only the tips of the nails rise above the benchtop, not the heads of the nails. These stops can have a lot of bite and hold your work in place.

And then there are the holdfasts. Moxon's description of the holdfasts is excellent. Clearly, this little metal wedge with a beak was just as curious to observers in the 17th century as it is today. The earliest image I have of a holdfast is from the 16th century in a painting titled "Le Raboteur" by the Italian artist Annibale Carracci (1560-1609). I would not be surprised if the holdfast is even older.

S.2. BBBBBBB Planes of several sorts: as, B1. A. Fore plane

a. The tote. b. The mouth. c. The wedge. d. The iron. e. The sole. f. The fore-end g. The britch. f g h The stock. All together a plane. It is called the fore plane because it is used before you come to work either with the smooth plane or with the jointer. The edge of its iron is not ground straight, as the smooth plane and the jointer are, but rises with a convex arch in the middle of it; for its [job is] to prepare the stuff for either the smoothing plane or the jointer. Workmen set the edge of it ranker than the edge either of the smoothing plane or the jointer. And should the iron of the plane be ground to a straight edge, and it be set ever so little ranker on one end of the edge than on the other, the ranker end would {bearing as then upon a point} in working, dig gutters on the surface of the stuff. But this iron {being ground to a convex arch} though it should

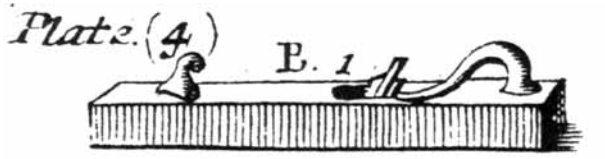
be set a little ranker on one end of its edge than on the other, would not make gutters on the surface of the stuff, but {at the most} little dawks [hollows] on the stuff, and that more or less, according [to how] the plane is ground, more or less arching. Nor is it the office of this plane to smooth the stuff, but only {as I said} to prepare it. That is, to take off the irregular risings, whether on the sides or in the middle. And therefore it is set somewhat ranker, that it may take the irregularities [more quickly] off the stuff [so] that the smoothing plane or the jointer may afterwards the easier work it try [flat]. The manner of trying shall be taught when I come to [discuss] the use of the rule.

You must note, that as I told you in smithing {Num. I. page 14, 15, 16} that it was the office of the coarse-toothed file to take off the prominent irregularities the hammer made in the forging, and that you were not to file them more away than you need. So the same caution is to be given you in the using of this fore plane in joinery, for the reason there alleged in smithing, whether, to avoid repetition, I refer you. Only with this consideration, that in smithing, iron or steel was the matter wrought upon, and there a coarse file the tool; but now wood is the matter, and a coarse, or fore plane, the tool.

Analysis

When it comes to the handplane illustrations in Moxon, I wouldn't rely on them as being accurate representations of typical 17th-century English planes. They show typical French planes. The text, however, is quite useful. Moxon spills more ink on fore planes than he does on any other form. These tools are the equivalent of the modern electric surface planer or powered jointer. The fore plane is the tool that removes a lot of wood in a hurry thanks to its curved iron and the fact that it is set to take quite a bite. And as a plane user, I find my fore plane to be one of the most useful tools I own. Whether the plane is made of wood or iron, the fore plane is able to quickly remove wood (it's almost shocking at first how fast it works). And I have found it is one of the tools that helps a beginning hand-tool user understand that a correctly set tool makes handwork easy.

The term "fore plane" has almost vanished from the modern vocabulary and has been replaced by the term "jack plane," a word from the carpenter's lexicon. Stanley Works labeled its No. 6 plane a "fore plane," though the jobs



MOXON'S FORE PLANE. It's shorter than the jointer and longer than a smoothing plane.

of the fore are easily picked up by Stanley's No. 5 jack plane. So if you're looking for a plane that will serve as a fore, buy one that's 14" to 18" long (wood or metal), grind the iron so it is curved (an 8"-radius curve is typical) and set the mouth wide open to pass thick shavings.

In reading Moxon, it's easy to think that the fore plane is actually what Stanley calls a "scrub plane" – a tool still manufactured today. However, the metal scrub plane is actually a modern version of a wooden European plane for rough work. The scrub is similar to the fore, but the scrub's sole is both shorter and narrower, and the iron has an even more pronounced curve.

Both tools work and get material out of your way. But I prefer the longer sole of the fore plane. The longer sole makes it easier to get the board flat than with a scrub, though the extra weight of a fore plane can be tiring.

The other important aspect of Moxon's entry on fore planes is that it discusses a philosophy that Moxon developed in his pamphlets on blacksmithing. That is: Use the coarsest tool possible to make the work with the finer-set tools quick. One stroke with a fore plane saves many strokes with a jointer plane. This is one of the core principles of hand work that is sometimes forgotten today. Many woodworkers are quick to grab their smooth plane when they should be grabbing the fore.

S.3 Of setting the iron

When you set the iron of the fore plane, consider the stuff you are to work upon. That is to say, whether it be hard or soft, or curling, as joiners call cross-grained stuff. If it be hard or curling, you must not set the iron very rank because a man's strength will not cut deep into hard wood. And if it be not hard wood, but curling or knotty, and the iron is rank-set, you may indeed work with it until you come to some knot or curl, but then you may either tear your stuff, or break the edge of your iron. Therefore you may perceive a reason to set the iron fine for curling and knotty stuff.

But if you ask me how rank your iron ought to be set? I answer, if your wood be soft, and your stuff free and soft, that is, evenly tempered all the way, you may set the iron to take a shaving off [that is] the thickness of an old coined shilling [likely a Commonwealth shilling, or approximately .0394″, or a fat 1/32″] but scarcely thicker. Whereas if your stuff be hard or curling or knotty, you shall scarcely be able to take a shaving off the thickness of an old groat [likely a Charles II groat, which would be .0236″ thick, or less than 1/32″]. Therefore you must examine the temper of your stuff by easy trials [to determine] how the plane will work upon it, and set your iron accordingly. And observe this as a general rule: That the iron of the fore plane is, for the first working with it, to be set as rank as you can make good work with; and that [is] for speed sake.

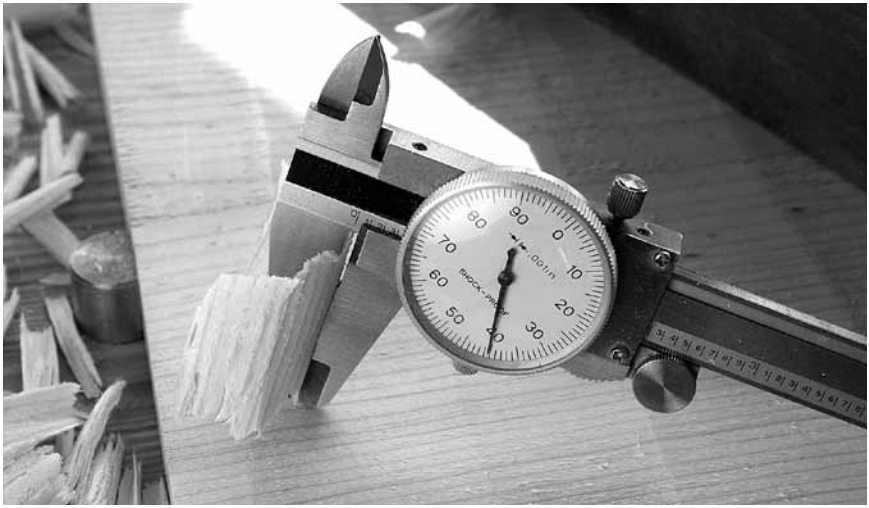
If your iron be set too rank, knock with a hammer upon the britch [rear] of the stock, and afterwards upon the wedge. For this knocking upon the britch, if you knock hard enough, will raise [retract] the iron a little and set it fine. If you knock not hard enough, you must knock again until the iron does rise. But if you knock too hard, it will raise the iron so much that its edge will rise above the sole into the mouth of the stock and consequently not touch the stuff. Therefore you must knock softly at first until, by trials, you find the iron rises to a convenient fineness. But as this knocking on the britch raises the iron, so it also raises and loosens the wedge. Therefore {as said before}, whenever you knock upon the britch, you must also knock upon the wedge to fasten the iron again.

If you have raised the edge of the iron too fine, you must knock softly upon the head of the iron and then again upon the wedge. And this you may sometimes do several times until you fit your iron to a convenient fineness.

When you have occasion to take your iron out of the stock to rub it, that is, to whet [sharpen] it, you may knock pretty smart blows upon the stock, between the mouth and the fore-end [to loosen the wedge and consequently the iron].

These ways of setting are used with all other planes, as well as fore planes.

In the using of this, and indeed, all other planes, you must begin at the hinder end of the stuff, [with] the grain of the wood lying along the length of the bench, and plane forward until you come to the fore-end,



SHILLING SHAVING. Moxon's instructions used coinage to explain how thick your shavings should be. For softer woods, Moxon specified an "old coined shilling." This shaving is just about that thickness – or .04" thick.

unless the stuff [is to be] proved cross-grained in any part of its length. For then you must turn your stuff to plane it the contrary way, so far as it runs cross-grained. And in [any] planing, you must, at once, lean pretty hard upon the plane and also thrust it very hard forwards, not letting the plane totter to or from you-wards, until you have made a stroke the whole length of the stuff. And this sometimes, if your stuff be long, will require your making two or three steps forward before you come to the fore-end of the stuff. But if you do this, you must come back and begin again at the farther end, by the side of the last planed stroke, and so continue planing until the whole upside [surface] of the stuff be planed.

And if the stuff be broad that you are to plane upon, and it has warped a little with the grain [cupped], or be any ways crooked in its breadth, you must then turn the grain so it is across the workbench, and plane cross-grain. For if your work be hollow in the middle, you must plane both the bearing sides [the high edges] thinner until they are in the same plane as the middle. Then turn the other side of your work [flip the board over], and working still cross-grained, work away the middle until it is in the same plane as the sides or edges.

This way of cross-grained working is, by workmen, called "traversing."

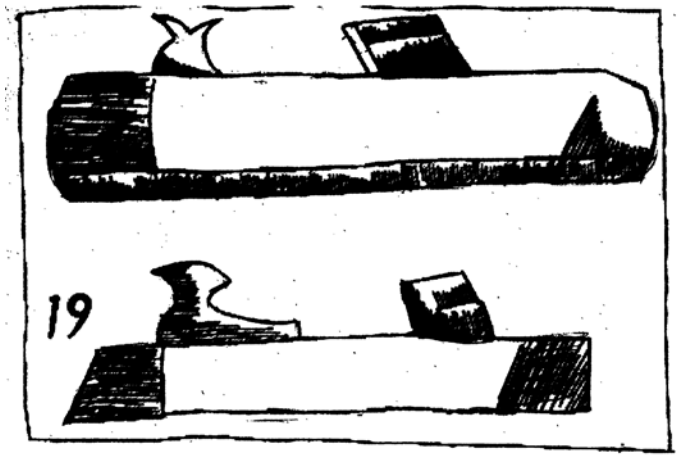
Thus have you, in general, the use of all the other planes. But the use of those planes are designed for other particular purposes. I shall show [them] as they come in order.

Analysis

Wooden planes work the same way they did in the 17th century, so Moxon's description of the process of adjusting one should seem familiar. However, what is interesting (to history dweebs especially) is when he discusses the sort of shavings you should get from a fore plane. Having no digital dial caliper, Moxon used the thickness of common coins to discuss the thickness of shavings.

After consulting with a couple coin collectors of British coinage and measuring some examples (which were surprisingly consistent) here's how to interpret Moxon's instructions. For wood that is easy to plane, Moxon recommends a shaving that is an "old coined shilling." The coin collectors said that judging from the time period and language, that Moxon was discussing a Commonwealth shilling. The Commonwealth shillings that weren't too worn were about .04" thick, or a fat 1/32".

For the harder, curly or knotty woods, Moxon recommends the shaving be the thickness of "old groat" – likely a Charles II groat. That would be



OTHER ENGLISH PLANES. Randle Holme's drawing of a fore and jack plane for the 1688 "The Academy of Armory" look more like English planes to me than the Moxon drawings.

A GROAT IN YOUR THROAT. For difficult woods, Moxon recommends a shaving that is as thick as an old groat – or .024" thick.

about .024" thick – or a bit less than 1/32". Then Moxon gives a rule that is golden (in my book): Take the thickest shaving you can that will produce good work, which is "for speed sake."

So how do you adjust the plane? Moxon's explanation is classic. One of the few "innovations" in wooden planes since Moxon is the "strike" or "start" button on the top of some wooden planes. This is a small circle of wood that protrudes like (surprise) a button between the toe of the tool and the escapement. You strike the button hard to release the iron. Moxon's instructions tell you to rap the plane there to release the iron. The strike button prevents you from denting your plane's body.

Moxon's instruction for applying a plane to the wood are straightforward: Begin at the hinder end (for right-handers, this is the right end). Plane to the fore-end (the left end). Plane the entire length of the board (walking as you push the plane if necessary). Work the entire length of the board. Come back, overlap your strokes and repeat.

What might be curious for moderns is Moxon's description of planing wide, crooked or cupped stock. In these cases, Moxon says you should work directly across the grain – what he calls traversing. This strategy works well and is typically under-utilized by modern woodworkers. Traversing flattens high spots with little tear-out. When you plane across the grain, the long fibers that make up the wood grain are sliced across by the plane's iron. It's

THE CUP IS UP. Traversing is most effective when you are working the cupped face of the board. The plane's sole rides the high spots and the iron cuts them back until you hit the low spots.

MAKE A CUP WITHOUT A LATHE. Plane out the middle by working with the grain. Then you've made a cup. Now plane across the grain to remove the cup.

like a crosscut with a plane instead of a rip. Traversing is easy work – you can take a big bite when you work across the grain. It doesn't leave a pretty surface (think: wooly worm), but it is one of the most powerful fore plane techniques I've found.

My personal experience with traversing has been that it works best on the cupped face of the board because you have two high spots touching the plane's sole.

When you work the face that is bowed, you tend to just copy that bow when you are traversing. So what do you do? Moxon says to plane out the middle first. I do this using strokes with the grain until I reach the final thickness of my board. This creates a cupped board. Then I traverse across the cup. When my iron just nicks the bottom of the cup, I stop. I'm done. That's not the gospel according to Joe, however.

S.4. Of the Jointer. B. 2.

The jointer is made somewhat longer than the fore plane and has its sole perfectly straight from end to end. Its office is to follow the fore plane and to shoot an edge perfectly straight, and not only an edge, but also a board of any thickness; especially when a joint is to be shet [shot]. Therefore the hand must be carried along the whole length with an equal bearing weight, and [al]so exactly even and upright to the edges of the board, [so] that neither side of the plane inclines either inward or outwards, but that the whole breadth be exactly square on both its sides. Supposing its sides straight, [then] so will two edges of two boards, when thus shot, lie so exactly flat and square upon one another that light will not be discerned between them. It is counted a piece of good workmanship in a joiner to have the craft of bearing his hand so curiously [in this way],

MOXON'S JOINTER PLANE. Ever wonder why the handles look so odd on the plane? I don't think they're particularly British. These illustrations were borrowed from the French.

even the whole length of a long board. And yet it is but a sleight [task] to those [where] practice hath accustomed the hand to [it]. The jointer is also used to try tabletops with {large or small}, or other such broad work. And then joiners work as well upon the traverse with it, as with the grain of the wood, and also angularly or corner-wise, that they may be more assured of the flatness of their work.

Its iron must be set very fine, so fine, that when you wink with [close] one eye, and [look at the iron with your open] eye, there appears a little above a hairs breadth of the edge above the surfaces of the sole of the plane, and the length of the edge must lie perfectly straight with the flat breadth of the sole of the plane. [With] the iron being then well wedged up and you working with the plane thus set, [you] have the greater assurance that the iron cannot run too deep into the stuff; and consequently you have the less danger that the joint is wrought out of straight.

Analysis

In Moxon, the primary job of the jointer plane seems to be working edges to make them straight and true. Not only to make them pretty but to glue them up into panels.

Now here is one area where Moxon vexes me. Moxon calls for the jointer plane to have an iron that is sharpened perfectly straight across, like a chisel. And the way you correct an edge is through skill – Moxon says it looks hard to the layman but is easy for joiners.

As one who has practiced freehand edge-planing with a jointer plane that has a straight-sharpened iron, I object. I think it's easier to correct an edge with an iron with a slight curve. You can remove material from localized spots by positioning the iron to take more meat off one area.

This jointing technique with a curved iron appears in British workshop practice throughout the 20th century. It is today a fight as fierce as tails-first or pins-first in dovetailing. So give both jointing techniques a try and take your side. And just be glad Moxon doesn't write a word about dovetailing.

One note here on long-grain shooting boards. Moxon doesn't mention them, though they are frequently mentioned and employed starting in the 18th century. When you use a jointer plane with a shooting board to true an edge of a board, the iron of the jointer plane can be either curved or straight. Both approaches work.

PROPER EDGE JOINTING. Whether you use a straight or curved iron, this is the proper way to joint an edge. The fingers of your off-hand serve as the fence against the work.

Several of my contemporary hand-tool woodworkers have suggested that perhaps Moxon simply could not see that the jointer plane's iron is slightly curved. And indeed, the curve used on the edge of a jointer plane's iron looks straight if you don't show it to a second piece of straight material. However, I prefer to simply take Moxon at his word here. The joiners he observed use jointers with straight irons.

Other jointer techniques in Moxon are quite helpful. He says you can traverse with a jointer and that you can work diagonally (corner to corner) across the grain with wide stock. Both of these techniques help flatten your boards because the jointer's sole is removing high spots at the corners, which is commonly known as "twist" or "wind." Note that Moxon says joiners use this for tabletops or other boards that are quite broad.

Other period accounts discuss other long planes. Richard Neve's "The City and Country Purchaser" (1703) calls out two long planes: "The Long Plane," which is about 24" long, for faces of boards; and the jointer plane, which is about 30" long, for edge joints.

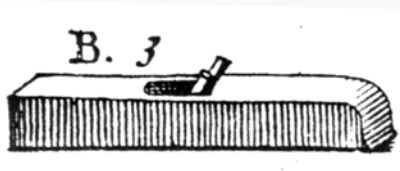
CRISS-CROSS. Working corner to corner is a powerful technique for flattening a board. You can work both ways, though you'll get more tear-out one way than the other.

Moxon's instructions for setting a jointer plane can be interpreted as follows: Turn the plane over and sight down the sole. Close one eye. Peer down the sole and adjust the iron until you see it as a fine black line (about the thickness of a hair) that is even all across the width of the sole. That's a good description of what it looks like. To my (one) eye, a hair's breadth usually gets me a shaving that's about .004" to .006" thick.

S. 5. The use of the strike-block.

The strike-block marked B 3. is a plane shorter than the jointer, having its sole made exactly flat and straight, and is used for the shooting of a short joint because it is more handy than the long jointer. It is also used

IT TAKES A STEADY HAND. With your plane in one hand and the work in the other, Moxon says you can clean up miters this way. I've worked miters this way, but I prefer to brace the tool against the bench.



MOXON'S STRIKE-BLOCK PLANE. It's shorter than the fore but longer than a smoothing plane.

for framing and fitting the joints of miters and bevels you are to fit. You must hold it very steady in your left hand with the sole of it upwards and its fore-end towards your right hand; and you must hold your work in your right hand very steady. Then apply the sawn miter or sawn bevel at the end of your stuff [work or work piece] to the fore-end of the strike-block and so thrust it hard and upright forwards until it passes over the edge of the iron. So shall the edge of the iron, with several of these thrusts continued, cut or plane off your stuff the roughness that the teeth

of your saw made. But if your work be so big that you cannot well wield it in your right hand, you must set the end of your work in the bench-screw and plane upon it with a smoothing plane.

Analysis

The strike-block entry is a curious animal. As shown in Moxon (and in Félibien's plate 31 – see page 152 of this book) it has no tote or knob, but it's longer than a smoothing plane. It's a bevel-down plane. Handplane historian John M. Whelan surmises that the strike block was a forerunner of the miter plane, and the tool's uses listed by Moxon back that up fairly well.

It is used for shooting short edges and miters. The part about edges is easy to visualize. The part about how to shoot a miter is unusual. It's a free-hand activity. Hold the strike block in your off-hand with the sole facing up. Point the plane at your dominant hand. Then, in your dominant hand, place the sawn miter on the sole of the plane at the toe of the tool. Push the miter across the mouth. If the miter is too big for this activity, put the miter in your vise and clean it up with a smoothing plane. This hotdogging maneuver, as you might imagine, takes a bit of skill and practice.

MOXON'S SMOOTHING PLANE. The extended sole at front and rear is unusual. No explanation is given in the text about the extensions, though they appear later in the historical record on miter planes.

S. 6. The use of the smoothing plane.

The smoothing plane marked B 4. must have its iron set very fine because its office is to smooth the work from those irregularities the fore plane made.

Analysis

Moxon doesn't discuss smoothing planes much in "Mechanick Exercises." But what he does say is remarkably illuminating. Perhaps the early

woodworker didn't fuss as much over this tool as we do. As someone who uses handplanes like Moxon describes, this is a frustrating entry. There are clues in the text that some of the tricks we use today were well-known then (such as the fact that high-angle tools are good for difficult grain, and that different planes have different mouths). But it would be good to know more, such as how the smoothing plane was used on the work.

Most woodworkers push the smoothing plane so its body is parallel to the grain of the board. But you don't have to do that. Experience shows that circular motions, traversing and the like can all be used with smoothing planes.

Other questions for the now-dead printer and observer: Would they skew the plane to make the work easier? Was the smoothing plane the last tool to touch the work or was it followed up with early abrasives (or scrapers made from steel or glass)? Is B 7 in Plate 4 a coffin smoothing plane? These topics are discussed in more detail starting in the 18th century.

But one thing Moxon does say about smoothing planes is important for the beginner to note:

"...its Office is to fmoothen the work from thofe Irregularities the Fore-plane made."

So Moxon says you can go from the fore plane to the smooth plane – skipping the jointer plane. Modern practice is to use the planes in this order: fore, jointer then smoothing. I think Moxon is giving us a clue here that you can skip the jointer plane at times. Later on in the text he discusses how to take a finer shaving with a fore plane to finish up a piece of work.

After reading Moxon, I adopted the practice of planing in this way:

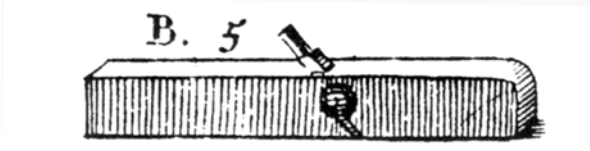
1. Use the fore plane with a rank-set iron to remove as much material as possible and get the surface fairly flat.

2. Use the fore with a fine-set iron to clean up the surfaces.

3. Use a jointer plane to flatten any surfaces that require a face or edge to be flat, straight and true for joinery – such as an edge or the interior of a carcase side. All other surfaces are left alone.

4. Finish with a smoothing plane all surfaces that will be seen by the owner of the piece.

This approach is consistent with Moxon's admonition to use the coarsest plane for as long as possible. And I end up using the smoothing plane after the fore plane quite a lot.



MOXON'S (AND FÉLIBIEN'S) RABBET PLANE. It's a bit long in the stock for a typical English rabbet plane, at least the kind that I typically see.

S. 7. The use of the rabbet plane.

The rabbet plane marked B 5. is to cut [away] part of the upper edge of a board or other stuff straight; that is, square down into the board so that the edge of another board also cut down in the same manner may fit and join into the square of the first board cut this way. And when two boards are thus lapped on the edges over one another, this lapping over is called rabbeting.

The rabbet plane is also sometimes used to strike a fascia in a piece of moulding, as shall be shown in its proper place.

The sides of the iron are not enclosed in the stock of this plane, as the foregoing planes are, but the iron is as broad as the stock is thick, [so] that the very angles of the edge [that is, the corners] of the iron may not be born [held] off the stuff, to hinder the straight and square cutting down[ward]: Nor does it deliver its shaving at a mouth on the top of the stock as the other planes do. But it has its mouth on the sides of the plane and delivers its shavings there. Its iron is commonly about an inch broad.

Analysis

Again, Moxon's rabbet plane doesn't look like the typical English or American rabbet plane. It looks a bit French. The typical English rabbet plane is shorter. And the escapement (where the shavings eject) is a different shape.

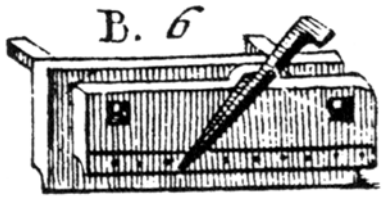
But the function described by Moxon is dead on. It makes square trenches on the long edges of boards, such as shiplap joints. Or a tongue that will fit into a groove. Or it creates a flat area (fascia) that will be incorporated into a moulding.

This form of rabbet plane went through many evolutions. Moxon's rabbet plane has an iron that extends to both cheeks of the plane. Some later tools opened to only one side and were fitted with an integral fence and nickers for cross-grain work.

HIGHLY EVOLVED RABBET. This moving fillister has an adjustable fence, a depth stop and a nicker for scoring the grain ahead of the iron. The additional features require additional attention, but the rabbeted results are more predictable, which is good for production work – not so much when you need to be flexible and fast.

If the fence was fixed in position, the tool was a standing rabbet or fillister. If the fence could move, it was called (no surprise) a moving fillister.

Simple rabbet planes employ the user's fingers as the fence and the tool is used to work up to gauge lines. There also is evidence that moving fillister planes were used for roughing out the work and rabbeting planes made the finishing cuts. More research is needed here.

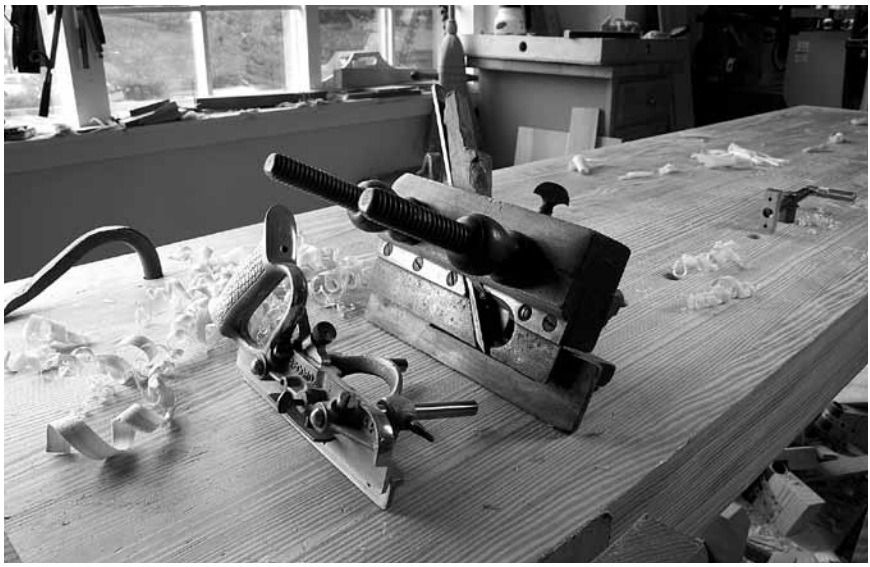


LEFTY PLOW? This plow plane is a mirror image of a plow, and is different than what Moxon describes in his text. So we'll have to show you some other plows.

S. 8. The use of the plow.

The plow marked B 6. is a narrow rabbet plane with some additions to it, including two square staves, marked a a {yet some of them have the upper edges of the staves rounded off for the better compliance [fit] with the hand}. These staves are let through two square mortises in the stock, marked "b b." The staves are about seven or eight inches long and stand straight and square on the far side of the stock. These two staves have shoulders on the closer side of the stock that reach down to the wooden sole of the plane {for there is also an iron sole belonging to the plow}. To the bottom of these two shoulders is riveted with iron rivets a fence {as workmen call it}, which comes close under the wooden sole, and its depth reaches below the iron sole about half an inch. Because the iron of the plow is very narrow and the sides of it towards the bottom are not to be enclosed in the stock {for the same reason that was given in the rabbet plane}, therefore upon the stock is let in, and strongly nailed, an iron plate that is the thickness of the plow iron. [That is because] wood [alone] of that breadth will not be strong enough to endure the force the lower end of the plow iron is put to. This iron plate is almost of the same thickness that the breadth of a plow iron is. Joiners have several plows for several widths of grooves.

The office of the plow is to plow a narrow, square groove on the edge of a board. The board is set on edge with one end in the bench-screw, and its other edge upon a pin or pins that are put into a hole or holes in the leg or legs of the bench. Such a hole or holes [are chosen that] will most conveniently for height, fit the breadth of the board. Then the fence of the



FAMILIAR PLOWS. These plows are more typical in English and North American shops. On metal plows, the fence moves on fixed posts (which Moxon calls staves). In Moxon's description, the staves move through the body of the plow to adjust the fence, as shown in this screw-arm plow.

plow is set to that distance off the iron plate of the plow that you intend the groove shall lie off the edge of the board. If you would have the groove lie half an inch off the [edge of the] board, then the two staves must with the mallet be knocked through the mortises in the stock until the fence stands half an inch off the iron plate. And if the staves are fitted stiff enough in the mortises of the stock, it will keep at that distance while you plow the groove. For the fence {lying lower than the iron of the plane}: When you set the iron of the plow upon the edge of the board, [it] will lie flat against the farther edge of the board, and so [it will] keep the iron of the plow all the length of the board at the same distance from the edge of the board that the iron of the plow has [been set by the user] from the fence. Therefore [with] your plow being thus fitted, [you can] plow the groove as you work with other planes; only as you hold on the stock of other planes when you use them, now you must lay hold of the two staves and their shoulders and so thrust your plow forwards until your groove be made to your depth.

BEGIN AT THE END. The first strokes with a plow are typically taken at the far end of the board, and the work progresses with longer and longer strokes. This helps keep the groove as straight as possible by reducing the chance that the iron will wander in a long cut.

If the staves are not stiff enough in the mortises in the stock, you must stiffen them by knocking a little wooden wedge between the staves and their mortises.

Analysis

Moxon's plow is widely reported as a mirror image of the same tool in Félibien's work. And that is why this picture of this plow is like a Gucci bag for sale on an urban street corner. It looks OK from about 10 feet. But on closer inspection, this is not the plow you're looking for.

Unlike many tools in Moxon, the plow has evolved quite a bit since his description. And you'd be unlikely to find a plow as he describes. Let's look at the differences between the Moxon plow and some ultra-contemporary (19th-century) ones.

1. The posts or staves. Moxon states that the staves move through the body of the tool to adjust the fence. The fence is fixed to the staves. This kind of wooden plow was common in England and North America but not

Europe. In typical European plows (which is what is shown in the accompanying plate) the staves are fixed to the body and the fence slides on them.

2. From many plows, one. Moxon states that the mechanic would have a different plow for every size groove. Modern plows have interchangeable irons in a range of sizes.

3. How the fence is set. In Moxon's book, the staves and fence are friction-fit into mortises. So you tap the fence and staves to move the fence closer to or farther away from the cutter (with wedges to help).

Modern plows use something mechanical to secure the fence, from thumbscrews to screws to far, far more clever mechanisms.

4. No depth stop. All but the most primitive plow planes have a depth stop that stops the plane's cutting action when you reach your final depth. No mention of a depth stop is made in Moxon.

As to actually using the plow, Moxon merely states that you set the fence and thrust it forward like the other planes. This would imply that you start planing at one end and take a shaving to the other end. This can work. However, many craftsmen use a different technique.

Many start near the far end of the board and take a short stroke with the plow to start cutting a groove just a few inches long. Then each following stroke is a little bit longer as the woodworker backs up along the length of the board.

You can indeed do exactly what Moxon suggests, but the chances of your iron wandering by following the grain of the board are greater.

By taking short, advancing strokes, you can keep the plow's fence against the work during the part of the cut that is new, then the cutter drops into the already-made groove and the tool won't jump out.

Plus, if your plow plane does wander, it will be for a shorter distance, and you'll get an opportunity to make a correction before the tool wanders so far that your work is ruined. Here's another tip on use: Give each of your hands only one job to do when working with the plow. Use one hand to thrust the plane forward. Use the other hand to press the fence against the work. Don't try to make both hands do both jobs.

S. 9. Of moulding planes.

There are several other planes in use amongst joiners called moulding planes, such as the round, the hollow, the ogee, the snipes bill, the rabbet plane, the grooving plane and others. And of these they have several

SIMPLE AND COMPLEX. Moulding planes typically come in two flavors: The simple section of a circle (either convex or concave), or a complex moulding that is formed fully by one plane. Each has its advantages in the shop.

sorts, namely, from half a quarter of an inch [1/8″] to an inch and a half. They are used as other planes are. In the planing of stuff, you must use planes whose irons have different mountings [pitches or angles of attack]; and that [pitch is] according to the hardness or softness of the wood you are to work upon. For if the wood be hard, the iron must stand more upright than it need do if the wood be soft. For soft wood, [such] as deal [typically pine], pear tree, maple, and so on, the iron is set to make an angle of 45 degrees with the sole of the plane. But if it be very hard wood you are to plane upon, as box[wood], ebony, Lignum Vitae, and so forth it is set to 80 degrees and sometimes quite upright. So that these hard woods are indeed more properly said to be scraped than planed.

But before you come to use your planes, you must know how to grind and whet [hone] them, for they are not so fitted when they are bought. Every workman accommodates them to this purpose. If it be a hard wood he is to work on, he grinds his bevel to a more obtuse [higher] angle than he would do for a soft wood.

The bevel or angle the iron is ground to [for] soft wood is about 12 degrees, and for hard wood about 18 or 20 degrees. Note that the more acute, or thinner, the bevel is, the better and smoother the iron cuts; and the more obtuse and thicker, the stronger the edge is to work upon hard work.

Analysis

I think that a Delta Machinery manual for a drill press might say more about moulding planes than Moxon does. He does list the types of fundamental planes in making mouldings, including snipes bills, rabbets and hollows and rounds. The hollow has a concave sole and the round a convex one. They come in a variety of sizes – a complete British set would have 18 pairs of the planes in graduated sizes.

Each plane cuts an arc that is one-sixth of a circle, and you use them in combination with a groove-cutting plane (such as a plow), a rabbet plane and the snipes bills (among others) to make mouldings.

Moxon also lists an ogee moulding plane, which is what is called a "complex moulding plane." This is a single plane that is dedicated to cutting one moulding shape. For modern woodworkers, it might be useful to distinguish between complex moulders and the hollows and rounds by thinking in the same terms as router bits.

A 1/2" Roman ogee router bit is like a complex moulder. It is designed to make that one profile alone. Making other profiles with that bit (or a small section of its cutters, perhaps), is a challenge.

The simple roundover and cove bits for the router are more like hollows and rounds. You can combine them to cut almost any kind of moulding you desire – but there are more set-ups required than with a complex moulder. Another distinct advantage of the hollows and rounds is that the irons are simpler to sharpen than those of a typical complex moulding plane.

What is most useful from Moxon's description is his mention of the different pitches available for these planes. Softer woods use lower-pitched irons and lower angles on their irons (12 degrees, according to Moxon, which seems low). And harder woods use higher pitches – up to 80 degrees, which seems rather high from the old planes I've seen. Typical moulding planes, even early ones, would use higher pitches, but I've never seen an 80-degree-pitch moulding plane. Typically, these planes top out at a 60-degree pitch in my experience.

SHARPENING IN THE 17TH CENTURY. This is quite different than modern sharpening, where the stone is usually planted on a flat surface. It does, however, work just fine with some practice. Spit is a remarkable lubricant for sharpening.

S. 10. Of grinding and whetting [honing] the iron and other edge tools.

When you grind your iron, place your two thumbs under the iron and your fingers of both hands upon the iron, and so clap down your iron to the stone, holding it to that angle with the stone [that] you intend the bevel shall have. Keep the iron in this posture without either mounting or sinking its ends while the stone is turning about; and when you lift the iron off the stone, see if it be ground to your mind. If it be not, you must be sure you place the iron again in the same position on the stone [as] it had [been] before; or else you will make a double bevel on your iron. But if it be true[ly] set on the stone and steadily kept to that position, your bevel will be hollow; and the smaller your grindstone is, the hollower it will be. You may know when it is well ground by the evenness and entireness of the edge all the way [across the edge].

Having ground your iron, you must smoothen the edge finer with a good whetstone. Thus, hold the edge of your iron upwards in your left

hand and your whetstone in your right, and having first spit upon your stone to wet it, apply it to the bevel of your iron in such a position that it may bear upon the whole breadth of the bevel. And so working the stone over the bevel, you will quickly wear the coarser gratings of the grindstone off the edge on that side. Then turn the flat side of the iron and apply the stone flat to it until you have worn off the coarse gratings of the grindstone on that side, too.

Joiners often grind their irons upon a flat grindstone also. They hold the iron also in their hands in the same posture as if it were to be ground on the round grindstone. Yet instead of keeping the iron on one place of the stone, they thrust it hard straight [and] forwards, almost the length of the stone; and draw it lighter straight back again, keeping it all the while at the same angle with the surface of the stone. And then [they] smoothen its edge with the whetstone, as if it had been ground upon the round grindstone. And this they do so often, until they have rubbed the hollowness of the bevel to a flat, and then they grind it again upon the round grindstone.

This order and manner of setting, grinding and smoothing a bevel and edge is also used in all other edge tools joiners use.

Analysis

In this section, Moxon describes grinding an iron, which is done to prepare a new iron for use, to repair a nicked iron or to freshen up an edge that has been sharpened too many times on the honing stones.

A grinder in Moxon's day was likely a large sandstone wheel, hand cranked, and running in a water bath. These large-diameter wheels can leave a nice smooth finish on an iron, but they were known for being slow to cut. The grinders' tool rests were simple or non-existant affairs, and so Moxon's trickery with the fingers is a suggestion for a way to keep the iron under control when it is shown to the spinning grinding wheel.

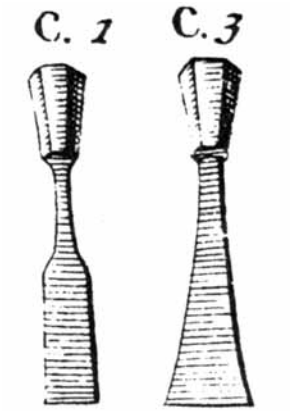
In the second section, Moxon describes honing, which removes the coarse grinding scratches left by the grinder. Moxon says this is done with a whetstone, presumably a natural sharpening stone lubricated with liquid. In this case, spittle.

What is unusual about Moxon's honing method isn't the choice of lubricant. It's the way he recommends you hold the tool and the stone.

Typically, a modern woodworker will put the stone flat on the bench and place the tool on the stone. Moxon, however, recommends you hold the tool in one hand with the working end facing up and the whetstone in the other. This is more like sharpening a knife than a woodworking tool, but it works, of course.

After honing the bevel, Moxon says to apply the flat part to the whetstone as well to remove grinding scratches. Presumably, this action removes the burr left from grinding and honing the bevel. It seems unlikely that you are supposed to grind the bevel and unbeveled face on the round grindstone.

In the third part of this section, Moxon describes a way of grinding tools on a flat stone that lets you avoid the round grindstone until you've worn away the hollow made by the grindstone (the hollow speeds sharpening because it doesn't have to be honed). This is the modern equivalent of grinding on a diamond stone or #220-grit waterstone. It works, but you still need a grinder with round wheels to sharpen things à la Moxon.



FORMERLY CALLED A FORMER. The rectangular shape of the blade identifies this as a former (or firmer) chisel. Once common, these tools are now scarce in modern catalogs.

S. 10. Of chisels of several sorts. And first of formers [firmers].

Formers [firmers] marked C 1. C 3. are of several sizes. They are called formers because they are used before the paring chisel, even as the fore plane is used before the smoothing plane. The stuff you are to work upon being first scribed {as I shall show in its proper place}, you must set the edge of the former a little without [away from] the scribed stroke with its bevel outwards, that it may break and shoulder off the chips from your work as the edge cuts it. And you must bear the helve [handle] of the former a little inwards over the stuff, [so] that the former do[es] not first cut straight down, but a little outwards [instead]. For, should you venture to cut straight down at the first, you might with a negligent or unlucky knock

with the mallet, drive the edge of the former under the work and so cut, before you are aware, more off the underside than the upper side of your work, and so {perchance} spoil it. Therefore, you may make several cuttings to cut it straight down by little and little until your work is made ready for the paring chisel. When it [the former chisel] is used, the helve [handle] of it is knocked upon with a mallet to drive the edge into the stuff.

Analysis

This section introduces an error in numbering. This is "Section 10," and so is the section above.

Firmer chisels are now uncommon, but they were the standard for many years. They were rectangular in cross-section and lacked the bevels on the two long edges that are on modern garden-variety chisels.

The term that Moxon uses for them, "formers," suggests the tools were used for forming or roughing out joinery or shapes. And then the formers were followed by the paring chisel to clean things up.

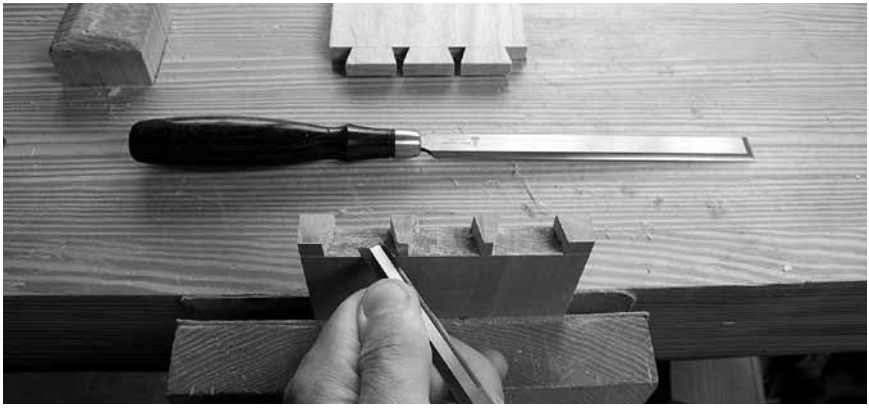
Moxon also describes a fact of chiseling that bedevils every woodworker – that they don't travel down in a straight line that follows the face (some call it the back) of the tool. Instead, they tend to undercut your joints, which is frustrating. The solution in the 17th century is the same as today: Take smaller bites. Tip the handle back a little toward the face of the chisel so the tool won't undercut your work.

S. 11. Of the paring chisel.

The paring chisel marked C 2. must have a very fine and smooth edge. Its office is to follow the former and to pare off and smoothen the irregularities [that] the former made.

It is not knocked upon with the mallet, but the blade is clasped upon the outside of the hindermost joints of the fore and little fingers, by the clutched inside of the middle and third fingers of the right hand. And so its edge being set upon the scribed line and the top of the helve [handle] placed against the

MOXON'S PARING CHISEL.



FINISHING CHISEL. The paring chisel, whether old or new, is a finesse tool in the right hands. Keep it sharp and with a low bevel angle on its edge and you will be able to work magic.

hollow of the inside of the right shoulder. With [the workman] pressing the shoulder hard upon the handle, the edge cuts and pares away the irregularities.

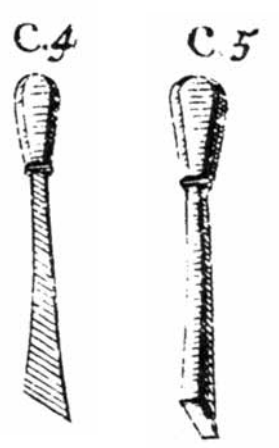
This way of handling may seem a preposterous posture to manage an iron tool in, and yet the reason of the original contriver of this posture is to be approved.

For should workmen hold the blade of the paring chisel in their whole hand, they must either hold their hand pretty near the helve [handle], where they cannot well manage the tool, or they must hold it pretty near the edge, where the outside of the fingers will hide the scribed line they are to pare in[to]. But this posture all workmen are at first taught; and [their] practice doth so inure them to it, that if they would, they could not well leave it.

Analysis

The paring chisel is used to clean up the junk left behind by the former, and the way that Moxon describes it in use seems a bit unusual: The blade is woven between the fingers and pressed with the shoulder into the work. This grip gets your hand near the bevel (which increases control) but also allows you to see the scribe line you are working to (a good thing). If you try this, I think you'll be hooked. It is an effective way to drive a paring chisel, assuming the height of your bench allows it. A bench that is too high or too low makes this motion awkward.

MOXON'S SKEW FORMER. Moxon says this isn't used much by joiners, who fit houses with moulding, doors, windows and cabinets. It might be more useful to a cabinetmaker who would use it for dovetails.



BRUTES OF THE CHISEL WORLD. Mortise chisels are even stouter than former chisels and are beefy so they won't easily snap in deep mortises, which I have seen happen during the quite violent process of mortising.

S. 12. Of the skew former.

The skew former marked C 4. is seldom used by joiners but for cleansing acute angles with its acute angle on its edge, where the angles of other chisels will not so well come.

Analysis

This skew chisel is great for cleaning out all sorts of dovetail sockets. Though it is a "former" chisel, it is generally not struck with a mallet today, but it is driven by hand.

S. 13. Of the mortise chisel.

The mortise chisel marked C 5. is a narrow chisel, but hath its blade much thicker and consequently stronger {that it may endure the heavier blows with the mallet} than other chisels have, so that in grinding it to an edge, it is ground to a very broad bevel as you may see in the figure. Its office is to cut deep, square holes, called mortises, in a piece of wood. Joiners use them in several breadths according[ly] as the breadths of their mortises may require.

Analysis

The mortise chisel of the 17th century is a bit different than modern forms, but it is used the same way. The biggest difference is in the blade. The old form swells in thickness at the tip (this saves steel) and modern chisels don't. They are thick along their entire length.

NOT FOR CARVING. A gouge like this, sometimes called a firmer gouge, will be used to remove large chips without splintering the grain, like a firmer chisel might.

S. 14. Of the gouge.

The gouge marked C 6. is a chisel having a round edge for the cutting [of] such wood as is to be rounded or hollowed.

These several sorts of chisels joiners have in several sizes [so] that they may be accommodated to do several sizes of work.

Analysis

This is presumably a firmer gouge, not a carving tool. These remove material in a localized area, such as removing waste from a very large tenon or breadboard end on a tabletop. You can follow this tool with finer tools if the work requires it.

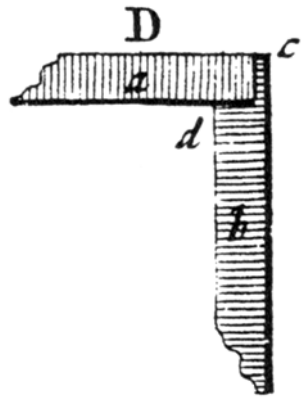
S. 15. Of the square and its use.

The square, marked D, is two adjunct sides of a geometrical square. a The handle. b The tongue. c The outer square. d The inner square. For [a] joiner's use, it is made of two pieces of wood, the one about an inch thick, and the other about a quarter of an inch thick. These two pieces are severally shot exactly straight and have each of their sides parallel to each of their own sides. The thick piece {called the handle} has a mortise in it as long {within a quarter of an inch} as the thin piece {called the tongue} is broad, and so wide, as to contain the thickness of the tongue. The tongue is fastened into the mortise of the handle with glue and wooden pins so [that] the two outer sides {and then consequently the two inner sides} may stand at right angles with one another.

The reason why the handle is so much thicker than the tongue is because the handle should on either side become a fence to the tongue. And the reason why the tongue has not its whole breadth let into the end of the handle is because they may with less care strike a line by the side of a thin than a thick piece: For if instead of holding the hand upright when they strike a line, they should hold it never so little inwards, [then] the

shank of a pricker [an awl-like marking tool] falling against the top edge of the handle would throw the point of a pricker farther out than a thin piece would. To avoid this inconvenience, the tongue is left about half an inch out of the end of the handle.

Another reason is that if with often striking the pricker against the tongue it becomes ragged or uneven, they can with less trouble plane it again when the stuff is all the way of an equal strength [that is, same grain direction] than they can if cross-grained shoulders be added to any part of it.



MOXON'S SQUARE. This square – more stylish than modern ones – is made from wood and is designed to be trued on occasion. Its decorative ends are similar to what Roubo will show about 100 years later in France.

Its use is for the striking of lines square — either to other lines or to straight sides, and to try the squareness of their work by. To strike a line square to a side they have already shot, they apply the inside of the handle close to the side shot and lay the tongue flat upon the work. Then [on] the outside of the tongue they draw with a pricker a straight line. This is called striking, or drawing of a square. To try the squareness of a piece of stuff shot on two adjoining sides, they apply the insides of the handle and tongue to the outsides of the stuff. And if the outsides of the stuff do all the way agree in line with the insides of the square, it is true[ly] square. To try the inward squareness of work, they apply the two outsides of the square to the insides of the work.

Analysis

Moxon's explanation of the try square's anatomy is fairly straightforward, though the description of the square's tongue is a bit awkward, despite efforts to unscramble it. What Moxon is saying is that it's easier to scribe a line against a thin tongue than a thick tongue. Why? You are less likely to miss your mark when you tip your awl (or knife or pricker) and place it against the tongue. If the tongue is thick, your error can be greater.

THE PRICKER I PRESUME? This tool is missing a call-out, but it is shown with the dividers and a rule, so it could be surmised this is the pricker that Moxon discusses. It does seem to be a marking tool.

Moxon's other two explanations for why the tongue is thinner are better: The handle can then be used as a fence against the work, and the tongue is easier to plane back to square after it becomes ragged.

I think Moxon also has made a small error here: He first implies the tongue should extend out of the handle 1/4". Then he says later it is 1/2" (which is the distance used by Roubo in his later work). It's impossible to tell which is correct from the illustration.

We also learn a bit about the pricker here, though it is not called out in the plates. (Could it be the bulbous tool shown beneath the dividers on plate 5? This tool is not on Félibien's plates to my knowledge.) One guess is that the pricker is like a striking awl: A rod of steel sharpened to a point at one end that is used for striking lines for joinery.

The description of using the square is revealing: It implies that the inside and outside angles of the square should both be square. Some writers have suggested that only one or the other is important. Here Moxon is clear: The try square is square on both the outside and inside of its tongue and is used for both striking lines and confirming that your work is square, inside and out.

S. 16. The manner of planing and trying a piece of stuff square.

We will take, for example, a piece of stuff called a quarter, which is commonly two inches thick, four inches broad, and seven foot long. To plane this square, lay one of its broad sides upon the bench, with one of its ends shoved pretty hard into the teeth of the bench hook, [so] that it may lie the steadier. Then with the fore plane, as you were taught, S.2. Numb. 2, plane off the roughness the saw made at the pit, and work that side of the quarter as straight in its length and breadth as you can with the fore plane. You may give a pretty good guess at [straightness], if the edge of the iron has born all the way upon the work, yet you may try [the piece] by taking up your work and applying one end of it to one eye while you wink with [close] the other and observe if any hollow, or dawks, [are] in the length. If not, you may conclude it pretty true. For the work thus held, the eye will discern pretty nearly. Or, for more certainty, you may apply the edge of the two-foot rule, or rather a rule shot the full length of the quarter, to your work. And if it agrees all the way with the rule, you may conclude it is straight in length. But if you find it not straight, you must with the fore plane work off those risings that bear [against] the edge of the rule. Then try [to see] if the breadth be pretty straight; if it be, {the dawks and the roughness of the fore plane excepted} the first office of the fore plane is performed. If it be not, you must straighten the breadth as you did the length.

But though this quarter be planed straight in length and breadth, yet because the iron of the fore plane for its first working the stuff is set rank, and therefore makes great dawks [hollows] in the stuff, you must set the iron of your fore plane finer, as you were taught, S.3. Numb. 2, and with it then work down even almost to the bottom of those dawks. Then try it again as before. And if you find it try all the way, you may with the jointer or smoothing plane — but rather with the jointer — go over it again to work out the irregularities of the fine fore plane — for the iron of the fore plane being ground to a rising in the middle, as has been showed, S.2. Numb. 2. Though it be very fine set, [it] will yet leave some dawks in the

stuff for the jointer or smoothing plane to work out. Thus the first side of the quarter will be finished.

Having thus tried one side of the quarter straight and flat, apply the inside of the handle [of the square] to it, and if one of the adjoining sides of the quarter comply also with the inside of the tongue all the way, you need only smooth that adjoining side. But if it does not comply {that is, if it be not square to the first side, which you will know by the riding of the inside of the tongue upon one of the edges; or some other part between the edges} you must, with the fore plane rank-set, plane away that stuff which bears off the inside of the tongue [and thus] from complying all the way with it. But if the risings be great, you may for quickness hew away the risings with the hatchet. But then you must have a care you let not the edge of your hatchet cut too deep into the stuff, lest you either spoil your stuff by making it unsizeable [undersized], if it be already small enough. Or if it have substance enough, make yourself more labor to get out those hatchet strokes with the plane. Then take off the roughness the hatchet made with the fore plane rank-set, then fine set, and last of all with the jointer or smoothing plane. So is the second side also finished.

To work the third side, set the oval [head] of the [marking] gauge exactly to that width from the gauge that you intend the breadth [width] of the quarter {when wrought} shall have, which in this example is four inches, but will be somewhat less, because working it true will diminish the stuff. Therefore sliding the oval on the staff [the beam], measure on your inch-rule so much less than four inches as you think your stuff will diminish in working. Measure, I say, between the oval and the tooth [of the gauge], your size. If, at the first profter [attempt], your oval stands too far from the tooth, hold the oval in your hand and knock the tooth-end of your staff upon the workbench until it stands near enough. If the oval stands too near, knock the other end of the staff upon the workbench until it be fit. Then apply the flat of the oval to the second wrought side of your stuff so the tooth may reach athwart [across] the breadth of the stuff upon the first side, and keeping the oval close against the second side, press the tooth so hard down that by drawing the gauge in this posture all along the length of the quarter, the tooth may strike a line. In like manner upon

the side opposite to the first, namely, the fourth side, gauge another line opposite to the first gauged line and work your stuff down to those two gauged lines on the third side, either with planing or with hewing {and afterwards planing}, as you were taught to work the second side.

To work the fourth side, set the tooth of the gauge to its exact distance from the oval {two inches, wanting as much as you think the stuff will diminish in working} and apply the flat of the oval to each side of the first side, and gauge as before two lines, one on the second side, the other on the third wrought side.

Work your stuff then down on the fourth side to those two gauge lines, either with planing alone, or with hewing, and afterwards planing, as you were taught to work the second side.

Analysis

Now we get to the fun part: Putting the tools to use. Moxon's first "exercise" is to plane a large piece of wood square to transform it from a rough pitsawn board to a piece of finished work. Below is my reading of Moxon's method. There are some steps missing that might be familiar to modern hand-tool users, such as checking for twist with winding sticks. Moxon confirms the board is true by eye (just wink) and with a ruler that is anywhere from 2' to 7' long. Your eye (and a 7' ruler) are powerful measuring devices, though I prefer winding sticks for high-tolerance work.

Step One: True One Face

You begin with the fore plane and set it so it will take a shaving that is the thickness "of an old coined shilling," a bit more than 1/32" thick. If the grain is difficult, reduce the cut to "the thickness of an old groat," or less than 1/32". If the board is warped or cupped, you need to plane across the grain – what Moxon calls "traversing" – to bring the high spots down to the low spots on your first face.

Moxon says you should check your work by sighting down the face of the board either with one eye, with a 2'-long ruler or with a piece of straight stock that is as long as the piece you are working.

When the first face is flat, you should refine the face a bit. First set the fore plane to a lighter shaving and plane the board. Then use a jointer plane. Traverse across the grain for wide panels or work at angles – corner to-corner – for narrow stock. Then finish that first face with a smoothing plane if necessary. Work with the grain; overlap your strokes.

FIRST FACE. Planing across the grain is easy work. Work the high spots until they're the same as the low spots on one face of the board.

CORNER TO CORNER FOR TRUE WORK. Work narrower stock (such as this board) at an angle with the jointer, Moxon writes, to ensure flatness. As always, work the high corners diagonally to remove twisting.

NOW ONE ADJACENT EDGE. Use your fore, jointer and smoother to true and finish one edge. Check your work with a square and 2' rule.

Step Two: Straighten One Edge

Next you should straighten one long edge. Use a try square to find the high spots (called the "risings") on the edge. Reduce these with a fore plane or (in extreme cases) with a hatchet, Moxon writes. (Some woodworkers might use a drawknife or scrub plane here.) Follow this up with a jointer plane and smoothing plane.

Step Three: Work the Other Edge

Now use a marking gauge or panel gauge to scribe the finished width of the board. The gauge's head rides on the finished edge and marks a line parallel to it. You also should strike this same line on the rough face. Now work this edge down to your scribe line. Use a hatchet if you have lots of material to remove; or use a fore, jointer and smoothing plane if there isn't much waste.

Step Four: The Final Face

With one face and two edges completed, use your marking gauge to scribe the finished thickness on your two completed edges. Press the gauge

GAUGE YOUR WIDTH. A panel gauge marks the board's finished width. Make this mark on both faces.

CHOP, CHOP. Use "ladder cuts" to remove wood in a hurry. Chop down to your scribe lines, then flip the work and chop the other way.

FINAL FACE. When working wood by hand, remove as little material as necessary. Scribe the finished thickness on your two long edges. Then work to these marks.

firmly against your first face to make these marks. Then use a fore, jointer and smoothing plane to dress the fourth face.

S. 17. To frame two quarters square into one another.

You must take care in mortising and tenoning, that as near as you can equalize the strength of the sides of the mortise to the strength of the tenon. I do not mean that the stuff should be of an equal substance, for that is not equaling the strength. But the equaling strength must be considered with respect to the quality, position and substance of the stuff. If you were to make a tenon upon a piece of fir, and a mortise to receive it in a piece of oak, and the fir and oak have both the same size, the tenon therefore made upon this piece of fir must be considerably bigger than a tenon need be made of oak, because fir is a much weaker wood than oak, and therefore ought to have a greater substance to equal the strength of the oak. And for position, the shorter the stuff that the tenon is made on, the less violence the tenon is subject to. Besides, it is easier to split wood with the grain, than to break wood across the grain; and therefore the same wood when made as a tenon is stronger than the same wood of the same size when made as a mortise. For the injury a mortise is subject to is splitting with the grain of the wood, which without good care it will often do in working. But the force that must injure a tenon must offend it across the grain of the wood, in which position it will best endure violence.

When two pieces of wood of the same quality and substance {as in this our example} are elected to make on the one a tenon and in the other mortise [the following is what you should consider]. If you make the

mortise too wide, the sides of the mortise will be weaker than the sides that contain the mortise. And if one be weaker than the other, the weakest will give way to the strongest when an equal violence is offered to both. Therefore you may see a necessity of equalizing the strength of one to the other as near you can. But because no rule is extant to do it by, nor can {for many considerations I think} a rule be made, therefore this equalizing of strength must be referred to the judgment of the operator. Now to the work.

The mortise to be made is in a quarter four inches broad. In this case, workmen make the mortise an inch wide so that an inch and and [a] half [of] stuff remains on either side [of] it. Therefore your stuff being squared, as was taught in the last section, set the oval of the gauge an inch and an half off the tooth, and gauge with it on either side of your stuff a straight line at the distance from the end you intend the mortise shall be. Then open your compasses to two inches and prick off that distance on one of these lines [to mark] the length of the mortise. Then lay the inside of the handle of the square to one side of the stuff, and upon both the pricks successively and with your pricker, draw straight lines through them [along] the side of the tongue, so shall the bounds of your mortise be struck out on the quarter. If your mortise go[es] through the quarter, draw the same lines on the opposite side of the quarter thus: Turn the quarter on its edge and apply the inside of the handle of the square to the ends of the former drawn lines. And by the side of the tongue draw two lines on the edge of the quarter. Then turn the quarter again with its other broad side upwards, and apply the inside of the handle of the square to the ends of the last lines drawn on the edge. And by the side of the tongue, draw two lines on this broad side also. These two lines {if your quarter was truly squared} shall be exactly opposite to the two lines drawn on the first broad side of the quarter for the length of the mortise. And for the width of the mortise gauge this side also as you did the first. Then for the tenon, gauge on that end of the quarter you intend the tenon shall be made, the same lines you did for the mortise. And because the quarter [that will house the mortise] is two inches thick, prick from the end two inches, and applying the inside of the handle of the square to the side of the quarter, and the

tongue to that prick, draw by the side of the tongue a line through that side the quarter. Then turn the other sides of the quarter successively, and draw lines along each side the quarter as you were taught to draw the opposite lines for the mortise. [This marks the shoulder of the tenon.]

Then place the edge of the inch-wide mortise chisel with its bevel from you, and the handle bearing a little towards you, within one half quarter of an inch [1/8″] of one end of the struck mortise, and with your mallet knock hard upon it until you find the bevel of the chisel will no longer force the chips out of the mortise. Then remove the chisel to the other end of the mortise and work, as with the first end, until the chips will void no longer. Then work away the stuff between the two ends, and begin again at one of the ends, and then at the other, and work deeper into the mortise, then again between both. And so work deeper by degrees until you have wrought the mortise through, or {if not through} to the intended depth. Then with the mortise chisel, work nearer the drawn lines at the ends of the mortise, {for before you were directed to work within half a quarter of an inch [1/8″] of the drawn lines} by laying light blows on it until you have made it fit to pare smooth with a narrow paring chisel, and then pare the ends as you were taught to work with the paring chisel. Pare the sides of the mortise just to the struck lines. So is the mortise finished.

To work the tenon, lay the other quarter on edge upon your workbench, and fasten it with the holdfast, as you were taught [in] Sec. I. Then with the tenon [saw], saw a little without [outside] the struck line towards the end. You must not saw just upon the struck line because the saw cuts rough. Besides, you must leave some stuff to pare away smooth to the struck line, that the stile {that is, the upright quarter} may make a close [tight] joint with the rail [that is] the lower quarter. Saw therefore right down [on the tenon's shoulder] with the tenon saw just almost to the gauged lines for the thickness of the tenon, and have a care to keep the blade of the saw exactly upright. Then turn the opposite side of the quarter upwards and work as you were taught to work the first side.

Then with the paring chisel, pare the work close to the gauged lines for the tenon. Then try how it fits the mortise. If it be not pared enough away, you must pare it where it bears, that is, [where it] sticks. But if you should

FROM BOTH FACES? This is generally a no-no in hand work. You typically work from one true face. The other face is just for show and doesn't have to be flat. However, this method as shown in Moxon works great if your work has been squared all around as he describer earlier.

chance to have made it too little, you have spoiled your work. Therefore you may see how necessary it is not to make the mortise too wide at first or the tenon too narrow. Then with the piercer, pierce two holes through the sides, or cheeks, of the mortise, about half an inch off either end [of the mortise]. Then knock the tenon stiff into the mortise and set it upright by applying the angle of the outer square to the angle the two quarters make; and with your pricker, prick round about the insides of the pierced holes upon the tenon. Then take the tenon out again and pierce two holes with [the] same bit, about the thickness of a shilling above the pricked holes on the tenon; that is, nearer the shoulder of the tenon, [so] that the pins you are to drive in may draw the shoulder of the tenon the closer to the flat side of the quarter the mortise is made in.

Then with the paring chisel, make two pins somewhat tapering, full big enough, and setting the two quarters again square as before, drive the pins stiff into the pierced holes. If you make another square, as you did this [one] and make also a tenon on each un-tenoned end of the stiles, and another mortise on the top and bottom rails, you may put them together, and make square frames of them.

DIVIDE AND SCRIBE. The dividers allow you to keep a consistent measurement across several mortises. The scribed lines make the chisel easy to position in the right place.

Analysis

Moxon begins his explanation of the mortise-and-tenon joint with a description of how to design the joint so it is strong. In essence, he says there are no hard and fast rules and that it is up to you, the maker, to equalize the strength of the two components.

So you must consider the species you are joining (if you are using two species). And you must consider that the mortise is weaker because it is prone to split along its grain. Moderns have come up with rules for sizing tenons and mortises. Here are some general guidelines:

1. The tenon thickness is typically one-third the thickness of the tenon material. However, the tenon can be thicker if the piece you are mortising is beefy.

2. The tenon width should be two-thirds the width of the material.

3. The tenon length should be five times the thickness of the tenon. (So a typical ¼"-thick tenon should be 1¼" long).

Moxon begins with making the mortise and gives instructions for marking out the opening before excavating it. What is unusual about Mox-

on's explanation is that he works from both sides of the work with a gauge with a single pin. Many later sources indicate you should work off one face and use either a mortising gauge (with two pins) or two gauges. Still other woodworkers will use one scribe line for marking out the mortises – the other wall of the mortise is determined by the width of the chisel and doesn't need to be marked out.

The method Moxon describes works here because the material has been squared all around, as explained earlier.

The length of the mortise is marked by the dividers and completed by the square and the pricker. If it's a through-mortise, then mark the other side of the work as well. It should be said that through-mortises were common in early work, and I find them easier to make than blind mortises when doing the operation by hand. That's because the most difficult part of excavating a mortise is chip removal. And with a through-mortise, waste removal is easier than with a blind mortise.

Then Moxon advises to mark out the tenon before proceeding – presumably you won't make an error in mortising and all your tools are correctly set for marking both.

Moxon isn't clear (to my mind) as to which end of the mortise you should work first – the end near you or the end away from you. I assume it's the end nearest you because that will make a vertical cut near the extant of the mortise because you are tipping the handle toward you as Moxon describes. I've tried it both ways – at the far end and the near end – and I begin as shown in the photo on the following page.

Once the ends are worked, you remove the waste by degrees in the middle. Mortising tends to leave a bit of a hump in the middle that you have to work out – and it can be a bit of work when it's a blind mortise. Other methods of mortising exist that work from the center out, which avoids this problem. Don't slavishly follow Moxon – try other methods.

At the end of the process, you pare the ends and then the cheeks, according to Moxon. Perhaps his mortise is undersized because of the way the mortise was marked out and needs its cheeks pared. This is my reading of the situation because Moxon says you should choose a mortising chisel that is equal to the width of your mortise.

This little point has flummoxed some modern woodworkers and separated them into the camps of those who pare mortise walls and those who don't. Me? I just go for a mortise that is the final size and avoid the extra step of paring whenever I can.

TIPPED, BUT STRAIGHT DOWN. Begin at the end of the mortise near you (you're standing at the end of the stock). Tip the handle toward you a bit so the chisel will drive straight down.

FLIP THE TOOL. Turn the tool around and repeat the operation at the other end of the mortise.

THEN THE MIDDLE. Move the chisel in toward the middle by degrees, levering out as much waste as possible as you go. When you've done all you can, flip your work over and work the other face (if it's a through-mortise).

NOT THE RIGHT SAW, PERHAPS. The traditional English tenon saw is a backsaw, though Moxon doesn't show a traditional backsaw in his plates.

Then you saw the tenon. Cut it close, Moxon advises, and then pare it to fit the mortise with the paring chisel. Finally, you drawbore the mortise and tenon together. Drawboring is where you drill two offset holes – a hole in the mortise is slightly offset from the hole in the tenon.

When you drive a peg through the offset holes, it pulls the tenon tight into the mortise. It's an ingenious way of getting around unreliable adhesives and is still used today in timber framing and accurate furniture reproductions from the 17th century, for example.

MOXON'S MITER SQUARE. This is likely what Moxon referred to when discussing the miter square, though it will be unfamiliar to modern eyes. The handle (or stock) is tiny, which can make it less accurate than miter squares with large handles.

S. 18. Of the miter square and its use.

The miter square marked E [likely R instead] hath {as the square} a handle marked a, one inch thick and three inches broad, and a tongue marked b, of about the same breadth. The handle and the tongue {as the square} have both their sides parallel to their own sides. The handle {as the square} hath in the middle of its narrowest side a mortise in it of an equal depth the whole length of the handle. Into this mortise is fitted one end of the tongue, but the end of the handle is first beveled off to make an angle of 45 degrees with its inside. This tongue is {as with the square} pinned and glued into the mortise of the handle.

It is used for striking a miter line, as the square is to strike a square line, by applying the inside of the handle to the outside of the quarter, or batten, you are to work upon. And then by striking a line by the side of the tongue, that line shall be a miter line. And if upon two battens you strike two such lines, and saw and pare them just off in the lines, when the flats of those two sawn ends are applied to one another, the outside and inside of the battens will form themselves into the figure of a square.

Thus picture frames and looking glass frames are commonly made, as by a more full example you may see in the next section.

MODERN MITERS. This miter square has a long handle, which allows you a higher degree of accuracy because the handle will touch more of your work. That's useful in hand work.

Analysis

I assume that this is a typographical error and that the miter square doesn't resemble a compass saw. Take a look at R and you can see that this is likely the miter square, though the handle, sometimes called the stock, is small. A modern miter square looks more like a try square with the blade fixed at 45 degrees. I think a disadvantage of this old form is that it is less accurate because the handle bears against a small amount of your material. If work is true, then this isn't a problem. But if your stock is rough, then your miter might be spoiled.

S. 19. Of the bevel.

As the square is made to strike an angle of 90 degrees, and the miter an angle of 45 degrees, so the bevel {marked F} having its tongue movable upon a center, may be set to strike angles of any greater or lesser numbers of degrees, according as you open the tongue wider from or shut it closer to the handle. It is used as the square and the miter and will perform the offices of them both, though it be not purposely made for either. [Instead it is made] for the striking [of] such bevel lines, as one part of your work must be cut away to, to make it join with another part of your work. For example:

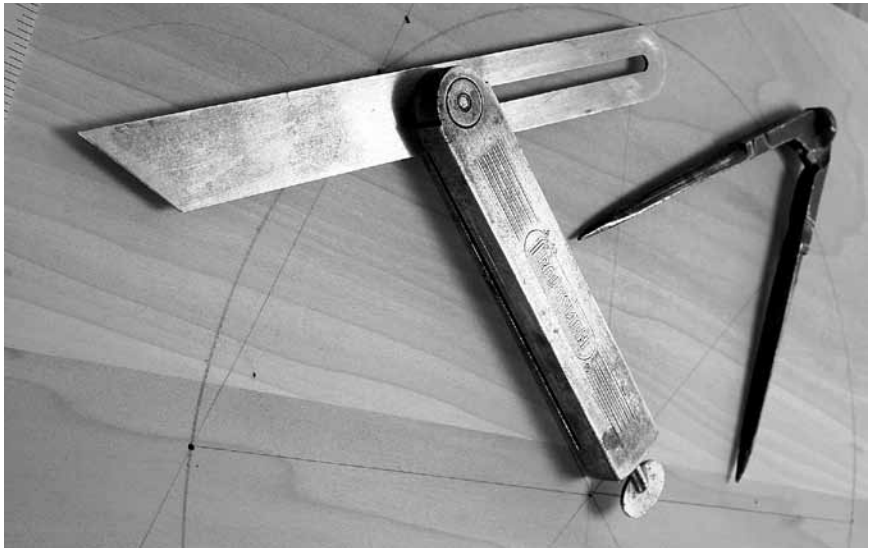
MORE ADJUSTABLE AND TIGHTER LOCKING. Modern squares (when well made) will be more adjustable because the blade slides through the stock. Plus, some locking mechanisms (especially those at the base of the stock) lock everything firmly without getting in the way of layout. However, the wooden ones are lighter, cheaper and can be bigger.

We will propose to make a frame for a picture or looking glass containing eight straight sides. You may quickly perceive that all the ends of these eight sides must be cut to bevels, and what bevels they must be. You will find [the angle of these bevels] if you describe [them] upon a smooth flat board a circle of any bigness, but the larger the better. Divide this circle into eight equal parts, and from every point draw a line to the center. Draw also straight lines from every point to its next point. Then lay the inside of the handle of your bevel exactly upon any one of these straight lines so as the angle made by the inside of the handle and the inside of the tongue lie exactly at the very angle made by this straight line and the semi-diametral [attached] line proceeding from the center. Move the tongue nearer or farther off the handle until the inside of the tongue and the inside of the handle lie exactly upon those two lines, so shall your bevel be set.

OLD-SCHOOL BEVEL. The blade doesn't slide through the stock and it's unclear if there is some manner of fixing your setting. It could be a tight friction fit.

Then having fitted [or cut] your pieces to your scantling [finished size], stick your pricker as near the outward corner of your pieces as your stuff will bear and apply the inside of your handle also to the outer sides of your pieces, and so as the inside of the tongue may be drawn home to the pricker. For then lines drawn on those pieces by the inside of the tongue shall be the lines the pieces must be cut in, to make these eight pieces join evenly together by the sides of each other's bevel. Then with the strike block, smooth the ends of the bevels as you were taught in the section on the strike block. If you have a board on the backside of this frame, you may glue the backsides of these pieces piece by piece to the board. But first you must fit them to an exact compliance of every bevel with its match. And when they are so fitted, drive two nails close to the outside of every piece, but drive not the nails deep into the board, because when the frame is set and glued, or otherwise fastened, you must draw the nails out again. For these nails are only intended to serve as fences to set and fit each piece into its proper place before the whole frame is fastened together. And should you not thus fence them, though by your eye you might judge you fitted the bevels exactly, yet one piece being never so little out of its due position, would drive the next piece more out, and then the next, until at the last, the last piece would not join, but either be too short or too long, or stand too much out or in, or else too open or too close on the out or inside.

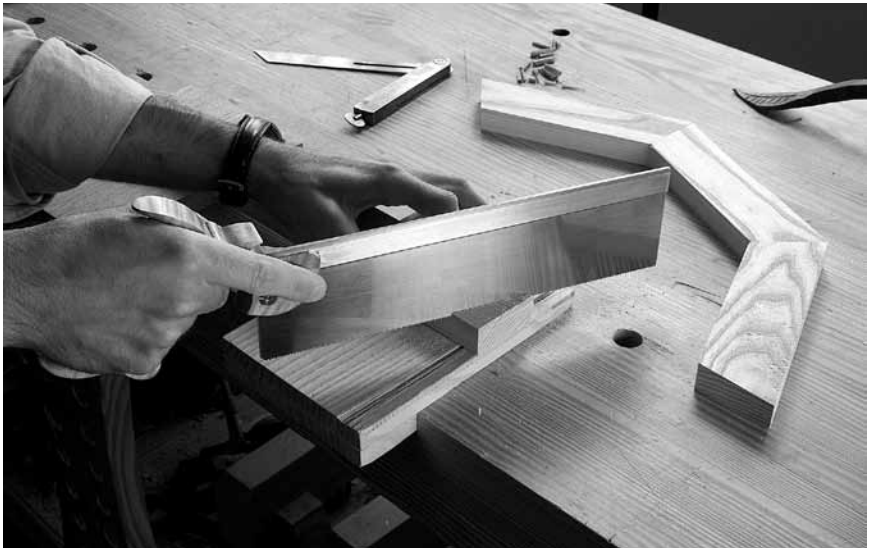
But if you have no board on the backside, you must, when you saw the beveling angles upon the square ends of pieces, not saw quite through the depth of one end of every piece, but about halfway through the depth [or thickness], and then with your chisel either split or else pare the upper side of the square end flat away to the bevel, and so leave part of the square end of your piece to lap under the piece it is joined to.



ANY ANGLE, NO DEGREES. You can set your bevel to any angle merely by drawing a large circle and dividing it into segments with your dividers. Then it's just a game of connect the dots to get all your angles.

Example: In Fig. 3. Plate 5. a b is the square end of the piece, and b c is the bevel you work the piece to. Therefore you must work away so much of the thickness of the square end, as is comprehended between a and c, so that you will see the triangle a b c, is to be wrought away halfway down the thickness of the stuff, and so will the triangle a b c be left for the other half thickness of the stuff. But that end of the piece marked 1, which joins to the piece marked 2, must, upon its bevel stroke, be sawn quite off, and its underside must have the same triangle wrought into it, just so fit as to receive the triangle in piece 2, and just so deep, as that when the triangle on piece 2 is fitted into the triangle in piece 1 the superficies [surfaces] of both the pieces may be even with one another. And thus you may lap the ends of every piece into one another.

These triangles at the ends of the pieces you may glue into one another, but if you think gluing alone [is] not strong enough, you may pierce a hole near the inner edge of the frame because the triangle hath there [the] most substance of stuff. And afterwards pin it as you are taught to pin the rail and stile together in Sec. 17.



EIGHT SIDES, ONE ANGLE. With your bevel set, you can position the tool at the corners of your workpieces and mark the bevel you need. Cut that away.

Analysis

The adjustable bevel square shown in F is a lot like the modern sliding T-bevel with a few differences. The blade doesn't slide through the stock. It only pivots. Perhaps it was friction-fit and pivots on a wooden pin. I have an antique one (not nearly as old as Moxon) that looks just like this one, but it does have a nut that locks the whole assembly.

Moxon doesn't mention any locking mechanism. Then Moxon shows you how to lay out an eight-sided frame with the bevel. The layout is clever and doesn't rely upon the knowledge that you are trying to achieve 22 1/2-degree bevels on your workpieces. In essence, you scribe a large circle on a scrap and divide its circumference into eight equal segments (hint: use your dividers). Connect these points to their neighbors. Then draw lines from these eight points to the center. Then you have every angle you need to lay out your frame.

The directions for making the actual miters begin with marking out the joints at each corner with your bevel. Once you lay out your joints, cut them with a saw and clean them up with a plane; you then fit them to their mate using the same procedure.

Moxon says you need to use triangular half-lap joints to join these bevels if you aren't gluing the pieces to a stiff frame behind. That's good advice for

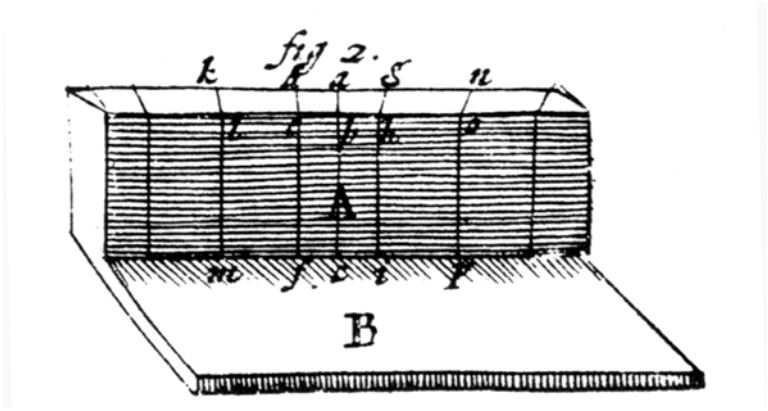
longevity. If you have a stiff frame behind your miters, you can merely glue them in place to the frame behind.

Moxon also says you can pin the miters together if you need more strength, which would be a tricky drawboring operation. A simple pinning of the joints would add some strength to the half-lap joint.

This way of lapping over is sometimes used also for square miters or other angular frames.

S. 20. Of the miter box.

There is another way used by joiners that make many frames to save themselves the labor of drawing or [the] striking out of squares, miters, and several bevels upon their stuff, and this is with a tool called a miter box, described in plate 5. fig. 2. It is composed of two pieces of wood, an inch thick each, as A the upright piece [and] B the bottom piece. The upright piece is nailed upright, fast upon the bottom piece. And this upright piece hath on its upper side the miter lines struck with the miter square, as d e, on the left hand, and g h on the right hand. On these two miter lines the edge of the saw is set, and a kerf made straight down the upright piece, as from d e on the left hand to f, and from g h on the right hand to i. In like manner, any other bevel is struck on the upper side of the upright piece with the bevel, as k l on the left hand and n o on the right. On these two bevel lines the edge of the saw is set, and a kerf made



MOXON'S MITER BOX. Some might call this a miter block. This workshop appliance is much like a bench hook that has frequently used angles cut into it.

straight down the upright piece, as from k to l m, and from g h to i. You may make as many bevels as you please on the upright piece of the miter box: Bevels to join frames of either five, six, seven, eight sides, and so on. And the manner to make them to any number of sides was in part taught in the last section. For as there you were directed to divide the circle into eight equal parts, because eight was the number of sides, we proposed to make that frame consist of. So, if for any number of sides you divide the circle into the same equal parts, and work as you were there directed, you may find what bevel the pieces must have that make a frame that consists of any number of sides.

So also for sawing of any batten, or other small pieces square: Strike at the point a, on the upper side of the upright piece a line straight athwart it to b, and saw straight down the upper piece to c.

The manner how these kerfs are sawn straight down with greatest certainty is thus: Apply the inside of the handle of the square to the upper side of the upright piece, so as the tongue lie close to that end of the [marks for the] miter, bevel, or square line struck through the upper side of the miter box. And with the pricker, strike a line close by the side of the tongue through that side of the upright piece. Turn the tongue to the other side of the upright piece and apply the inside of the handle of the square to the other end of the miter, bevel, or square line, and with the pricker strike also a line close by the side of the tongue through that side [of] the upright piece. These two lines struck on either side of the upright piece shall be a line on each side in which the edge of the saw must run to saw it straight down.

Analysis

Moxon's miter box isn't like the modern U-shaped miter box you can still buy at hardware stores. Moxon's is a simple block of wood on a platform. The block is sliced with several kerfs that correspond to the miters you commonly cut. The appliance sits on your bench and works with the cutting action of the tool. Because Western saws cut on the push stroke, the work is pushed into the corner formed by the upright block and bottom plate.

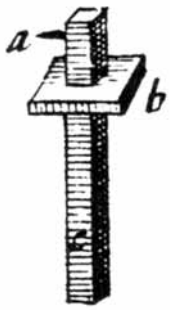
The advantage of the miter box is that you don't have to lay out a large circle to set your bevel every time you make a mitered frame. You can just

saw the miter straightaways. The only complication is that you have to make some accurate sawcuts in your miter block when you build it. And so Moxon describes how to use the square to layout vertical cuts on the inside and outside of the upright block. Then you connect the lines with the saw and follow them down the upright block. Voilà. Accurate kerfs for accurate miters.

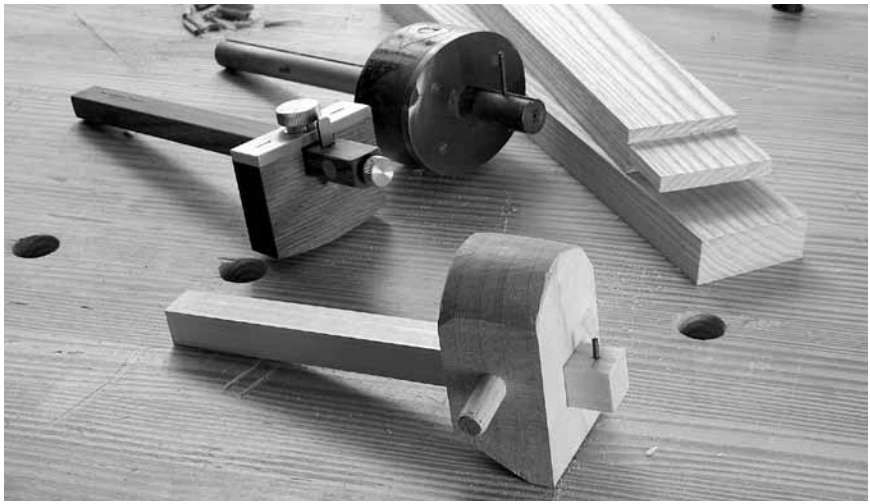
S. 21. Of the gauge.

The gauge marked G {in plate 4}. The oval b is fitted stiff upon the staff c, that it may be set nearer or farther from the tooth a. Its office [purpose] is to gauge a line parallel to any straight side. It is used for gauging tenons and for gauging stuff [boards] to an equal thickness.

When you use it, you must set the oval to the intended distance from the tooth. If the oval stands too near the tooth, hold the oval in your right hand and knock the hinder end of the staff upon the workbench until it remove [moves] to its just [correct] distance from the tooth. If it



MOXON'S GAUGE.



A LITTLE LATER THAN MOXON. This 18th-century style gauge uses a wedge to secure the head on the shaft. Moxon's used only friction, which made the gauge susceptible to wear.

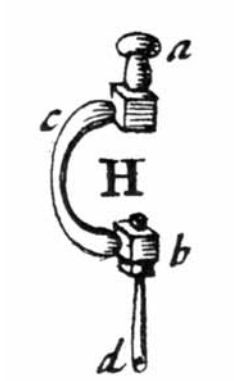
stands too far off the tooth, knock the fore end of the staff {that is, the tooth end} until it moves to its correct distance from the tooth. If the oval slides loosely on the staff, you may stiffen it by striking a wooden wedge between the mortise and the staff. So may you apply the side of the oval next [to] the tooth to the side of any table or any other straight side, [and] with the tooth [then] gauge a line [that's] parallel {or of equal distance} all the way from that side.

Analysis

Moxon describes a marking gauge that has the shaft fit by friction alone into the head (what Moxon calls the "oval"). We know from the 1545 shipwreck of the English ship the Mary Rose that gauges with a locking mechanism existed before Moxon described his.

After Moxon's time, it was common for marking gauges to use all manner of devices to secure the head to the shaft, including a wedge captured in the head. Moxon suggests using a wedge to tighten up a loose gauge, which would have been a common problem as a gauge such as this would loosen up in time from wear (and seasonal shrinkage).

So if you are setting up a shop using early tools, you might not want an adjustable gauge that copies Moxon exactly.



MOXON'S PIERCER.

S. 22. Of the piercer.

The piercer H, in plate 4, hath a the head, b the pad, c the stock, d the bit. Its office is so well known that I need say little to it. Only [that] you must take care to keep the bit straight to the hole you pierce, lest you deform the hole or break the bit. You ought to be provided with bits of several sizes, fitted into so many pads.

Analysis

Moxon is discussing the brace and bit in this section, which has remained little changed since it was introduced in Northern Europe in the 15th century, according to W.L. Goodman's "The History of Woodworking Tools." In fact, 16th-century braces look almost exactly like Moxon's "piercer."

LATER BRACES. While the braces of Moxon's day had wooden frames, such as the example with the brass plating shown here, most modern variants had metal frames, including the example at top.

In the last 500 years there have been a few improvements, mostly in materials. Moxon's piercer has a wooden frame, like early braces. Later braces incorporated metal plating. Eventually braces were made entirely of metal. The other advancement has been in the chuck. Modern braces hold a wide variety of bits and are even ratcheting, a feature that some consider a dubious advancement because it adds weight. I am actually fond of the ratchet. It allows you to limit your arms to a motion that's less tiring. The ratchet also allows you to bore in tight corners. Moxon's spoon-like bits would also encourage this back-and-forth action. So perhaps there's nothing new here.

S. 23. Of the gimlet.

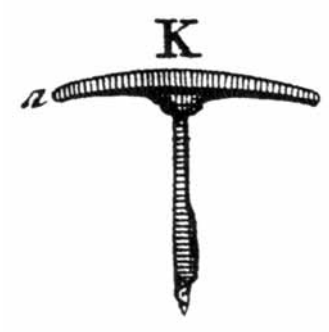
The gimlet is marked I, in plate 4. It hath a worm at the end of its bit. Its office [purpose] is to make a round hole in those places of your work where the stock of the piercer by reason of its own shoulder butting out upon the work will not [allow it to] turn about. Its handle is held in a clutched hand, and its bit twisted stiff into your work. You must have them [in] several sizes.

MOXON'S GIMLET.

SAME BORING TOOLS. These are modern gimlets with a lead screw and drill-bit-like body. Gimlets in Moxon's time had more of a shell-bit structure above the lead screw.

Analysis

Gimlets today are a bit similar to the versions of the 17th century. Moxon's look a little fancier than the ones we use today that are made from twisted heavy-gauge wire and barely function. So perhaps we're devolving. Gimlets are the tool of choice for making small holes for hardware, such as hinges, and the occasional pilot hole for a cut nail. Using them is simple: Push the tip against your work and twist the handle.



MOXON'S AUGER.

S. 24. Of the auger.

The auger marked K in plate 4, hath a a the handle, b the bit. Its office is to make great round holes. When you use it, the stuff you work upon is commonly laid low under you, so that you may the easier use your strength upon it. For in twisting the bit about by the force of both your hands, [one hand] on each end of the

BEFORE THE DRILL PRESS. Drilling large holes was the office (oh heck, now I'm using that word) of the spiral auger. This modern auger was a wooden handle with a variety of interchangeable square-shanked bits.

handle, it cuts great chips out of the stuff. You must bear your strength perpendicularly straight to the end of the bit, as with the piercer.

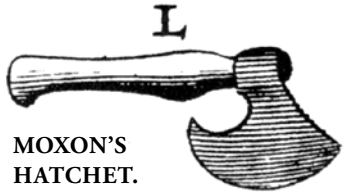
Analysis

Moxon's shell-like augers have all but disappeared from woodworking shops. You'll find most of them on the wall of your local Cracker Barrel.

In Moxon's day, the auger was for boring large-diameter holes that couldn't be handled by the piercer (the brace and bit). These days, the woodworker will rely on a hole saw, Forstner or saw-tooth bits to bore large-diameter holes. The advice Moxon gives on where to apply pressure is good advice for the gimlet-user as well – the goal is to keep the bit completely perpendicular.

S. 25. Of the hatchet.

The hatchet marked L, in plate 4. Its use is so well known {even to the most un-intelligent} that I need not use many words on it, yet this much I will



MOXON'S HATCHET.

FOR CHOPPING. Use the hatchet like a hammer to make ladder-chops down to your line. Then flip the work over and chop the other way.

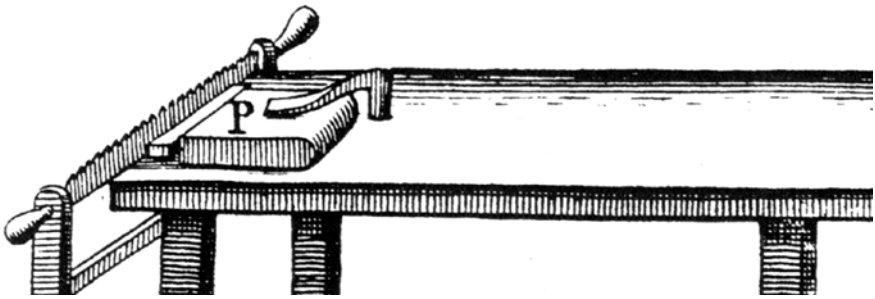
say: Its use is to hew the irregularities off such pieces of stuff which may be sooner hewn than sawn.

When the edge is downwards and the handle towards you, the right side of its edge must be ground to a bevel so as to make an angle of about 12 degrees with the left side of it. And afterwards set with the whetstone, as [with] the irons of planes and so forth.

Analysis

If only Moxon's comments about the hatchet were still true. Moxon dismisses the tool as too easy to even discuss because "even the most unintelligent" know how to use one. Well my first hatchet instructor did a hatchet job in showing me how to do it. Here's what you need to know if you are a Moxon-style dullard: A typical hatchet blade has one flat face and one beveled face – like a plane iron (though double-bevel hatchets are also common). If you are right-handed, the flat face should be the left side.

Hewing with a hatchet is done with a series of swings along an edge. Make "ladder-chops" down an edge. Hew down to your chalk line or pencil line. Then flip the work over and work down the edge, hewing the other way down to the line on the wood. Work back and forth until you get it to the point where a fore plane can take over.

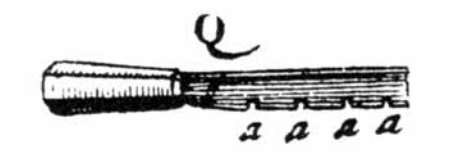


MOXON'S WHETTING BLOCK. Today we would call this a saw filing vise. It clamps the blade of a saw so you can file the teeth. This plate is taken straight from Félibien.

S. 26. The use of the saw in general.

In my former Exercises, I did not teach you how to choose the tools a smith was to use because it is a smith's office to make them. And because in those Exercises I [discussed] making the iron work and steel work in general and the making excellently of some tools in particular, which might serve as a general notion for the knowledge of all smith's workmanship, especially to those who should concern themselves with smithing. But to those who shall concern themselves with joinery, and not with smithing, it will be necessary that I teach them how to choose their tools that are made by smiths, that they may use them with more ease and delight, and make both quicker and nearer work with them.

All sorts of saws for joiners' use are to be sold in most ironmongers' shops, but especially in Foster Lane, London. Choose those that are made of steel {for some are made of iron} for steel of itself is harder and stronger than iron. You may know the steel saws from iron saws thus: The steel saws are generally ground bright and smooth and are {the thickness of the blade considered} stronger than iron saws. But the iron saws are only hammer hardened, and therefore if they could be so hard, yet they cannot be so smooth, as if the irregularities of the hammer were well taken off with the grindstone. See it be free from flaws and very well hammered and smoothly ground {that is, evenly ground}. You may know if it be well hammered by the stiff bending of it; and if it be well ground



MOXON'S SAW WREST. This old-school tool is designed to set a set of teeth with one twist of the wrist.

{that is, evenly ground} it will not bend in one part of it more than in another. For if it do[es], it is a sign that [the] part where it bends most is either too much ground away or too thin[ly] forged in that place. But if it bend into a regular bow all the way and be stiff, the blade is good. It cannot be too stiff because they are but hammer hardened and therefore often bow when they fall under unskillful hands, but [they] never break unless they have been often bowed in that place.

The edge with the teeth is always thicker than the back because the back follows the edge. And if the edge should not make a pretty wide [enough] kerf, [and even] if the back [of the saw] does not strike [jam] in the kerf, yet a little irregular bearing or twisting of the hand awry might stop [the blade and] bow the saw. And {as I said before} with often [frequent] bowing it will break at last.

When workmen light of [find] a good blade, they don't mind whether the teeth are sharp or deep or set well. For to make them so is a task they take to themselves, and thus they perform it. They wedge the blade of the saw hard into a whetting block, marked P in plate 4. With the handle towards their left hand and the end of the saw to the right, then with a three-square [triangular] file they begin at the left hand end, leaning harder upon the side of the file on the right hand than on that side to the left hand so that they file the upper side of the tooth of the saw aslope towards the right hand, and the underside of the tooth a little aslope towards the left, or almost downright. Having filed one tooth thus, all the rest must be so filed. Then with the saw wrest, marked O, in plate 4, they set the teeth of the saw. That is, they put one of the notches marked a a a of the wrest between the first two teeth on the blade of the saw and then turn the handle horizontally a little towards the end of the saw. That at once turns the first tooth somewhat towards you and the second tooth from you. Then skipping two teeth, they again put one of the notches of

the wrest between the third and fourth teeth on the blade of the saw, and then {as before} turn the handle a little towards the end of the saw, and that turns the third tooth somewhat towards you and the fourth somewhat from you. Thus you must skip two teeth at a time and turn the wrest until all the teeth of the saw are set. This setting of the teeth of the saw {as workmen call it} is to make the kerf wide enough for the back to follow the edge. And [each tooth] is set ranker for soft, coarse, cheap stuff, than for hard, fine, and costly stuff. For the ranker the tooth is set, the more stuff is wasted in the kerf. And besides, if the stuff be hard it will require greater labor to tear away a great deal of hard stuff than it will do to tear away but a little of the same stuff.

The pit saw is set so rank for coarse stuff as to make a kerf of almost a quarter of an inch; but for fine and costly stuff they set it finer to save stuff. The whip saw is set somewhat finer than the pit saw. The handsaw and the compass saw [are set] finer than the whip saw. But the tenon saw, frame saw and the bow saw {and the like} are set fine, and [they] have their teeth but very little turned over the sides of their blades so that a kerf made by them is seldom above half a half quarter of an inch [1/16″].

The reason why the teeth are filed to an angle pointing towards the end [toe] of the saw and not towards the handle of the saw or directly straight between the handle and end of the saw is because the saw is designed to cut only in its progress forwards. Man [has] in that activity more strength to rid {in that forward direction} and command of his hands to guide his work than he can have in drawing back his saw. And therefore when he draws back his saw the workman bears it lightly off the un-sawn stuff, which is an ease to his labor, and [this] enables him the longer to continue his several progressions of the saw.

Master workmen, when they direct any of their underlings to saw such a piece of stuff have several phrases for the sawing of it. They seldom say, "Saw that piece of stuff." But instead, "Draw the saw through it," "Give that piece of stuff a kerf," "Lay a kerf in that piece of stuff," and sometimes {but most unproperly}, "Cut or slit that piece of stuff." For the saw cannot properly be said to cut or slit the stuff; but it rather breaks or tears away such parts of the stuff from the whole as the points of the teeth prick

into. And these parts it so tears away are proportion[ate] to the fineness or rankness of the setting of the teeth.

The excellent [way] of sawing is to keep the kerf exactly in the line marked out to be sawn without wriggling on either or both sides — and straight through the stuff, as workmen call it. That is, in a geometrical term, perpendicular through the upper and underside, if your work requires it, as most work does. But if your work be to be sawn upon is a bevel, as some work sometimes is, then you are to observe that bevel all the length of the stuff.

Analysis

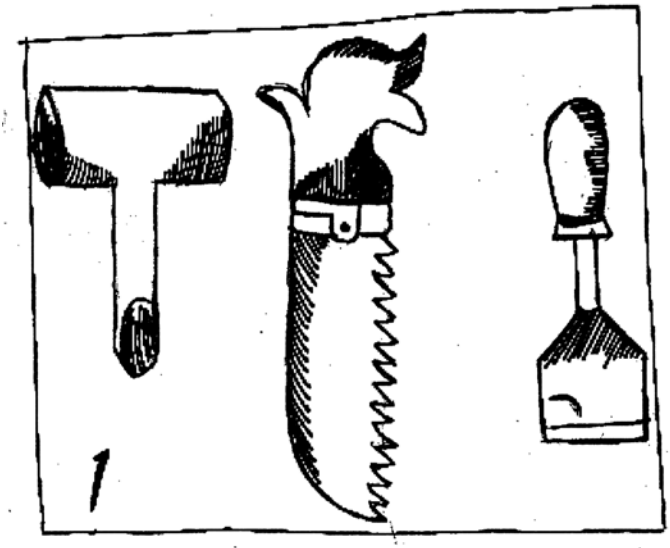
Moxon's entry on saws is interesting because it doesn't match up well with the line drawings in the plates, which clearly show two European-style frame saws; and because he makes very specific recommendations about what saws to buy, even the name of the street in London.

For the history buff, this long entry suggests that workmen would typically buy their saws (rather than make them) and that they were deeply involved in the sharpening and tuning of them. And – most interestingly – the blades were tapered in their thickness. Latter-day woodworkers tend to send out their saws for sharpening. Perhaps our saws are harder and require less filing. Perhaps we saw less. Perhaps we're too lazy to learn saw filing. Perhaps all are a bit true.

If you want to buy a saw, Moxon gives you some advice about how to determine junk from a jewel: bend it. If it folds or bends unevenly, it's junk. If it bends evenly and springs back, buy it. Where the saw bends is the weak point of the saw, where it's too soft or too thin, and that's where it will fail when your stroke goes a bit awry.

Today, there's little to consider about the steel when picking a saw. The steel is universally good, and most of the modern manufacturers even get it from the same mills. The bigger concerns today are how the tool feels in your hand and how well the saw is set up initially. Because most home woodworkers work alone and teach themselves the craft, it's uncommon to teach yourself to file a saw before you learn to saw.

For his part, Moxon gives you some perfunctory advice for filing and then setting a saw, though nothing that is practically useful for today's woodworker – though the description of using a saw wrest for setting the teeth is fun to read. Today many woodworkers use an anvil-like setting tool that



THE OTHER "HAND-SAW." Randle Holme's 1688 work calls the saw above a "hand-saw or a board-saw."

plunges and bends each tooth to the precise amount of set. Some professional saw sharpeners use a small hammer to tap the teeth in place.

In addition to the advice on saw filing and setting, we get to learn some lingo. In other words: "saw" is not a verb. It's a noun.

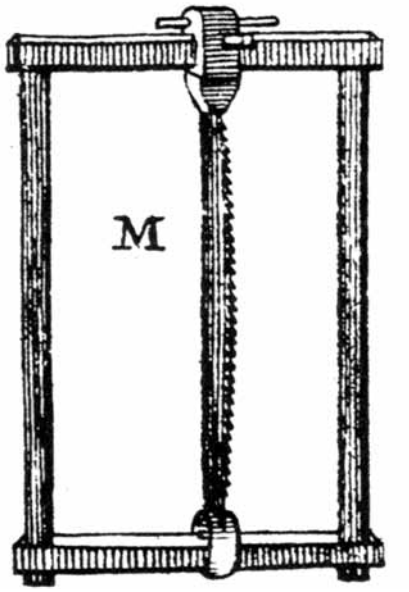
S. 27. The use of the pit saw, marked M, in plate 4.

The pit saw is not only used by those workmen that make sawing timber and boards their whole business, but is also for small matters used by joiners when what they have to do may perhaps be as soon done at home as they can carry or send it to the sawyers. The manner of their working is both alike, for if it be a board they would slit off a piece of timber, or if they would take any square, quarter, or batten off, they first set off their scantlin. For example, if it be an inch {or more, or less} they would [need to] take off a piece of stuff, [then] they open the points of their compasses to an inch measure on their rule, [plus] so much more as they reckon the kerf of the saw will make. And from on [the] side of their stuff they set off at either end of the stuff the distance of the points of their compasses.

And this distance therefore they make with the points of their compasses [with] a prick at either end of the stuff. Then with chalk they whiten a line by rubbing the chalk pretty hard upon it. Then one holds the line at one end upon the prick made there, and the other [workman] strains the line pretty stiff upon the prick at the other end. Then whilst the line is thus strained, one of them between his finger and thumb draws the middle of the line directly upright to a convenient height {that it may spring hard enough down} and then lets it go again so that it swiftly applies to its first position, and strikes so strongly against the stuff that the dust or atoms of the chalk that were rubbed into the line shake out of it and remain upon the stuff. And thus also they mark the underside of their stuff. This is called "lining of the stuff." And the stuff cut into those lines shall be called "inch stuff," because the compasses that pricked the stuff were opened wider by the width of the kerf than an inch measure upon the rule. But had the compasses been opened but an inch exactly, that piece sawn off should {in workmen's language} have been called "inch pricked," thereby giving to understand that it is half the breadth of the kerf thinner than an inch. And thus they call all other scantlins 2 inches, 2-1/2 inches, 3 inches, {and so forth either} "sawn" or "pricked."

When two workmen are not at hand to hold the line at both ends, he that lines it strikes one point of this compass {or sometimes a pricker or a nail aslope} towards that end into the prick set off. And putting the noose at the end of his line over his compasses {or other device}, [he] goes to the other end and strains his line on that prick and strikes it as before.

The stuff being thus lined is fastened with wedges over the pit {if the joiner be accommodated with a pit}. If he has none, he makes [do] with two high frames a little more than man-high in its stead {which are called great trestles} with four legs. These legs stand spreading outwards that they may stand the firmer. Over these two trestles the stuff is laid and firmly fastened that it shakes not. Its outer side from whence the pricks were set off must be perpendicular — which you must try by a plumb line. For should the top edge of that side hang never so little over the bottom edge, or the bottom edge not lie so far out as the top edge, the scantlin you saw off would not be of an equal thickness on the top or bottom



IT'S THE PITS. Here's a framed pit saw. Many early English pit saws were frame saws because it would save a significant amount on metal. Many blades, in fact, were iron instead of more expensive steel.

because the saw is to work exactly perpendicular. Then with the pit saw they enter the one end of the stuff, the top man at the top, and the pit man under him. The top man observing to guide the saw exactly in the line. And [therewith] drawing the saw somewhat toward him when the saw goes down, and the pit man drawing it with all his strength perpendicularly down, but not so low that the upper and lower handles of the saw sink below both their managements. Then, bearing the teeth of the saw a little off the stuff, the top man draws the saw up again, and the pit man assists or eases him in it, and thus they continue sawing on until the saw has run through the whole length upon the stuff. But when the kerf is made so long that by the working of the saw the pieces of stuff on either side will shake against one another, and more or less hinder the easy progress of the saw, they drive a wedge so far in the kerf as they dare do for fear of splitting the stuff, and [this] provides the saw freer and easier passage through the stuff. This wedging they continue so oft[en] as they find occasion.

Analysis

Is this where lumber thievery begins in the English language? Have you ever wondered why 2x material isn't 2″ thick? Or why 4/4 stuff is smaller than 1″ thick? Modern sawyers say this is because of shrinkage during drying. But I have always had sincere doubts.

In this excellent description of pit sawing, we can see how lumber shrinks without the lumber's descriptive terms shrinking in the same manner. If a sawyer takes off an inch of thickness plus the kerf, then that is called "inch stuff." But there is another term: "inch pricked." And that is where the sawyer cuts off an inch of stuff – minus half the kerf.

Now I'm half-joking when I say this is the first evidence we have of lumber shrinking during processing, but I'm also half-serious.

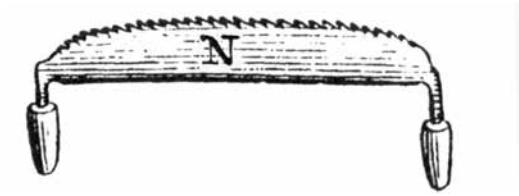
Other than that nugget of woodworking lore, what else can we take away from this entry about pit sawing? Unless you have a partner to be the pit man (or obedient but muscular offspring) you probably should suck it up and buy a big band saw.

S. 28. The use of the whip saw, marked N in plate 4.

The whip saw is used by joiners to saw such greater pieces of stuff that the handsaw will not easily reach through. When they use it, the stuff is laid upon the trestle, marked O in plate 5, in the angles of it. Then two men takes each a handle of the saw. He to whom the teeth of the saw points drawing to him, and the other thrusting from him. And {as before} the saw, having run its length, is lifted gently over the stuff to recover another stroke of the saw.

Analysis

The whip saw is another obsolete saw, and it is shaped much like the crosscut saw that was used to fell trees. Moxon's description of it makes it sound like it's as fun to use as the pit saw. The little detail here (and in the pit saw entry) that is important is Moxon's advice to lift the saw a bit on the return stroke. This makes the work easier, of course, and it also clears the line of sawdust – the dust scatters left and right off the line as it falls out of the gullets of the saw. This is a trick that is still passed down by carpenters who use handsaws.



IT WILL WHIP YOU. Perhaps the whip saw is so named because it whips around more than a frame saw in use. Or maybe it's because you feel whipped after using it.

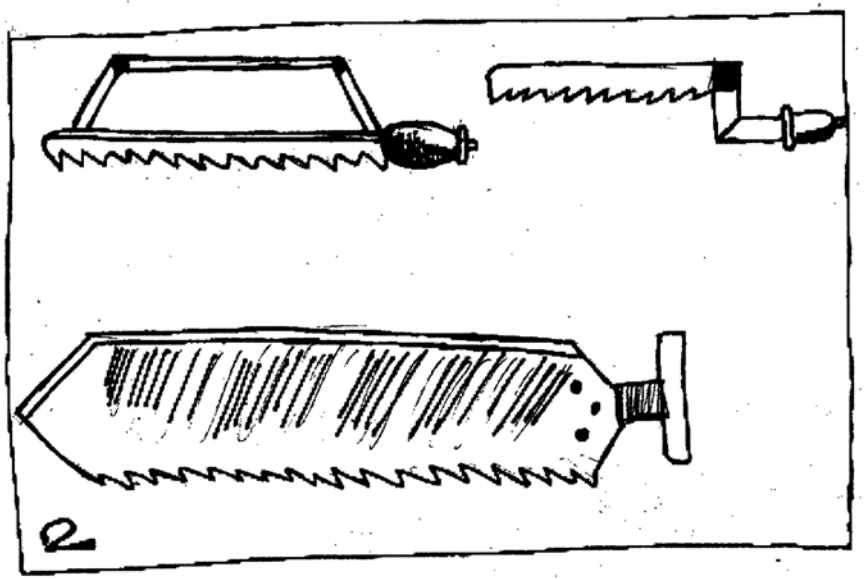
SAWING ACCESSORY. These trestles are used with a whip saw or pit saw. One person is on top of the work (wedged into the "X"). The unlucky second person is below.

S. 29. The use of the handsaw marked D, the frame or bow saw, the tenon saw, marked O in plate 4.

These saws are accommodated for a single man's use and cut [on the] forward [stroke] as the other saws do. The office of the cheeks made to the frame saw is, by the twisted cord and tongue in the middle, to draw the upper ends of the cheeks closer together [so] that the lower end of the cheeks may be drawn the wider asunder and strain the blade of the saw the straighter. The tenon saw, being thin, hath a back to keep it from bending.

Analysis

This entry confounds many woodworkers. There is no handsaw marked "D." The item marked "D" is a try square. However, there's an unmarked saw on the plate that looks like a fancy-handled handsaw to modern eyes. It has a knife-like blade and resembles an Egyptian saw or Disston & Sons' so-called Turkish saw. Is this is the handsaw?

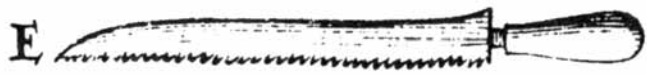


ODD SAWS. Is the frame saw (top left) a tenon saw? Randle Holme's 1688 book calls the saw that looks like a hacksaw at top right a "tennant saw" with a "back of iron." Is the handled saw (at bottom) a handsaw? We cannot know what Moxon meant exactly because his text doesn't mesh with his plates.

Then there's the matter of the frame saw marked "O." It's indeed a frame saw, and Moxon gives a good description of how the cord is twisted to tension the blade. But then Moxon confuses us by saying the tenon saw has a back to keep the blade from bending. There's not a backsaw shown the plate. So I consulted an account contemporary to Moxon. Randle Holme's "Academy of Armory" (1688) also describes a tenon saw as "a thin Saw, and therefore hath a Back of Iron to keep it from bending." But Holme's plate shows a saw that looks more like a hacksaw in form. And later on the same page, Holme shows a bow saw and says it is sometimes called a "tenant saw." It's all a little confusing.

S. 30. The use of the compass saw, marked Q in plate 4.

The compass saw should not have its teeth set, as other saws have. But the edge of it should be made so broad and the back so thin that it may easily follow the broad edge without having its teeth set. For if the teeth be set, the blade must be thin or else the teeth will not bow over the

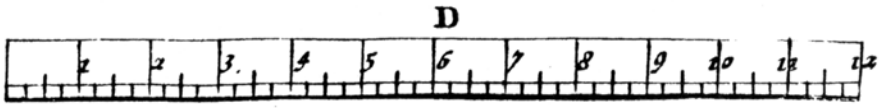


MOXON'S COMPASS SAW. Modern compass saws look even narrower than this one. This saw resembles the knife-shaped blades of early Egyptian saws.

blade. And if it be thin {considering the blade is so narrow} it will not be strong enough to abide tough work. An ever so little irregular thrust will bow and at last break [the blade]. Yet for cheapness, they are many times made so [that you] think that the teeth require a setting. Its office is to cut a round or any other compass [curved] kerf. Therefore the edge must be made broad and the back thin so that the back may have a wide kerf to turn in.

Analysis

The compass saw actually is E in Plate 4 – not Q (which is a saw wrest). It sounds to me like the compass saw was as temperamental then as it is today. As this form of saw cuts on the push stroke and is so thin, it has a tendency to bend. This is one of the reasons the Japanese version of this tool (which cuts on the pull stroke) is favored by many today.



A BRIEF RULE. The illustration of Moxon's rule shows a shorter version that isn't marked in the same graduations explained in the text.

S. 31. Of the rule marked D in plate 5.

The use of the rule is to measure feet, inches, and parts of inches. For that purpose, [they] are marked upon the flat and smooth sides of the rule and numbered with inches, and hath every inch divided into two halves, and every half into two quarters, and every quarter into two half-quarters. So that every inch is divided into eight equal parts. And these

inches are numbered from one end of the rule to the other, which commonly is in all 24 inches. This is a two-foot rule.

They have commonly both board and timber measures {and the like} marked upon them for the finding both the superficial and solid content of board or timber. The use of [these] lines and tables have been often taught by others, and being more mathematical than mechanical, [it] is un-proper for me to meddle with in this place but rather to refer to those books.

But the manual use of it is either to measure length with it, or to draw a straight line by the side of it. Or to try the straightness or flatness of their work with. They try their work by applying one of its edges to the flat of the wrought side of their work and bring their eye as close as they can to see if they can see light between the edge of the rule and their work. If they cannot, they conclude their work is try and well-wrought.

Analysis

Again, Moxon's drawing and his text don't match up, but I think we should trust the text. Moxon says that joiners would use a 24″-long ruler that was divided into eighths, yet he shows a 12″ ruler divided into quarters. There are early sources that point to the fact that joiners used very fine measurements, so eighths (and even fractions of eighths) are perfectly believable.

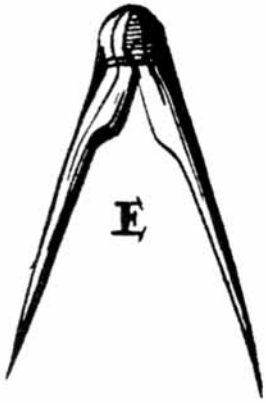
Other than that, Moxon's entry offers no surprises: The joiner uses it to measure stuff, to determine if it's flat and to draw straight lines.

S. 32. Of the compasses marked E in plate 5.

a a The joint b b, the cheeks of the joint c c, the shanks, d d the points. Their office is to describe circles and set off distances from their rule {or any other measure} in their work.

Analysis

Moxon gives only two sentences to one of the most important measuring and scribing tools. The usefulness of Moxon's "compasses" is evident in other entries in "Mechanick Exercises." Marking tenons, mortises, miters and even the rough thickness of boards would be impossible without this simple tool.



SIMPLE AND ESSENTIAL. The compass was used for marking and transferring measurements in all of the joiner's work. Its usefulness does not belie its short entry. The older form relies on friction to hold its setting. One of Holme's 1688 compasses (right) used a screw.

Early blacksmith-made examples are elegant and simple, much like the ones that Moxon shows in Plate 5. They rely on friction to hold a setting, which even old ones do well (perhaps due to built-up crud in the hinge). Modern ones lock (thanks to more complex mechanisms) like a compass you'd find in a child's school locker. Some woodworkers, such as Peter Follansbee and Jennie Alexander, say the locking mechanism can differentiate a compass from "dividers," a similar tool. Dividers can be locked at a setting. Compasses cannot.

ssssS. 33. Of the glue-pot marked F in Plate 5.

The glue pot is commonly made of good thick lead that by its substance it may retain heat longer, that the glue chill not {as workmen say when it cools} when it is to be used.

S. 34. Of choosing and boiling glue.

The clearest, driest, and most transparent glue is the best. When you boil it, break it with your hammer into small pieces and put it into a clean skillet, or pipkin [an earthenware pot], by no means greasy, for that will spoil the clamminess of the glue. Put to it so much water as is convenient

SEVENTEENTH-CENTURY CROCK-POT. Though most woodworkers use modern yellow glues or liquid hide glue for almost all joinery, there still are woodworkers who do reproduction work and restoration experts who rely upon a pot much like this.

to dissolve the glue and to make it, when it is hot, about the thickness of the white of an egg. The quantity of water cannot be assigned because of the different quality there is in glue. Keep it stirring while it is melting and let it not stick to the sides or bottom of the vessel. When it is well-boiled, pour it into your glue pot to use, but let your glue pot be very clean. When it is cold and you would heat it again in your glue pot, you must take great care that it burn not to the sides or bottom of the glue pot. For that burning either turns to a thick, hard skin, or else to a burnt cinder-like substance, which, if it mingles with the glue, will spoil it all. [That is] because by its substance it [the skin or cinder] will bear the two joints you are to glue together off each other.

When {with often heating} the glue grows too thick, you may put more water to it. But then you must make it very hot, lest the glue and water do not wholly incorporate.

Some joiners will, when their glue is too thick, put "small beer" into it, thinking it strengthens it. I have tried it, and could never find it so, but [I] think it makes the glue weaker, especially if the small beer [is] new, and it's yet not well settled from it, or so stale that it be either draggy or any bit mingled with the settlings of the cask.

S. 35. Of using the glue.

Your glue must be very warm, for then it is thinnest; and as it chills, it thickens. With a small brush you must smear the glue well upon the joint of each piece you are to glue together. And before you set them as they

are to stand, you must jostle them one upon the other that the glue may very well touch and take hold of the wood and that the glue on each [of the] joints may well incorporate. Then fit the two joints as they must stand. And when you set them by to dry, let the one stand upright upon the other. For if they stand aslope, the weight of the stuff when it leans upon two extreme edges may make one end of the joint open.

Analysis

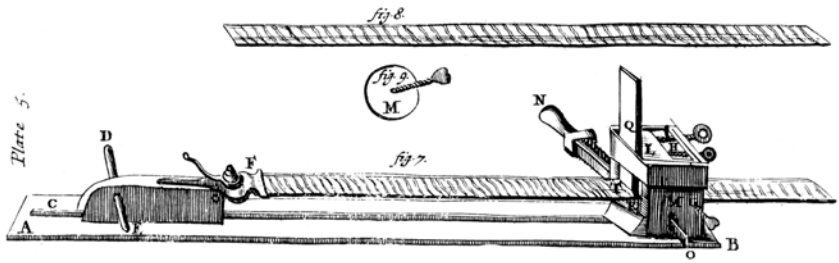
Not much has changed with the preparation and keeping of hide glue, and Moxon's advice on the matter is still sound. Keep the stuff clean. Add water to thin it (I like the description to keep it as thick as an egg white). Don't burn it. Don't add low-alcohol beer to it.

As to the description of using the glue, Moxon seems to be describing gluing up a panel in what's called a "rubbed joint." You apply warm glue, rub the two pieces against one another as the glue cools and sets up. Then you set the panel aside for the glue to cure. Moxon advises that you set the panel up vertical against the wall after gluing so one side presses down directly against the other. Standing the panel at an angle could cause the joint to open on one edge.

S. 36. Of the waving engine.

The waving engine described in plate 5. fig. 7, hath A B, a long square plank of about seven inches broad, five foot long, and an inch and a half thick. All along the length of this plank on the middle between the two sides runs a rabbet [a raised track], as part of it is seen at C. Upon this rabbet rides a block with a groove in its underside. This block is about three inches square and ten inches long, having near the hinder end of it a wooden handle going through it [that is] about one inch diameter, as D E. At the fore-end of this block is fastened a vise, [that is] somewhat larger than a great hand-vise, as at F. The groove in the block is made to receive the rabbet on the plank.

At the farther end of the plank is erected a square strong piece of wood, about six inches high, and five inches square, as G. This square piece has a square wide mortise in it on the top, as at H. Upon the top of this square piece is a strong square flat iron collar, somewhat loosely fitted on, having



MOULDING MACHINE. The waving engine is a moulding machine that operates off a pattern-cutting principle. The flame mouldings it makes are uncommon today and not generally made with common workshop machinery.

two male screws fitted into two female screws, to screw against that part of the wooden piece un-mortised at the top, marked L, that it may draw the iron collar hard against the iron [that cuts the moulding], marked Q, and keep it stiff against the fore-side of the un-mortised piece, marked L, when the piece Q is set to its convenient height. And on the other side the square wooden piece is fitted another iron screw, having to the end of its shank fastened a round iron plate which lies within the hollow of this wooden piece, and therefore cannot in draft be seen in its proper place. But I have described it apart, as at M. {Fig. 9.} Its nut is placed at M on the wooden piece. On the farther side of the wooden piece is fitted a wooden screw called a knob, as at N. Through the farther and hither side of the square wooden piece is fitted a flat piece of iron, about three quarters of an inch broad and one quarter of an inch thick, standing on edge upon the plank; but its upper edge is filed round {the reason you will find by and by}. Its hither end comes through the wooden piece, as at O, and its farther end on the opposite side of the wooden piece.

Upright in the hollow square of the wooden piece stands an iron, as at Q, whose lower end is cut into the form of the moulding you intend your work shall have.

In the fore side of this wooden piece is [a] square hole, as at R, called the mouth.

To this engine belongs a thin flat piece of hard wood, about an inch and a quarter broad and as long as the rabbet. It is disjunct [distinct, uncon-

nected] from the engine, and in fig. 8. is marked S S, called the rack. It hath its under[side] flat cut into those fashioned waves you intend your work shall have. The hollow of these waves are made to comply with the round edge of [the] flat plate of iron marked O {described before}. For when one end of the riglet [workpiece] you wave is, with the vise, screwed to the plain side of the rack, and the other end put through the mouth of the wooden piece, as at T T, so as the hollow of the wave on the underside of the rack may lie upon the round edge of the flat iron plate set on edge, as at O, and the iron Q, is strong fitted down upon the reglet [sic]. Then if you lay hold of the handles of the block D E and strongly draw them, the rack and the riglet will both together slide through the mouth of the wooden piece. And as the rounds of [the] rack ride over the round edge of the flat iron, the rack and reglet will mount up to the iron Q, and as the rounds of the waves on the underside of the rack slides off the iron on edge, the rack and reglet will sink, and so in a progression [or more] the riglet will on its upper side receive the form of the several waves on the underside of the rack, and also the form or moulding that is on the edge of the bottom of the iron. And so at once the riglet will be both moulded and waved.

But before you draw the rack through the engine, you must consider the office of the knob N, and the office of the iron screw M. For by them the rack is screwed evenly under the iron Q. And you must be careful that the groove of the block flip not off the rabbet on the plank. For by these screws, and the rabbet and groove, your work will be evenly gauged all the way [as I said before] under the edge of the iron Q, and keep it from sliding either to the right or left hand, as you draw it through the engine.

Analysis

Of course, the No. 1 question you have to have about the "waving engine" entry is what the heck the thing actually does. Is it a planer? A moulding machine? Well, yes. It works like both a planer and a moulding machine to produce what are called rippled or waveform mouldings, which were all the rage during Cromwell's reign in England.

Wave mouldings show up in many picture frames of the era and reflect light in a most unusual way – thanks to their undulations or ripples.

Moxon's device seems complex from the description because he is writing about a thing that doesn't exist in this exact form today. In essence, the waving engine produces rippled mouldings much like a duplicator lathe or a pattern-cutting bit in a router. A flat piece of iron follows a block with the desired pattern cut into it. This moves the stock against a fixed cutter, which gradually (very gradually) cuts away the waste to reveal the final wave shape in the workpiece.

The workpiece, by the way, is pulled through the waving engine by hand. If you are interested in this fascinating machine, I recommend you check out a 2002 article by Jonathan Thornton, who built a close reproduction of Moxon's waving engine and shows how it developed into a fancier machine that worked with a crank. It's easily available in pdf format from Stanford University's web site for the Wooden Artifacts Group (http://aic.stanford.edu/sg/wag/authorindex.html).

S. 37. Of wainscoting rooms

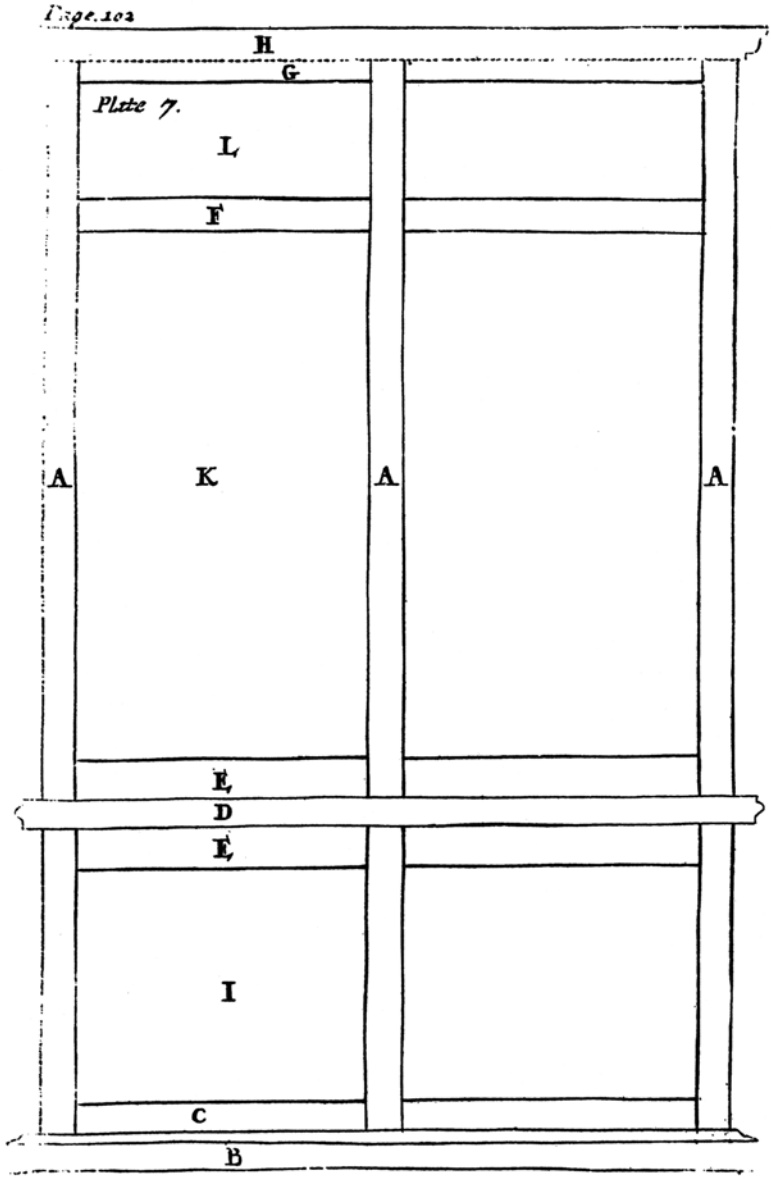
A A A [in plate 7] the stiles. B the base. C the lower rail. D the sur-base [upper base]. E E the middle rail or rails. F the frieze rail. G the upper rail. H the cornice. I the lying panel. K the large panel. L the frieze panel.

In wainscoting of rooms there is, for the most part, but two heights of panels used, unless the room to be wainscoted is above ten foot high, as some are eleven or twelve foot high. And then three heights of panels are used. As I the lying panel, above the base. K the large panel above the middle rail. And L the frieze panel above the frieze rail.

The frieze rail is to have the same breadth [as] the margent [borders] of the stile has. The middle rail hath commonly two breadths of the margent [borders] of the stile; that is, one breadth above the sur-base [upper base] and the other below the sur-base [upper base]. And the upper and lower rails have also each the same breadth with the margent [borders] of the stile.

Those mouldings above the pricked line on the top, as H, are called the cornice.

Sometimes {and especially in low rooms} there is no base or sur-base [upper base] used, and then the middle and lower rail need not be so broad. For the middle rail need not be above a third part more than the margent



SIMPLE WAINSCOT. This plate shows the bare-bones structure of a wainscoted room and is intended as a lesson in anatomy and proportion.

[borders] of the rail. And the lower rail you may make of what breadth you see convenient. They are commonly about three inches and an half or four inches broad. Yet this is no rule, for sometimes workmen make only a flat plinth serve.

You may {if you will} adorn the outer edges of the stiles and rails with a small moulding. And you may {if you will} bevel away the outer edges of the panels and leave a table [or raised panel] in the middle of the panel.

Analysis

In this entry, Moxon lays out some of the guidelines for wainscoting a room with an anatomy lesson and tips on how to proportion your rails.

The drawing isn't exactly proportional to the explanation in the text (or key parts are partially obscured), so this is what (I think) Moxon is trying to convey:

The width of your stiles (the long vertical pieces) should be the same width as your frieze rail, each of your middle rails, your upper rail and your lower rail. What is left to the workman then is the width of the base, surbase and plinth.

In rooms with low ceilings, you can omit the base moulding and surbase and use a narrow middle rail instead.

And one final decision on your part: You can make things fancier with stuck moulding bordering the rails and stiles, or by making the panels raised instead of flat and plain.

An explanation of terms used among joiners

When I first began to print these Exercises, I marked some terms in joinery with superior letters {as printers call them} thus a b c & c. intending, at the latter end of these Exercises, to have explained the terms [that] those Letters referred to. But upon consideration that those terms might often be used in this discourse when the superior letter was out of sight and perhaps position[ed where] forgotten, I have changed my mind and left out the superior letters beyond page 66 [after section 2 in this text]. And instead of those references [I] give you this alphabetical table of terms, by which you may always more readily find the explanation, though you often meet with the term. [All page numbers refer to the original text.]

A.

Architrave. See Plate 6. l. is the architrave molding.

Auger. S 24. Plate 4. fig. K

B.

Base. See Plate 6. b. And Plate 7. B.

Bead. See Plate 6. a.

Bed Molding. See Plate 6. d.

Bevel. The bevel is an angle the edge of a tool is ground away to. See [S.10].

Batten. Is a scantling of stuff either two, three or four inches broad and is seldom above an inch thick. The length [is] unlimited.

Beak. The end of the holdfast. See [S.1].

Bench Screw. See Plate 4. A g. and [S.1].

Bevel. Any sloping angle that is not a square is called a bevel. See pages [S.10] S19. And Plate 4. F.

Bit. See S.22.

Bow Saw. Plate 4. O.

C.

Capital. See Plate 6. g.

Cast. Stuff is said to cast, or warp, when by its own droughth [dryness] or moisture, or the droughth or moisture of the air or other accident, it alters its flatness and straightness.

Clamp. When a piece of board is fitted with the grain to the end of another piece of board across the grain, the first board is clamped. Thus the ends of tables are commonly clamped to preserve them from warping.

Compass Saw. See [S.30]. And Plate 4. Fig. R [actually, E].

Cornice. See Plate 6. q. and Plate 7. H.

Cross-grained Stuff. Stuff is cross-grained when a bough or some branch shoots out on that part of the trunk of the tree. For the bough or branch shooting forwards, the grain of that branch shoots forwards also, and so runs across the grain of the trunk; and if they be well grown together, it will scarce be perceived in some stuff, but [will reveal itself when you are] working. Yet in deal boards, those boughs or branches are knots, and [they are] easily perceived; and if it grew up young with the trunk, then instead of a knot you will find a curling in the stuff when it is wrought [worked].

Curling Stuff. If the bough or branch that shoots out of the trunk of a tree be large, and the stuff in that place sawn somewhat aslope, [then] when that stuff comes under the plane you will find a turning about or curling on that place upon the stuff. And in a straight progress of the plane, the iron will cut with, and suddenly across the grain, and that more or less as the bough grew in the youth of the tree, or grew more or less upright, or else sloping to the trunk, or was sawn so. Such stuff therefore is called curling-stuff.

D.

Door Case. Is the framed work about the door.

Double Screw. See page [S.1]. Plate 4. fig. g. on the workbench A.

F.

Facia. See Plate 6. b.

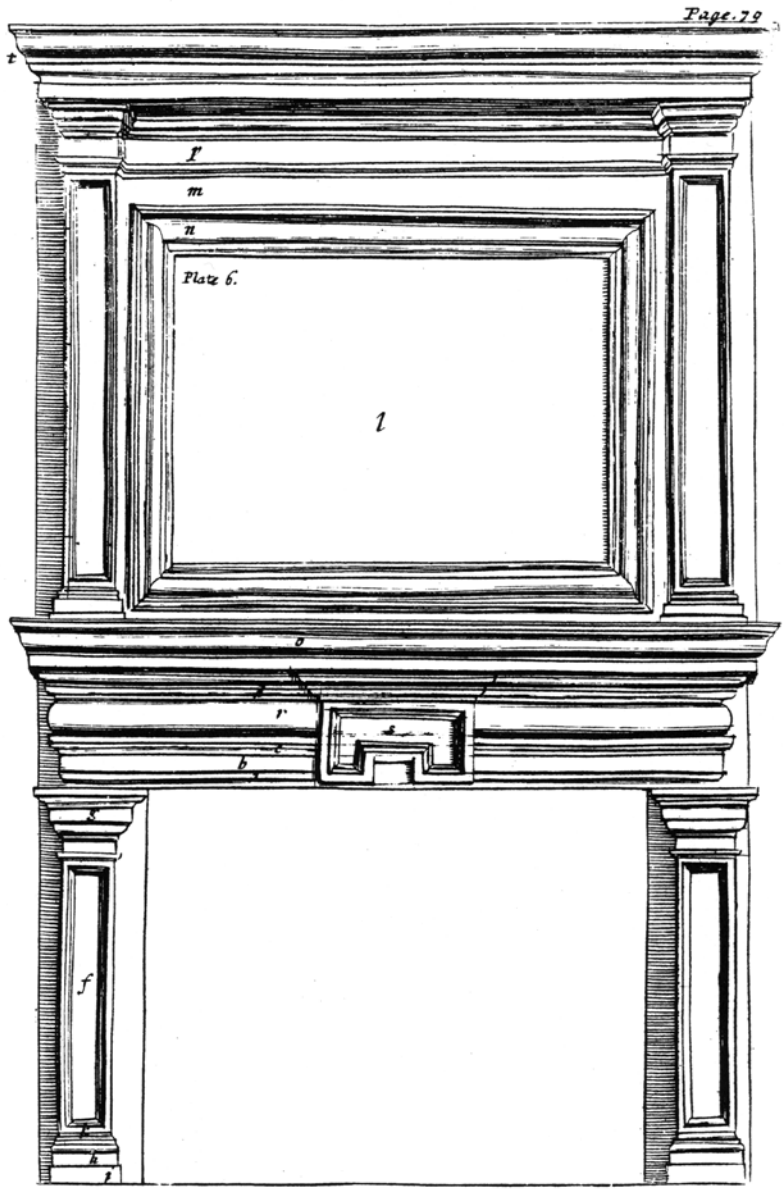
Fence. See S 8. use of the plow, and Plate 4. fig. B. 6.

Fine Set. The irons of the planes are set fine or rank. They are set fine when they stand so shallow below the sole of the plane, that in working they take off a thin shaving. See S.3.

Flat Frieze. See Plate 6. p.

Fore Plane. See S.2. And Plate 4. B 1.

Former. See S.10 [Of chisels; there are two S.10s]. And Plate 4. C 1. C 3.



FANCY MOULDING. Many of the parts of this ornate mantle are dealt with in the glossary instead of the text, which is why we chose to print this plate at the end.

Frame. See [S.17].

Frame Saw. See S.28 [and S.29]. And Plate 4. O.

Free-stuff. See S.3.

Frieze. See Plate 6. p.

Frieze Panel. See Plate 7. L.

Frieze Rail. See Plate 7. F.

Frowy Stuff. See S.3.

G.

Gauge. See S.21. And plate 4. G.

Gimlet. See S.23. And Plate 4. I.

Gouge. See S.14. [And Plate 4] C 6.

Groove. See [S.8].

H.

Hammer Hard. See Numb. I. page 58

Handle. See S.15. And Plate 4. D a.

Hard Stuff. See S.3.

Hatchet. See S.25. Plate 4. L.

Head. See S.22. Plate 4. H a.

Holdfast. See S 1. Plate 4. H d.

Hook. See S.1. Plate 4. A b.

Husk. See Plate 6. n.

I.

Inner Square. See S.15. And Plate 4. D d.

Iron. See S.2. And Plate 4. B I d.

J.

Joint. See [S.17].

Jointer. See S.4. And Plate 4. B 2.

K.

Kerf. The sawn-away slit between two pieces of stuff is called a kerf. See [S.26].

Knob. See S.36. And Plate 5. fig. 7. N.

Knot. See Plate 6. o. [an error, perhaps. See S.3 instead]

L.

Large Panel. See Plate 7. K.

Lying Panel. See Plate 7. I.

Lower Rail. See Plate 7. H.

M.

Margent. See Plate 7. at A A A the flat breadth of the stiles besides the mouldings is called the margent of the stiles.

Middle Rail. See Plate 7. E E.

Miter. See [S.18].

Miter Box. See S.20. And Plate 5. fig. [2].

Miter Square. See S.18. And Plate 4. [probably R].

Mouldings. The several wrought-work made with planes on wood is called mouldings. See Plate 6.

Moulding Planes. See S.9.

Mortise. Is a square hole cut in a piece of stuff to entertain a tenon fit to it. See S.17.

Mortise Chisel. See S.13. And Plate 4. C 5.

Mouth. See S.2. B 7. [b] The mouth.

O.

Ogee. See Plate 6. c.

Oval. See S.21. And Plate 4. G. b.

Outer Square. See S.15. And Plate 4. D c.

P.

Pad. See S.22. And Plate 4. H b.

Panel. In Plate 7. I K L are panels, but distinguished by their positions.

Pare. The smooth cutting with the paring chisel is called paring.

Paring chisel. See S 11. And Plate 4. C 2.

Plaister. See Plate 6. f.

Pit Man. The sawyer that works in the pit is called the pit man.

Pit Saw. The pit saw is a great saw fitted into a square frame; as in Plate 4. M is a pit saw.

Planchier. In Plate 6. between d and e is the Planchier.

Plinth. See Plate 6. [And Plate 7]

Plow. See S.8. And Plate 4. B 6.

Pricker. Is vulgarly called an awl. Yet for joiners use it has most commonly a square blade which enters the wood better than a round blade will because the square angle in turning it about breaks the grain, and so the wood is in less danger of splitting.

R.

Rabbet. See S.7.

Rabbet Plane. See S.7. And Plate 4. B 5.

Rack. See Plate 5. fig. 8. Read S.36.

Rail. See Plate 7. A A A [Actually, those are the stiles. See G F E C].

Rank. The iron of the plane is said to be set rank when its edge stands so far below the sole of the plane that in working it will take off a thick shaving. See S.3.

Rank Set. See Rank.

Range. The side of any work that runs straight without breaking into angles is said to run range. Thus the rails and panels of one straight side of wainscoting is said to run range.

Return. The side that falls away from the fore-side of any straight or rank-work is called the return.

Riglet. Is a flat, thin [and] square piece of wood [the workpiece before moulding it with the waving engine]. Thus the pieces that are intended to make the frames for small pictures and the like before they are moulded are called riglets. [Note: Moxon also spells this word "reglet."]

S.

Saw Wrest. See S.26. And Plate 4. [Q].

Scantlin. The size that your stuff is intended to be cut to.

Scribe. When joiners are to fit a side of a piece of stuff against the side of some other piece of stuff, and the side of the piece of stuff they are to fit to is not regular. To make these two pieces of stuff join close together all the way, they scribe it [as they phrase it] thus: They lay the piece of stuff they intend to scribe close against the other piece of stuff they intend to scribe to and open their compasses to the widest distance, These two pieces of stuff bear off each other. Then {the compasses moving stiff in their joint} they bear the point of one of the shanks against the side they intend to scribe to, and with the point of the other shank they draw a line upon the stuff to be scribed. And then the points of the compasses remaining unremoved, and your hand carried even along by the side of the piece to be scribed to, that line scribed upon the piece intended to be scribed shall be parallel to the irregular side intended to be scribed to. And if you work away your stuff exactly to that line, when these two pieces are put together, they shall seem a join.

Shoot a Joint. See page 63.

Skew Former. See S.12. And Plate 4. C 4.

Smoothing Plane. See S.6. And Plate 4. B 4.

Sole. See Plate 4. B 7. b a b The underside of a plane is called the sole.

Square. See S.15. And Plate 4. D.

Staff. See S.21. And Plate 4. G c.

Staves. See S.8. And Plate 4. B 6. a a.

Stile. The upright pieces AAA in Pl[ate] 7. are stiles.

Stock. See S.22. And Plate 4. H c.

Stops. In Plate 6. K k are stops.

Stuff. The wood that joiners work upon they call in general stuff.

Sur-base. In Plate 7. D is the Sur-base [upper base].

Swelling Frieze. In Plate 6. r is the swelling-frieze.

T.

Table. In Plate 6. f is the table.

Taper. All sorts of stuff or work that is smaller at one end than at the other and diminishes gradually from the biggest end, is said to be taper[ed].

Tenon. Is a square end fitted into a mortise. See S.17.

Tenon Saw. In Plate 4. O. would be a tenon saw were the flat of the blade turned where the edge there stands.

Tongue. See S.16. And Plate 4. D b.

Tooth. See S.21. and Plate 4. G a.

Top Man. Of the two sawyers, the uppermost is called the top man.

Tote. See S.2 and Plate 4. B I a.

Traverse. See [S.3].

Truffel. See [S.27]. And Plate 5. Fig. 3. [Actually, Moxon probably means O]

Try. See S.[16].

U.-V.

Vaws-Cornice. See Plate 6. e. [perhaps a middle or lower cornice]

Upper Cornice. See Plate 6. t.

W.

Warp. The same that cast is.

Waving Engine. See S.36. And Plate 5.

Wedge. See S.2. And Plate 4. B 1. C. [And S.2]

Whetting Block. See Plate 4. P.

Whip Saw. See Plate 4. N.

Wrest. See S.26. And Plate 4. Q.

Thus much of joinery. The next Exercises will be of carpentry.

Analysis

Moxon started this section with superscripts to indicate they were tied to a glossary at the back. Then he quickly abandoned the notion and decided to offer a straight glossary without the notations. Below I've dealt with some of the glossary words that might require even further explanation.

Clamp. It's not what you think. Moxon is referring to a breadboard end here that is fastened to a tabletop to keep it flat.

Cross-grained Stuff vs. Curling stuff: Both situations are when the regular grain is interrupted by a branch. Cross-grained stuff can be a small path of difficult end grain in a board, or it can be a knot. Curling stuff could be interpreted as what we know as "curly," such as curly maple, but Moxon appears to be saying it's more of a series of grain reversals in a board that is wider ranging than in simple cross-grained stuff.

Free-stuff: Easily planed or worked wood.

Frowy stuff: Soft and brittle wood; perhaps what we would call punky.

Inner Square: The part of the try square that uses the inside of the handle and tongue to determine square.

Margent: Literally, the margins of a piece. It might be easier for you to think of it as the measurement of a piece from one long edge to another – the "width" of a piece in modern terms.

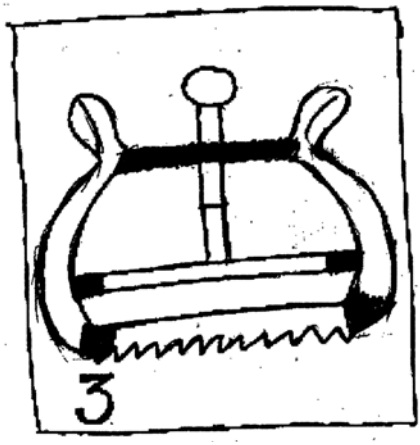
Plaister: This panel section is called out as a plaister (an early word for plaster). It could be f, it could s – see "Table" below.

Planchier: Probably the modern "plancher," the underside of a cornice, or a soffit. Its exact location in the plate is left unclear by Moxon's lettering, however it should be the horizontal piece above p.

Pricker: I wonder if the bulbous unlettered tool at the bottom of plate 5 is Moxon's pricker.

Table: The item lettered f is called out as both a "plaister" and a "table." As it is difficult to tell the difference between the two characters, the item labeled s might be the table or the plaister.

Tenon saw: More confusion here. Moxon says the saw he is calling out as a tenon saw isn't a tenon saw because the blade needs to be turned around. Never mind it is also missing a back he refers to earlier to become what we moderns would consider a "backsaw."



HOLME'S BOWSAW. According to Randle Holme, the above tool is a called a "Frame Saw," a "Framing Saw," a "Bow Saw" or a "Tenant Saw." So, bottom line, it's unclear as to when the backsaw entered the English workshop.

The Plates

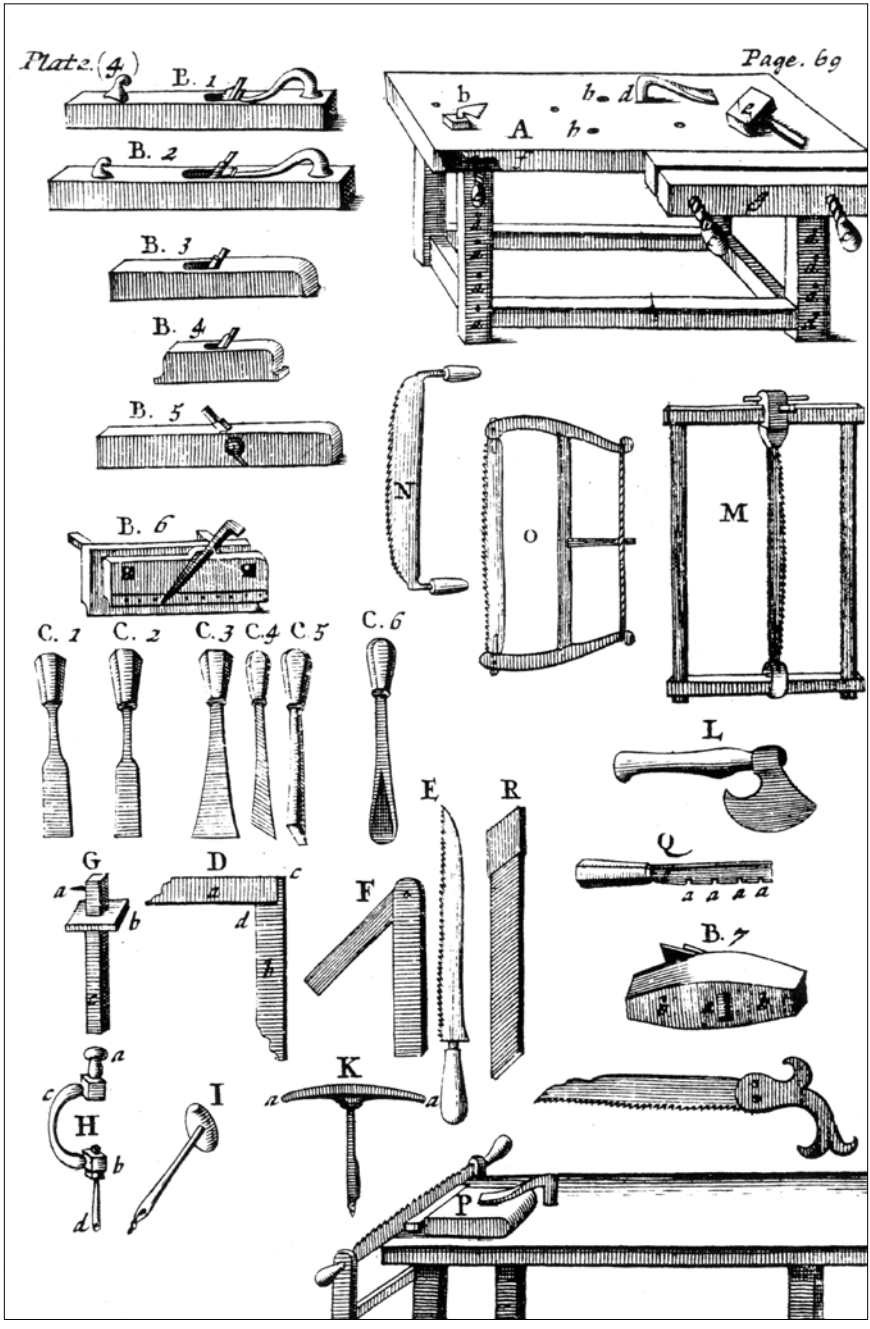


Plate. (4)
Page. 69
B. 1
B. 2
B. 3
B. 4
B. 5
B. 6
A
b
b d
N
O
M
C. 1
C. 2
C. 3
C. 4
C. 5
C. 6
L
E
R
Q
G
D
F
B. 7
a
b
c
d
H
I
K
P

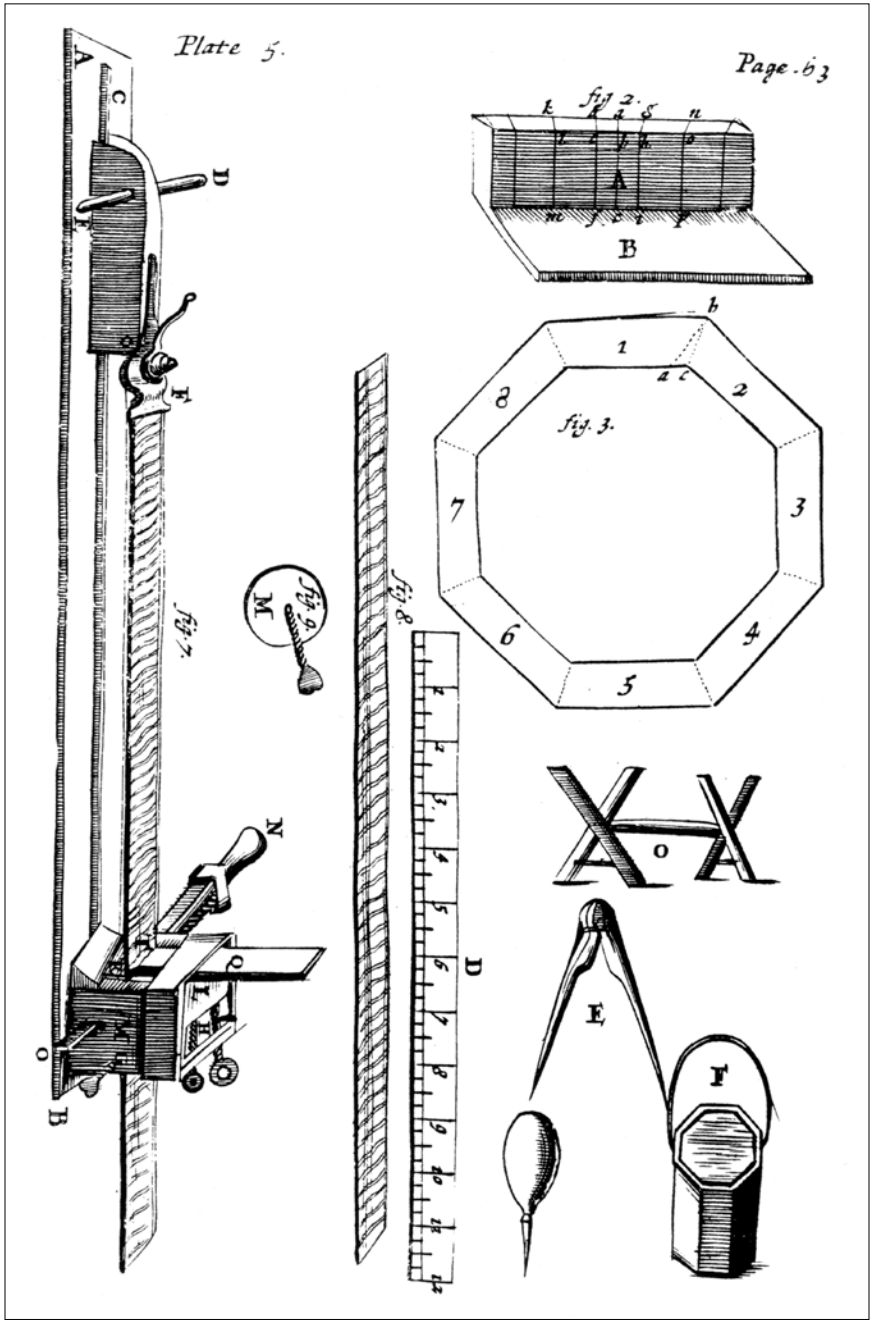
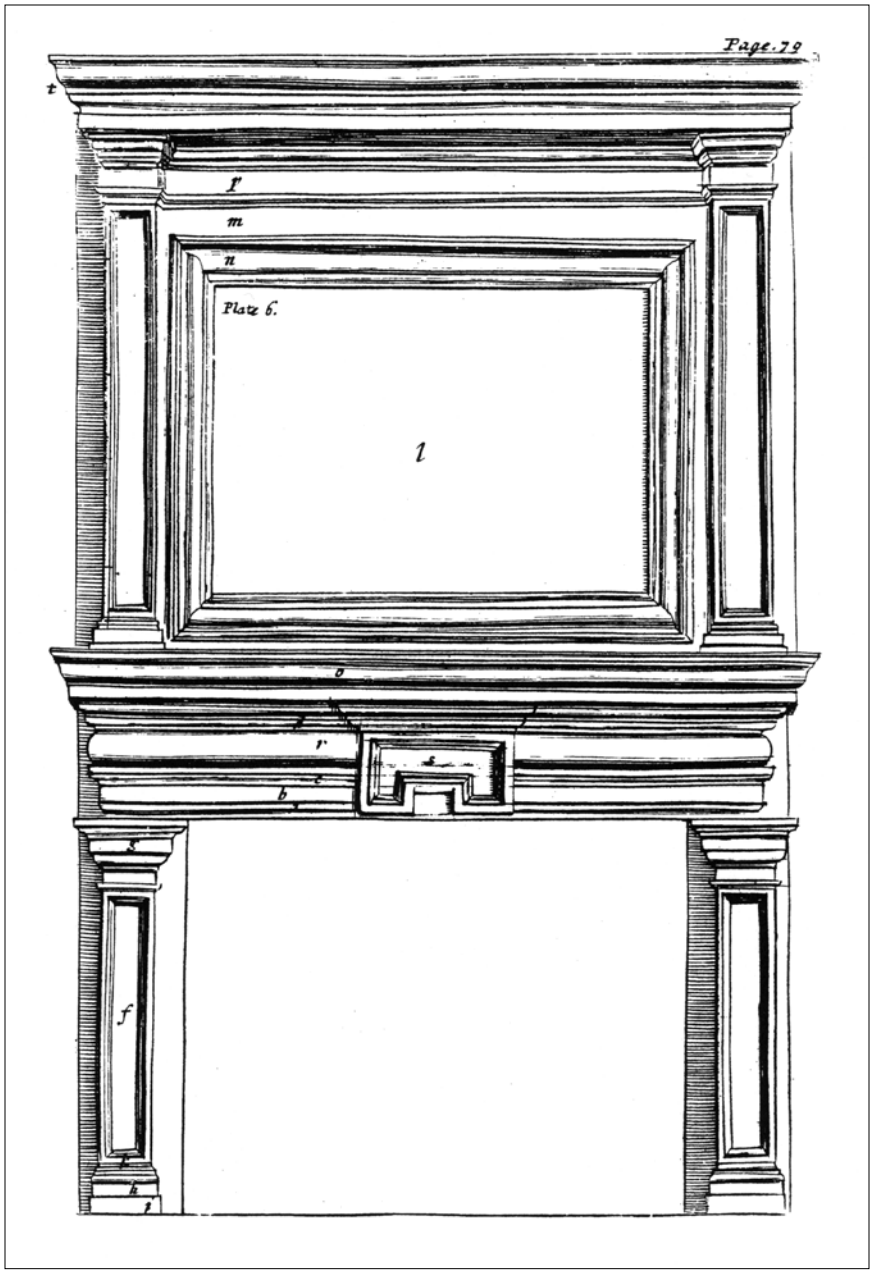
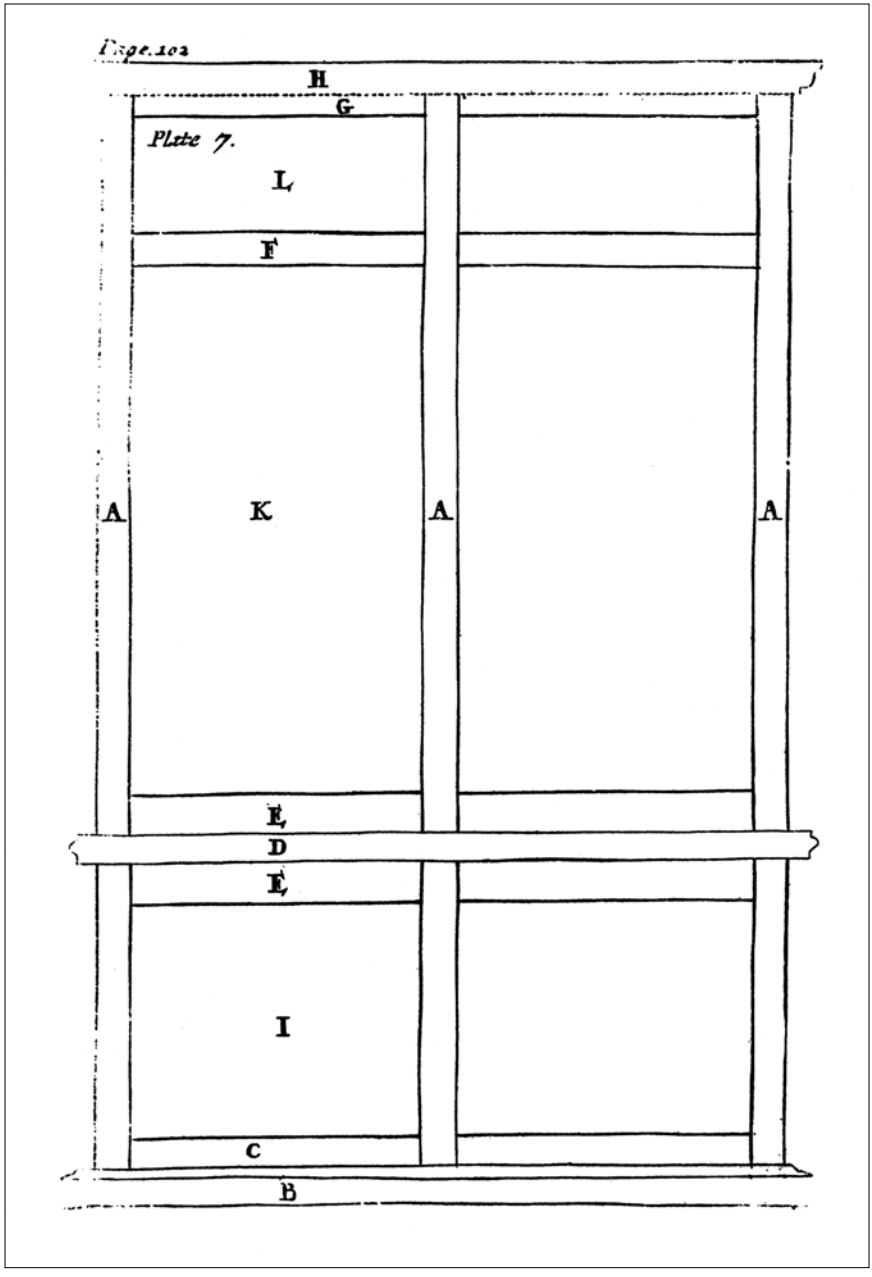


Plate 5.
Page. 63
fig 2.
fig. 3.
fig. 7.
fig. 8.
fig. 9.
A
B
C
D
E
F
M
N
O


Page. 79
t
f
m
n
Plate 6.
1
o
r
b
f


Page. 102
H
G
Plate 7.
L
F
A
K
A
A
E
D
E
I
C
B

MECHANICK EXERCISES;
OR,
The Doctrine of *Handy-Works*

The Art of JOINERY.

Definition.

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

Explanation.

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

By *Squares*, I mean the making of Frames, with for Door-caſes or ſuch like which is the Framing of two pieces of Wood athwart two other pieces of Wood, ſo as the four Angles of the Frame may comply with the *Square* marked D.

By *Miters* are meant the joining of two pieces of Wood, ſo as the Joint makes half a Square, and does comply with the *Miter-ſquare* marked E.

By a *Bevel* is meant any other Angle: As Frames that may be made of *Pentagon, Hexagon, Octagon* &c. Figures.

ss 1. *The Names of Joyners Tools deſcrib'd in Plate IV.*

A. A Work-bench. *b.* The Hook in it, to lay Boards or other Stuff flat againſt, whilſt they are Trying or Plaining. c. The Bench-Screw {on its hither ſide} to Screw Boards, in whiſlt the Edges of them are Plaining or Shooting; and then the other edge of the Board is ſet upon a Pin or Pins {if the Board be ſo long as to reach the other Leg} put into the Holes marked a a a a down the Legs of the Bench; which Pin or Pins may be removed into the higher or lower holes, as the breadth of the Board ſhall require: ſo then, the Bench —Screw keeps the Board cloſe to the edge of the Bench, and the Pins in the Leg keep it to its height, that it may ſtand ſteddy whilſt the other edge is working upon: For in the Shooting of a Joint, if the Board keep not its exact poſition, but ſhakes or trembles under the Plain, your Joint will very hardly be truly Straight. d. The Hold-faſt, let pretty looſe into round holes marked b b b b b b, in the Bench: Its Office is to keep the Work faſt upon the Bench, whilſt you either Saw, Tennant, Morteſs, or ſometimes *Plain* upon it, & c. It performs this Office with the knockt of an *Hammer*, or *Mallet*, upon the *head* of it; for the *Beak* of it being made crooked downwards, the end of the *Beak* falling upon the flat of the *Bench*, keeps the *head* of the *Hold-faſt* above the flat of the Bench, and the hole in the *Bench* the *Shank* is let into being bored ſtraight down, and wide enough to let the *Hold-faſt* play, the head of the *Hold-faſt* being knockt, the point of the *Beak* throws the *Shank* a-ſlope in the hole in the *Bench*, and preſſes its back-ſide hard againſt the edge of the *hole* on the upper Superficies of the *Bench*, and its fore-ſide hard againſt the opposite side of the under Super-ſufices of the *Bench*, and ſo by the point of the *Beak*, the *Shank* of the *Hold-faſt* is wedged between the upper edge, and its opperſite edge of the round hole in the *Bench*. Sometimes a double *Screw* is fixed to the ſide of the *Bench*, as at g; or sometime its farther *Cheek* is laid an edge upon the flat of the *Bench* and faſtned with an *Hold-faſt*, or, sometimes, two on the *Bench*. e A *Mallet*.

Ss 2. BBBBBBB *Plains* of ſeveral Sorts: as,

B1. A *Fore Plain*, *a* The *Tote*. *b* The *Mouth*. *c* The *Wedge*. *d* The *Iron*. *e* The

Sole. f The *Fore-end g* The *Britch. f g h* The *Stock*. All together *A Plane*. It is called the *Fore Plane* becauſe it is uſed before you come to work either with the *Smooth Plane*, or with the *Joynter*. The edge of its *Iron* is not ground upon the ſtraight, as the *Smooth Plane*, and the *Joynter* are, but riſes with a *Convex-Arch* in the middle of it; for its Office being to prepare the Stuff for either the *Smoothing Plane*, or the *Joynter*, Workmen ſet the edge of it [e] *Ranker* than the edge either of the *Smoothing Plane*, or the *Joynter*; and ſhould the *Iron* of the *Plane* be ground to a ſtraight edge, and it be ſet never ſo little *Ranker* on one end of the edge than on the other, the *Ranker* end would {bearing as then upon a point} in working, dig Gutters on the Surface of the *Stuff*; but this *Iron* {being ground to a Convex-Arch} though it ſhould be ſet a *little* Ranker on one end of its edge than on the other, would not make Gutters on the Surface of the *Stuff*, {but at the moſt} little hollow dawks on the *Stuff*, and that more or leſs, according as the *Plane* is ground more or leſs Arching. Nor is it the Office of this *Plane* to ſmooth the *Stuff*, but only {as I ſaid} to prepare it, that is, to take off the irregular Riſings, whether on the ſides, or in the middle, and therefore it is ſet ſomewhat Ranker, that it may take the Irregularities the ſooner off the *Stuff*, that the *Smoothing Plane*, or the *Joynter*, may afterwards the eaſier work it *Try*. The manner of *Trying* ſhall be taught, when I come to Treat of the uſe of the Rule.

You muſt note, that as I told yon in *Smithing*, *Num*. I. *fol*. 14, 15, 16. it was the Office of the *courſe tooth'd File* to take off the prominent Irregularities the *Hammer* made in the *Forging*, &c. and that you were not to *file* them more away than you need, ſo the ſame Caution is to be given you in the uſing of this *fore Plane* in *Joynery*, for the reaſon there alledged in *Smithing*, whether, to avoid Repetition, I refer you; only with this Conſideration, that there *Iron*, or *Steel*, was the matter wrought upon, and there a *courſe File* the *Tool*; but now *Wood* is the matter, and a *Courſe*, or *Fore-Plane*, the *Tool*.

S. 3 Of *ſetting* the *Iron*.

When you *ſet* the Iron of the *Fore-Plane*, conſider the *Stuff* you are to work upon, *viz*. Whether it be *hard* or *ſoft*, or *Curling*, as *Joyners* call *Croſs*

grain'd Stuff: If it be *hard* or *curling*, you muſt not *ſet* the *Iron* veay *rank*, becauſe a Man's ſtrength will not cut deep into hard *Wood*; and if it be not hard *Wood*, but *curling*, or *knotty*, and the *Iron Rank-ſet*, you may indeed work with it till you come to ſome *Knot*, or *Curl*, but then you may either tear your *Stuff*, or break the edge of your *Iron*; therefore you may perceive a reaſon to *ſet* the *Iron* fine for *curling*, and *knotty Stuff*.

But if you ask me how *rank* your *Iron* ought to be ſet? I anſwer, If your Wood be *ſoft*, and your *Stuff free*, and *frowy*, that is, evenly temper'd all the way, you may *ſet* the *Iron* to take a ſhaving off the thickneſs of an old coined Shilling, but ſcarce thicker; whereas, if your *Stuff* be *hard*, or *curling*, or *knotty*, you ſhall ſcarce be able to take a ſhaving off the thickneſs of an old Groat. Therefore you muſt examine the Temper of your *Stuff*, by eaſy Trials, how the *Plane* will work upon it, and ſet your *Iron* accordingly. And obſerve this as a General Rule, that the *Iron* of the *Fore-Plane* is, for the firſt working with it, to be *ſet* as *rank* as you can make good work with; and that for ſpeed ſake.

If your *Iron* be ſet too *rank*, knock with an *Hammer* upon the *Britch* of the *Stock*, and afterwards upon the *Wedge*; for this knocking upon the *Britch*, if you knock hard enough, 'twill raiſe the *Iron* a little, and *ſet* it *fine*; if you knock not hard enough, you muſt knock again, till the *Iron* do riſe; but if you knock too hard, it will raiſe the *Iron* ſo much, that its edge will riſe above the *Sole* into the *Mouth* of the *Stock*, and conſequently not touch the *Stuff*: Therefore you muſt knock ſoftly at firſt, till, by trials, you find the *Iron* riſes to a convenient fineneſs. But as this knocking on the *Britch* raiſes the *Iron*, ſo it alſo raiſes and looſens the *Wedge*; therefore {as aforeſaid} whenever you knock upon the *Britch*, you muſt alſo knock upon the *Wedge*, to ſoften the Iron again.

If you have raiſed the edge of the *Iron* too fine, you muſt knock ſoftly upon the head of the *Iron*, and then again upon the *Wedge*, and this you may ſometimes do ſeveral times, till you fit your *Iron* to a convenient fineniſs.

When you have occaſion to take your *Iron* out of the *Stock* to *rub* it, that is, to whet it, you may knock pretty ſmart Blows upon the

Stock, between the *Mouth* and the *Fore-end*, to looſen the *Wedge*, and conſequently the Iron.

Theſe ways of ſetting, are uſed to all other *Planes*, as well as *Fore-planes*.

In the uſing of this, and indeed, all other *Planes*, you muſt begin at the hinder end of the *Stuff*, the Grain of the Wood lying along the length of the *Bench*, and Plane forward, till you come to the fore-end, unleſs the *Stuff* proved *Croſs-grain'd*, in any part of its length; for then you muſt turn your *Stuff* to Plane it the contrary way, ſo far as it runs *Croſs-grain'd*, and in *Planeing*, you muſt, at once, lean pretty hard upon the *Plane*, and alſo thruſt it very hard forwards, not letting the *Plane* totter to, or from you-wards, till you have made a Stroak the whole length of the *Stuff*. And this foretimes, if your *Stuff* be long, will require your making two or three ſteps forwards, e er you come to the fore-end of the *Stuff*: But if it do, you muſt come back, and begin again at the farther end, by the ſide of the laſt plan'd Stroak, and ſo continue your ſeveral lays of Planeing, till the whole upſide of the *Stuff* be planed.

And if the *Stuff* be broad you are to Plane up-on, and it *warp* a little with the *Grain*, or be any ways crooked in the breadth, you muſt then turn the *Grain* athwart the *Work-bench*, and Plane upon the *Croſs-grain*. For, if your work be hollow in the middle, you muſt Plane both the Bearing ſides thinner, till they come to a *Try* with the middle. Then turn the other ſide of your work, and working ſtill *Croſs-grain'd*, work away the middle, till it come *Try* with the two ſides.

This way of *Croſs-grain'd* working, is, by Workmen, called *Traverſing*.

Thus have you, in general, the uſe of all the other *Planes*: But the uſe of thoſe Planes, that are deſigned for other particular purpoſes, I ſhall ſhew, as they come in Order.

S. 4. Of the *Joynter*. B. 2.

The *Joynter* is made ſomewhat longer than the *Fore-plane*, and hath its *Sole* perfectly ſtraight from end to end. Its Office is to follow the *Fore-plane*, and to *ſhoot* an edge perfectly *ſtraight*, and not only an edge, but alſo a Board of any thickneſs; eſpecially when a *Joynt* is to be ſhot. Therefore

the Hand muſt be carried along the whole length, with an equal bearing weight, and ſo exactly even, and upright to the edges of the Board, that neither ſide of the *Plane* encline either inward or outwards, but that the whole breadth be exactly ſquare on both its ſides; ſuppoſing its ſides ſtraight: ſo will two edges of two Boards, when thus *ſhot*, lie ſo exactly flat and ſquare upon one another, that light will not be diſcerned betwixt them. But yet it is counted a piece of good Workmanſhip in a *Joyner*, to have the Craft of bearing his Hand ſo curiouſly even, the whole length of a long Board; and yet it is but a ſleight to thoſe, Practice hath inur'd the Hand to. The *Joynter* is alſo uſed to *Try* Tables with, {large or ſmall} or other ſuch broad Work; and then *Joyners* work, as well upon the *Traverſe* with it, as with the Grain of the Wood, and alſo Angularly, or Cornerwiſe, that they may be the more aſſur'd of the flatneſs of their Work.

Its *Iron* muſt be *ſet* very *fine*, ſo fine, that when you wink with one Eye, and ſet that end the ſtraight ſide of the *Iron* is next to the other Eye, there appears a little above an hairs breadth of the edge above the Superficies of the *ſole* of the *Plane*, and the length of the edge muſt lie perfectly ſtraight with the flat breadth of the *ſole* of the *Plane*: For the *Iron* being then well wedg'd up, and you working with the *Plane* thus *ſet*, have the greater aſſurance that the *Iron* cannot run too deep into the *Stuff*, and conſequently you have the leſs danger that the *Joynt* is wrought out of ſtraight.

S. 5. The Uſe of the *Strike-block*.

The *Strike-block* marked B 3. is a *Plane* ſhorter than the *Joynter*, having its *ſole* made exactly flat, and ſtraight, and is uſed for the *ſhooting* of a ſhort *Joynt*; becauſe it is more handy than the long *Joynter*. It is alſo uſed for the framing, and fitting the Joynts of *Miters* and *Bevels*; but then it is uſed in a different manner from other *Planes*: For if the *Miter* and *Bevel* you are to fit be ſmall, you muſt hold it very ſteddy in your left hand, with the *ſole* of it upwards, and its fore-end towards your right hand: and you muſt hold your work in your right hand very ſteddy: Then apply the ſawn *Miter*, or ſawn *Bevel* at the end of your *Stuff*, to the fore-end of the *Strike-block*, and ſo thruſt it hard and upright forwards, till it paſs over the edge of the

Iron, ſo ſhall the edge of the *Iron*, with ſeveral of theſe thruſts continued, cut, or plane off your *ſtuff* the roughneſs that the *Teeth* of your Saw made: But if your work be so big that you cannot well weild it in your right hand, you muſt ſet the end of your work in the *Bench-ſcrew*, and Plane upon it with a *ſmoothing Plane*.

S. 6. *The Uſe of the* Smoothing-Plane.

The *Smoothing-plane* marked B 4. muſt have its *Iron ſet* very *fine*, becauſe its Office is to ſmoothen the work from thoſe Irregularities the *Fore-plane* made.

S. 7. *The Uſe of the* Rabbet-Plane.

The *Rabbet-plane* marked B 5. is to cut part of the upper edge of a Board, or other *Stuff*, ſtraight, that is, ſquare down into the Board, that the edge of another Board alſo cut down in the ſame manner, may fit and join into the Square of the firſt Board thus cut way: And when two Boards are thus *lapped* on the edges over one another; this *lapping* over is called *Rabbetting*.

The *Rabbet-plane* is alſo ſometimes uſed to ſtrike a *Facia* in a piece of *Molding*; as ſhall be ſhewed in its proper place.

The ſides of the *Iron* are not incloſed in the *Stock* of this *Plane*, as the fore-going *Planes* are, but the *Iron* is full as broad as the *ſtock* is thick, that the very Angles of the edge of the *Iron* may not be born off the *Stuff*, to hinder the ſtraight and ſquare cutting it down: Nor doth it deliver its ſhaving at a *Mouth* on the top of the *Stock* as the other *Planes* do: But it hath its *Mouth* on the ſides of the *Plane*, and delivers its ſhavings there. Its *Iron* is commonly about an Inch broad.

S. 8. *The Uſe of the* Plow.

The Plow marked B 6. is a narrow *Rabbet-plane*, with ſome Additions to it: *viz*. two ſquare *Staves*, marked *a a* {yet ſome of them have the upper edges of them rounded off for the better compliance with the Hand.} Theſe *Staves* are let ſtiff through two ſquare Morteſſes in the *Stock*, marked *b b*. They are about ſeven or eight Inches long, and ſtand ſtraight and ſquare

on the farther ſide of the *Stock*; and theſe two *Staves* have ſhoulders on the hither ſide of the *Stock*, reaching down to the wooden *ſole* of the *Plane*, {for there is alſo an *Iron ſole* belonging to the *Plow*.} To the bottom of theſe two Shoulders is, Rivitted with Iron Rivets, a *Fence* {as Workmen call it} which comes cloſe under the *Wooden ſole*, and its depth reaches below the *Iron ſole* about half an Inch: Becauſe the *Iron* of the Plow is very narrow, and the ſides of it towards the bottom are not to be incloſed in the *Stock*, for the ſame reaſon that was given in the *Rabbet-plane*; therefore upon the *ſtock* is let in, and ſtrongly nailed, an Iron Plate of the thickneſs of the Plow-Iron, for Wood of that breadth will not be ſtrong enough to endure the force the lower end of the Plow-Iron is put to: This Iron-Plate is almoſt of the ſame thickneſs that the breadth of a Plow-Iron is. Joyners have ſeveral *Plows*, for ſeveral widths of *Grooves*.

The Office of the *Plow* is, to plow a narrow ſquare *Groove* on the edge of a Board; which is thus perform'd. The Board is ſet an edge with one end in the *Bench-ſcrew*, and its other edge upon a Pin, or Pins, put into a Hole, or Holes in the Leg, or Legs of the Bench, ſuch an Hole, or Holes, as will, moſt conveniently for height, fit the breadth of the Board: Then the *Fence* of the *Plow* is ſet to that Diſtance off the Iron-Plate of the *Plow*, that you intend the *Groove* ſhall lie off the edge of the Board: As if you would have the *Groove* lie half an Inch off the Board, then the two *ſtaves* muſt, with the *Mallet*, be knocked through the Morteſſes in the *Stock*, till the *Fence* ſtands half an Inch off the Iron-Plate; and if the *Staves* are fitted ſtiff enough in the Morteſs of the *Stock*, it will keep at that Diſtance whilſt you Plow the *Groove*: For the *Fence* {lying lower than the *Iron* of the *Plane*} when you ſet the *Iron* of the *Plow* upon the edge of the Board, will lie flat againſt the farther edge of the Board, and ſo keep the *Iron* of the *Plow* all the length of the Board at the ſame Diſtance, from the edge of the Board that the *Iron* of the *Plow* hath from the *Fence*. Therefore your *Plow* being thus fitted, plow the *Groove* as you work with other *Planes*, only as you laid hold on the *Stock* of other *Planes* when you uſe them, now you muſt lay hold of the two *ſtaves* and their *ſhoulders*, and ſo thruſt your Plow forwards, till your Groove be made to yonr depth.

If the *Staves* go not ſtiff enough in the Morteſs of the Stock, you muſt ſtiffen them, by knocking a little wooden Wedge between the Staves and their Morteſſes.

S. 9. *Of* Molding-Planes.

There are ſeveral other Planes in uſe amongſt Joyners, called *Molding-planes*; as, the *Round*, the *Hollow*, the *Ogee*, the *Snipes-bill*, the *Rabbet-plane*, the *Grooving-plane*, &c. And of theſe they have ſeveral ſorts, *viz.* from half a quarter of an Inch, to an Inch and a half. They are uſed as other *Planes* are. In the Planeing of Stuff, you muſt uſe *Planes* whoſe *Irons* have different Mountings; and that according to the hardneſs, or ſoftneſs of the Wood, you are to work upon: For if the Wood be hard, the *Iron* muſt ſtand more upright than it need do, if the Wood be ſoft: For ſoft Wood, as *Deal*, *Pear-tree*, *Maple*, &c, The *Iron* is ſet to make an Angle of 45 Degrees, with the *Sole* of the *Plane*: But if it be very hard Wood you are to Plane upon, as *Box*, *Ebony*, *Lignum Vitae*, &c. It is ſet to 80 Degrees, and ſometimes quite upright: ſo that theſe hard Woods, are, indeed, more properly ſaid to be Scraped, than Planed.

But before you come to uſe your *Planes*, you muſt know how to grind, and whet them, for they are not ſo fitted when they are bought, but every Workman accommodates them to this purpoſe, as if it be an hard Wood he is to work on, he grinds his *Baſil* to a more obtuſe Angle, than he would do for ſoft Wood.

The *Baſil*, or Angle, and Iron is ground to, to work on ſoft Wood is about 12 Degrees, and for hard Wood about 18, or 20 Degrees. Where note, That the more acute, or thinner the *Baſil* is, the better and ſmoother the *Iron* cuts; and the more obtuſe and thicker, the ſtronger the Edge is to work upon hard Work.

S. 10. *Of Grinding and Whetting the Iron, and other* Edge-Tools.

When you grind your *Iron*, place your two Thumbs under the *Iron*, and your Fingers of both Hands upon the *Iron*, and ſo clap down your Iron to the Stone, holding it to that Angle with the Stone you intend the *Baſil* ſhall have: Keep the *Iron* in this Poſture, without either mounting, or

ſinking its ends all the while the *Stone* is turning about; and when you lift the *Iron* off the *Stone*, too ſee if it be ground to your Mind; if it be not, you muſt be ſure you place the *Iron* again in the ſame Poſition on the *Stone* it had before; for elſe you will make a double *Baſil* on your *Iron*: But if it be true ſet on the *Stone*, and ſteddily kept to that Poſition, your *Baſil* will be *Hollow*, and the ſmaller your *Grind-ſtone* is, the hollower it will be. You may know when it is well Ground, by the evenneſs, and entireneſs of the Edge all the way.

Having ground your *Iron*, you muſt ſmoothen the edge finer with a good *Whet-ſtone*. Thus, hold the edge of your *Iron* upwards in your left Hand, and your *Whet-ſtone* in your right, and having firſt ſpit upon your Stone to wet it, apply it to the *Baſil* of your *Iron*, in ſuch a Poſition, that it may bear upon the whole breadth of the *Baſil*; and ſo working the *Stone* over the *Baſil*, you will quickly wear the courſer grating of the *Grind-ſtone* off the edge on that ſide: Then turn the flat ſide of the *Iron*, and apply the *Stone* flat to it, till you have worn off the courſe gratings of the *Grind-ſtone*, on that ſide too.

Joiners often grind their *Irons* upon a flat *Grind-ſtone* alſo: And then they hold the *Iron* alſo in their Hands, in the ſame Poſture as if it were to be ground on the *Round Grind-ſtone*: Yet then inſtead of keeping the *Iron* on one place of the *Stone*, they thruſt it hard ſtraight forwards, almoſt the length of the *Stone*, and draw it lightlier ſtraight back again, keeping it all the while at the ſame Angle with the Superficies of the *Stone*; and then ſmoothen its edge with the *Whet-ſtone*, as if it had been ground upon the round *Grind-ſtone*. And this they do ſo often, till they have rubbed the hollowneſs of the *Baſil* to a flat, and then they grind it again upon the round *Grind-ſtone*.

This Order and Manner of *Setting*, *Grinding* and *Smoothing* a *Baſil* and *Edge*, is alſo uſed in all other *Edge-tools Joiners* uſe.

S. 10. *Of* Chiſſels *of ſeveral Sorts. And firſt of* Formers.

Formers marked C 1. C 3. are of ſeveral ſizes. They are called *Formers*, becauſe they are uſed before the *paring Chiſſel*, even as the *fore Plane* is uſed before the *ſmoothing Plane*. The *Stuff* you are to work upon being firſt

ſcribed, {as I ſhall ſhew in its proper place} you muſt ſet the edge of the *Former*, a little without the ſcribed Stroak with its *Baſil* outwards, that it may break, and ſhoulder off the Chips from your Work, as the Edge cuts it. And you muſt bear the *Helve* of the *Former* a little inwards over the *Stuff*, that the *Former* do not a firſt cut ſtraight down, but a little outwards: For, ſhould you venture to cut ſtraight down at the firſt, you might with a negligent, or unlucky knock with the *Mallet*, drive the edge of the *Former* under the work and ſo cut, before you are aware, more off the under ſide than the upper ſide of your Work, and ſo {perchance} ſpoil it. Therefore, you may make ſeveral Cuttings, to cut it ſtraight down by little and little, till your Work is made ready for the *paring Chiſſel*. When it is uſed, the *Helve* of it is knockt upon with a *Mallet*, to drive the edge into the *Stuff*.

S. 11. *Of the* Paring Chiſſel.

The *Paring-Chiſſel* marked C 2. muſt have a very fine and ſmooth edge: Its Office is to follow the *Former*, and to *pare* off, and *ſmoothen*, the Irregularities the *Former* made.

It is not knockt upon with the *Mallet*, but the Blade is claſped upon the out-ſide of the hindermoſt Joints of the fore and little Fingers, by the clutched inſide of the middle and third Fingers of the right Hand, and ſo its edge being ſet upon the *ſcribed line*, and the top of the *Helve* placed againſt the hollow of the inſide of the right ſhoulder, with preſſing the ſhoulder hard upon the *Helve*, the edge cuts and pares away the Irregularities.

This way of handling, may ſeem a Prepoſterous Poſture to manage an Iron Tool in, and yet the reaſon of the Original Contriver of this Poſture is to be approved; For, ſhould Workmen hold the *Blade* of the *Paring-Chiſſel* in their whole Hand, they muſt either hold their Hand pretty near the *Helve*, where they cannot well manage the Tool, or they muſt hold it pretty near the edge, where the outſide of the Fingers will hide the *ſcribed line* they are to pare in. But this Poſture, all Workmen are at firſt taught, and Practice doth ſo inure them to it, that if they would, they could not well leave it.

S. 12. *Of the* Skew-Former.

The *Skew-Former* marked C 4. is ſeldom uſed by Joiners, but for cleanſing acute Angles, with its acute Angle on its edge, where the Angles of other *Chiſſels* will not ſo well come.

S. 13. *Of the* Morteſs-Chiſſel.

The *Morteſs-Chiſſel* marked C 5. is a narrow *Chiſſel*, but hath its *Blade* much thicker, and conſequently ſtronger {that it may endure the heavier blows with the *Mallet*} than other *Chiſſels* have, ſo that in grinding it to an edge, it is ground to a very broad *Baſil* as you may ſee in the Figure. Its Office is to cut deep ſquare holes, called *Morteſſes*, in a piece of Wood. Joiners uſe them of ſeveral Breadths according as the Breadths of their *Morteſſes* may require.

S. 14. *Of the* Gouge.

The *Gouge* marked C 6. Is a *Chiſſel* having a round edge, for the cutting ſuch Wood as is to be Rounded, or Hollowed.

Theſe ſeveral ſorts of *Chiſſels* Joiners have of ſeveral Sizes, that they may be accommodated to do ſeveral Sizes of Work.

MECHANICK EXERCISES;
OR,
The Doctrine of *Handy-Works*

Continued in the Art of JOINERY.

S. 15. *Of the* Square, *and its Uſe.*

The *Square,* marked D, is two adjunct Sides of a Geometrical Square. *a* The *Handle. b* The *Tongue. c* The *Outer Square. d* The *Inner Square.* For Joiner's uſe, it is made of two pieces of Wood, the one about an Inch thick, and the other about a quarter of an Inch thick: Theſe two pieces are ſeverally ſhot exactly ſtraight, and have each of their Sides parallel to each of their own Sides. The thick Piece {called the Handle} hath a Morteſs in it, as long within a quarter of an Inch, as the thin piece {called the Tongue} is broad, and ſtifly ſo wide, as to contain the thickneſs of the Tongue. The Tongue is faſtned into the Morteſs of the Handle with Glew and wooden Pins, ſo as the two outer ſides {and then conſequently the two inner ſides} may ſtand at right Angles with one another.

The Reaſon why the Handle is ſo much thicker than the Tongue, is, becauſe the Handle ſhould on either ſide become a Fence to the Tongue. And the reaſon why the Tongue hath not its whole breadth let into the end of the Handle is, becauſe they may with leſs care ſtrike a line by the ſide of a thin than a thick piece: For if inſtead of holding the Hand upright when they ſtrike a Line, they ſhould hold it never ſo little inwards, the ſhank of a Pricker falling againſt the top edge of the Handle, would throw the Point of a Pricker farther out than a thin Piece would: To avoid which Inconvenience, the Tongue is left about half an Inch out of the end of the Handle.

Another Reaſon is, That if with often ſtriking the Pricker againſt the Tongue it becomes ragged, or uneven, they can with leſs trouble Plane it

again when the Stuff is all the way of an equal ſtrength, than they can, if Croſs-grain'd Shoulders be added to any part of it.

Its uſe is for the ſtriking of Lines ſquare either to other Lines, or to ſtraight ſides, and to try the ſquareneſs of their Work by; As if they would ſtrike a Line ſquare to a ſide they have already ſhot: They apply the inſide of the Handle cloſe to the ſide ſhot, and lay the Tongue flat upon the Work, than by the outerſide of the Tongue, they draw with a Pricker a ſtraight Line: This is called *Striking, or drawing of a Square.* Or, if they would Try the ſquareneſs of a Piece of Stuff ſhot on two adjoining ſides, they apply the inſides of the Handle and Tongue to the outſides of the Stuff, and if the outſides of the Stuff do all the way agree in Line with the inſides of the Square, it is true Square. Or if they would try the inward ſquarenſs of Work, they apply the two outſides of the Square to the inſides of the Work.

S. 16. *The manner of* Plaining *and* Trying *a piece of Stuff ſquare.* We will take, for Example, a Piece of Stuff called a Quarter, which is commonly two Inches thick, four Inches broad, and ſeven Foot long. To plane this Square, lay one of its broad Sides upon the Bench, with one of its ends ſhov'd pretty hard into the Teeth of the Bench-hook, that it may lie the ſteddier. Then with the Fore-Plane, as you were taught, S 2. *Numb.* 2. Plane off the roughneſs the Saw made at the Pit, and work that ſide of the Quarter as ſtraight in its length and breadth as you can with the Fore-Plane; which you may give a pretty good gueſs at, if the edge of the Iron have born all the way upon the Work, yet you may try by taking up your Work, and applying one end of it to one Eye, whilſt you wink with the other, and obſerve if any Hollow, or Dawks be in the length; if not, you may conclude it pretty true: For the Work thus held, the Eye will diſcern pretty nearly. Or, for more certainly, you may apply the edge of the two-foot Rule, or rather a Rule ſhot the full length of the Quarter to your Work, and if it agree all the way with the Rule, you may conclude it is ſtraight in length. But if you find it not ſtraight, you muſt ſtill with the Fore-Plane work off thoſe Riſings that bear the edge of the Rule off any part of the Stuff: Then try if the Breadth be pretty ſtraight; if it be, {the

Dawks the roughneſs the Fore-plane made excepted} the firſt office of the Fore-plane is perform'd: If it be not, you muſt ſtraighten the Breadth as you did the Length.

But tho' this Quarter be thus plained ſtraight in length and breadth, yet becauſe the Iron of the Fore-plane for its firſt working the Stuff is ſet Rank, and therefore makes great Dawks in the Stuff, you muſt ſet the Iron of your Fore-plane finer, as you were taught, S. 3. *Numb.* 2. And with it then work down even almoſt to the bottom of thoſe Dawks: then try it again, as before, and if you find it try all the way, you may, with the Jointer, or Smoothing-plane, but rather with the Jointer, go over it again, to work out the irregularities of the fine Fore plane: For the Iron of the Fore-plane being ground to a Riſing in the middle, as has been ſhew'd, S. 2. *Numb.* 2. Though it be very fine ſet, will yet leave ſome Dawks in the Stuff for the Jointer, or Smoothing-plane, to work out. Thus the firſt ſide of the Quarter will be finiſhed.

Having thus tryed one ſide of the Quarter ſtraight and flat, apply the inſide of the Handle to it, and if one of the adjoining ſides of the Quarter, comply alſo with the inſide of the Tongue all the way, you need only ſmooth that adjoining ſide: But if it do not ſo comply, that is, if it be not ſquare to the firſt ſide, which you will know by the riding of the inſide of the Tongue upon one of the Edges; or ſome other part between the Edges, you muſt, with the Fore-plane Rank-ſet, plain away that Stuff which bears off the inſide of the Tongue from complying all the way with it. But if the Riſings be great, you may, for quickneſs, hew away the Riſings with the Hatchet: but then you muſt have a care you let not the edge of your Hatchet cut too deep into the Stuff, left you either ſpoil your Stuff, by making it unſizeable, if it be already ſmall enough; or if it have ſubſtance enough, make your ſelf more labour to get out thoſe Hatchet-ſtroaks with the Plane than you need. Then take off the roughneſs the Hatchet made with the Fore-plane Rank-ſet, then fine ſet, and laſt of all with the Jointer, or Smoothing-plane: so is the ſecond ſide alſo finiſhed.

To work the third ſide, ſet the Oval of the Gage exactly to that width from the Gage, that you intend the Breadth of the Quarter {when wrought} ſhall have, which, in this our Example, is four Inches, but will

be ſomewhat leſs, becauſe working it true will diminiſh the Stuff: Therefore ſliding the Oval on the Staff, meaſure on your Inch-Rule ſo much leſs than four Inches, as you think your Stuff diminiſhes in working: Meaſure, I ſay, between the Oval and the Tooth, your ſize: If, at the firſt proffer, your Oval ſtand too far from the Tooth, hold the Oval in your Hand, and knock the Tooth-end of your Staff upon the Work-bench, till it ſtand near enough: If the Oval ſtand too near, knock the other end of the Staff upon the Work-bench till it be fit. Then apply the flat of the Oval to the ſecond wrought ſide of your Stuff, ſo as the Tooth may reach athwart the breadth of the Stuff upon the firſt ſide, and keeping the Oval cloſe againſt the ſecond ſide, preſs the Tooth ſo hard down, that by drawing the Gage in this poſture all along the length of the Quarter, the Tooth may ſtrike a Line. In like manner upon the ſide oppoſite to the firſt, *viz.* the fourth ſide, Gage another line oppoſite to the firſt gaged Line, and work your Stuff down to thoſe two gaged Lines on the third ſide, either with Plaining along, or with Hewing, and afterwards Plaining, as you were taught to work the ſecond ſide.

To work the fourth ſide, ſet the Tooth of the Gage to its exact diſtance from the Oval, *viz.* two Inches wanting ſo much as you think the Stuff diminiſh'd in working, and apply the flat of the Oval to each ſide of the firſt ſide, and Gage as before two Lines, one on the ſecond, the other on the third wrought ſide. Work your Stuff then down on the fourth ſide to thoſe two Gage lines, either with Plaining alone, or with Hewing, and afterwards Plaining, as you were taught to work the ſecond ſide.

S. 17. *To* Frame *two* Quarters *Square into one another.*

You muſt take care in Morteſſing and Tennanting, that as near as you can equallize the ſtrength of the ſides of the Morteſs to the ſtrength of the Tenant. I do not mean that the Stuff ſhould be of an equal Subſtance, for that is not equaling the ſtrength: But the equaling ſtrength muſt be conſidered with reſpect to the Quality, Poſition and Subſtance of the Stuff: As if you were to make a Tennant upon a piece of Fur, and a Morteſs to receive it in a piece of Oak, and the Fur and Oak have both the ſame ſize: The Tennant therefore made upon this piece of Fur, muſt

be conſiderably bigger than a Tennant need be made of Oak, becauſe Fur is much a weaker Wood than Oak, and therefore ought to have a greater Subſtance to equalize the ſtrength of Oak. And for Poſition, the ſhorter the Stuff that the Tennant is made on, the leſs Violence the Tennant is ſubject to. Beſides, it is eaſier to ſplit Wood with the Grain, than to break Wood croſs the Grain; and therefore the ſame Wood when poſited as a Tennant, is ſtronger than the ſame Wood of the ſame ſize when poſited as a Morteſs: for the injury a Morteſs is ſubject to, is ſpliting with the grain of the Wood, which, without good care, it will often do in working; but the force that muſt injure a Tennant, muſt offend it, croſs the Grain of the Wood, in which Poſition it will beſt indure Violence.

When two pieces of Wood, of the ſame quality and ſubſtance {as in this our Example} are elected to make on the one a Tennant, and in the other Morteſs. If you make the Morteſs too wide, the ſides of the Morteſs will be weaker than the ſides that contain the Morteſs: And if one be weaker than the other, the weakeſt will give way to the ſtrongeſt when an equal Violence is offer'd to both. Therefore you may ſee a neceſſity of equallizing the ſtrength of one to the other, as near you can. But becauſe no Rule is extant to do it by, nor can {for many Conſiderations, I think, } be made, therefore this equallizing of ſtrength muſt be referred to the Judgement of the Operator. Now to the Work.

The Morteſs to be made is in a Quarter four Inches broad. In this caſe Workmen make the Morteſs an Inch wide, ſo that an Inch and an half Stuff remains on either ſide it. Therefore your Stuff being ſquar'd, as was taught in the laſt Section, ſet the Oval of the Gage an Inch and an half off the Tooth, and gage with it, on either ſide your Stuff, a ſtraight line at the diſtance from the end you intend the Morteſs ſhall be, then open your Compaſſes to two Inches, and prick off that diſtance in one of the Lines, for the length of the Morteſs; then lay the inſide of the Handle of the Square to one ſide of the Stuff, and upon both the pricks ſucceſſively, and with your Pricker draw ſtraight Lines through them by the ſide of the Tongue, ſo ſhall the bounds of your Morteſs be ſtruck out on the Quarter. If your Morteſs go through the Quarter, draw the ſame Lines on the oppoſite ſide of the Quarter thus, Turn the Quarter, or its

Edge, and apply the inſide of the Handle of the Square, to the ends of the former drawn Lines, and by the ſide of the Tongue draw two Lines on the edge of the Quarter; then turn the Quarter again with its other broad ſide upwards, and apply the inſide of the Handle of the square to the ends of the laſt Lines drawn on the edge, and by the ſide of the Tongue, draw two Lines on this broad ſide alſo. Theſe two Lines {if your Quarter was truly ſqaur'd} ſhall be exactly oppoſite to the two Lines drawn on the firſt broad ſide of the Quarter for the length of the Morteſs: And for the width of the Morteſs gage this ſide alſo, as you did the firſt; then for the Tennant, gage on that end of the Quarter you intend the Tennant ſhall be made, the ſame Lines you did for the Morteſs. And becauſe the Quarter is two Inches thick, prick from the end two Inches, and applying the inſide of the Handle of the Square to the ſide of the Quarter, and the Tongue to that Prick, draw by the ſide of the Tongue a Line through that ſide the Quarter; then turn the other ſides of the Quarter ſucceſſively, and draw Lines athwart each ſide the Quarter, as you were taught to draw the oppoſite Lines for the Mortreſs.

Then place the edge of the Inch-Morteſs-Chiſſel with its Baſil from you, and the Helve bearing a little towards you, within one half quarter of an Inch of one end of the ſtruck Morteſs, and with your Mallet knock hard upon it, till you find the Baſil of the Chiſſel will no longer force the Chips out of the Morteſs; then remove the Chiſſel to the other end of the Morteſs and work, as with the firſt end, till the Chips will void no longer: Then work away the Stuff between the two Ends, and begin again at one of the Ends, and then at the other, and work deeper into the Morteſs, then again between both; and ſo work deeper by degrees, till you have wrought the Morteſs through, or {if not through} to the intended Depth; then with the Morteſs-chiſſel work nearer the drawn Lines at the ends of the Morteſs, {for before you were directed to work but within half a quarter of an Inch of the drawn Lines,} by laying light blows on it, till you have made it fit to pare ſmooth with a narrow Paring-chiſſel, and then pare the ends, as you were taught to work with the Paring-chiſſel: Then with the broad Paring-chiſſel, pare the ſides of the Morteſs juſt to the ſtruck Lines; ſo is the Morteſs finiſhed.

To work the Tennant, lay the other Quarter on edge upon your Work-bench, and faſten it with the *Holdfaſt*, as you were taught Sec. I. Then with the Tennant, ſaw a little without the Struck-line towards the end: You muſt not Saw juſt upon the Struck-line, becauſe the Saw cuts rough: Beſides, you muſt leave ſome Stuff to pare away ſmooth to the Struck-line, that the *Stile* {that is, the upright Quarter} may make a cloſe Joint with the *Rail* {that is} the lower Quarter: Saw therefore right down with the Tennant-Saw, juſt almoſt to the gaged Lines for the thickneſs of the Tennant, and have a care to keep the Blade of the Saw exactly upright. Then turn the oppoſite Side of the Quarter upwards, and work as you were taught to work the firſt Side.

Then with the Paring-chiſſel, pare the Work cloſe to the gaged Lines for the Tennant. Then try how it fits the Mortes: If it be not pared enough away, you muſt pare it where it bears, that is, ſticks. But if you ſhould chance to have made it too little, you have ſpoiled your Work: Therefore you may ſee how neceſſary it is, not to make the Mortes too wide at firſt, or the Tennant too narrow.

Then with the Piercer pierce two holes through the Sides, or Cheeks of the Mortes, about half an Inch off either end one. Then knock the Tennant ſtiff into the Mortes, and ſet it upright, by applying the Angle of the outer Square, to the Angle the two Quarters make, and with your Pricker, prick round about the inſides of the Pierced holes upon the Tennant. Then take the Tennant out again, and Pierce two holes with ſame Bit, about the thickneſs of a Shilling above the Pricked holes on the Tennant, that is, nearer the Sholder of the Tennant, that the Pins you are to drive in, may draw the Sholder of the Tennant the cloſer to the flat ſide of the Quarter the Mortes is made in. Then with the Paring-chiſſel make two Pins ſomewhat Tapering, full big enough, and ſetting the two Quarters again ſquare, as before, drive the Pins ſtiff into the Pierced holes.

If you make another Square, as you did this; and make alſo a Tennant on each Un-tennanted end of the Stiles, and another Mortes on the top and bottom Rails, you may put them together, and make ſquare Frames of them.

S. 18. *Of the* Miter Square. *And its Uſe.*

The Miter Square marked E, hath {as the Square} an Handle marked *a*, one Inch thick, and three Inches broad, and a Tongue marked *b*, of about the ſame breadth: The Handle and the Tongue {as the Square} have both their Sides parallel to their own Sides. The Handle {as the Square} hath in the middle of its narroweſt Side a Morteſs in it, of an equal depth, the whole length of the Handle: Into this Morteſs is fitted one end of the Tongue, but the end of the Handle is firſt Bereld off to make an Angle of 45 Degrees with its inſide. This Tongue is {as the Square} Pin'd and Glewed into the Morteſe of the Handle.

It is uſed for ſtriking a Miter-line, as the Square is to ſtrike a Square-line, by applying the inſide of the Handle to the outſide of the Quarter, or Batten, you are to work upon; and then by ſtriking a Line by the ſide of the Tongue: For that Line ſhall be a Miter-line. And if upon two Battens you ſtrike two ſuch Lines, and Saw and Pare them juſt off in the Lines, when the flats of thoſe two ſawn ends are applied to one another, the ont and inſide of the Battens, will form themſelves into the Figure of a Square.

Thus Picture Frames, and looking Glaſs-frames, are commonly made, as by a more full Example you may ſee in the next Section.

S. 19. *Of the* Bevil.

As the Square is made to ſtrike an Angle of 90 Degrees, and the Miter an Angle of 45 Degrees, ſo the Bevil {marked F} having its Tongue movable upon a Center, may be ſet to ſtrike Angles of any greater, or leſſer numbers of Degrees, according as you open the Tongue wider from, or ſhut it cloſer to the Handle. It is uſed as the square, and the Miter, and will perform the Offices of them both, though it be not purpoſely made for either; but for the ſtriking ſuch Bevil-lines, as one part of your work muſt be cnt away to, to make it join with another part of your Work: For Example,

We will propoſe to make a Frame for a Picture, Looking-glaſs, & c. containing eight ſtraight Sides; You may quickly perceive that all the ends of theſe eight Sides muſt be cut to Bevils, and what Bevils they muſt be, you will find if you deſcribe upon a ſmooth flat Board, a Circle of any

bigneſs, but the larger the better: Divide this Circle into eight equal Parts, and from every point draw a Line to the Center: Draw alſo ſtraight Lines from every point to its next Point: Then lay the inſide of the Handle of your Bevil exactly upon any one of theſe ſtraight Lines, ſo as the Angle made by the inſide of the Handle, and the inſide of the Tongue, lie exactly at the very Angle made by this ſtraight Line, and the Semi-Diametral Line proceeding from the Center, and move the Tongue nearer, or farther off the Handle, till the inſide of the Tongue and the inſide of the Handle, lie exactly upon thoſe two Lines, ſo ſhall your Bevil be ſet.

Then having fitted your Pieces to your Scantling, ſtick your Pricker as near the outward Corner of your Pieces as your Stuff will bear, and apply the inſide of your Handle alſo to the outer ſides of your Pieces, and ſo as the inſide of the Tongue may be drawn home to the Pricker. For then Lines drawn on thoſe Pieces by the inſide of the Tongue, ſhall be the Lines the Pieces muſt be cut in, to make theſe eight Pieces join evenly together by the ſides of each others Bevil: Then with the Strike-block ſmooth the ends of the Bevils, as you were taught in the Section of the Strike-block.

If you have a Board on the back-ſide of this Frame, you may Glew the back-ſides of theſe Pieces, piece by piece to the Board; but firſt you muſt fit them to an exact Compliance of every Bevil with its Match, and when they are ſo fitted, drive two Nails cloſe to the outſide of every piece, but drive not the Nails deep into the Board, becauſe when the Frame is ſet, and Glewed, or otherwiſe faſtned, you muſt draw the Nails out again: For theſe Nails are only intended to ſerve for Fences to ſet, and fit each piece into its proper Place, before the whole Frame is faſtned together. And ſhould you not thus Fence them, though by your Eye you might judge you fitted the Bevils exactly, yet one piece being never ſo little out of its due Poſition, would drive the next piece more out, and that the next, till at the laſt, the laſt piece would not join, but either be too ſhort, or too long, or ſtand too much out, or in, or elſe too open, or too cloſe on the out, or inſide.

But if you have no Board on the backſide, you muſt, when you Saw the Bevilling Angles upon the ſquare ends of pieces, not ſawn quite through

the depth of one end of every piece, but about half way through the depth, or thickneſs, and then with your Chiſſel either ſplit, or elſe pare, the upper ſide of the ſquare end flat away to the Bevil, and ſo leave part of the ſquare end of your piece, to lap under the piece it is joined to. For Example,

In Fig. 3. Plate 5. *a b* is the ſquare end of the piece, and *b c* is the Bevil you work the piece to. Therefore you muſt work away ſo much of the thickneſs of the ſquare end, as is comprehended between *a* and *c*, ſo that you will ſee the Triangle a *b c*, is to be wrought away half way down the thickneſs of the Stuff, and ſo will the Triangle *a b c* be left for the other half thickneſs of the Stuff. But that end of the piece marked 1, which joins to the piece marked 2, muſt, upon its Bevil-ſtroak, be ſawn quite off, and its underſide muſt have the ſame Triangle wrought into it, juſt ſo fit as to receive the Triangle in piece 2, and juſt ſo deep, as that when the Triangle on piece 2, is fitted into the Triangle in piece 1, the Superficies of both the pieces may be even with one another. And thus you may lap the ends of every piece into one another.

Theſe Triangles at the ends of the pieces you may Glew into one another, but if you think Glewing alone not ſtrong enough ,you may Pierce an hole near the inner edge of the Frame, becauſe the Triangle hath there moſt Subſtance of Stuff; and afterwards Pin it, as you are taught to Pin the Rail and Stile together in Sec. 17.

This way of Lapping over, is ſometimes uſed alſo for ſquare Miters, or other Angular Frames.

S. 20. Of the Miter-Box.

There is another way uſed by Joiners that make many Frames, to ſave themſelves the labour of Drawing, or ſtriking out of Squares, Miters, and ſeveral Bevils upon their Stuff: And this is with a Tool called a *Miter-Box*, deſcribed in Plate 5. Fig. 2. It is compoſed of two pieces of Wood, of an Inch thick each, as A the upright piece, B the bottom piece. The Upright piece is nailed upright, faſt upon the bottom piece. And this upright piece hath on its upper ſide the Miter Lines ſtruck with the Miter Square, as *d e*, on the left hand, and *g h* on the right hand: On theſe two Miter Lines the edge of the Saw is ſet, and a kerf made ſtraight down the upright piece,

as from *d e* on the left hand to *f*, and from *g h* on the right hand to *i*. In like manner any other Bevil is ſtruck on the upper ſide of the upright piece with the Bevil, as *k l* on the left hand, and *n o* on the right. On theſe two Bevil Lines the edge of the Saw is ſet, and a kerf made ſtraight down the upright piece, as from *k* to *l m*, and from *g h* to *i*. You may make as many Bevils as you pleaſe on the upright piece of the Miter Box; Bevils to join Frames of either five, ſix, ſeven, eight Sides, & c. and the manner to make them to any number of Sides, was in part taught in the laſt Section. For as there you were directed to divide the Circle into eight equal Parts, becauſe eight was the number of Sides, we propoſed to make that Frame conſiſt of; So, if for any number of Sides you divide the Circle into the ſame equal parts, and work as you were there directed, you may find what Bevil the pieces muſt have that make a Frame that conſiſts of any number of Sides.

So alſo for Sawing of any Batten , or other ſmall pieces ſquare: Strike at the Point *a*, on the upper ſide of the upright piece a line ſtraight athwart it, to *b*, and Saw ſtraight down the upper piece, to c.

The manner how theſe Kerfs are ſawn ſtraight down with greateſt certainty is, thus, Apply the inſide of the Handle of the ſquare to the upper ſide of the upright piece, ſo as the Tongue lie cloſe to that end of the Miter, Bevil, or ſquare Line ſtruck through the upper ſide of the Miter-Box, and with the Pricker ſtrike a Line cloſe by the ſide of the Tongue, through that ſide of the upright piece; Turn the Tongue to the other ſide of the upright piece, and apply the inſide of the Handle of the ſquare to the other end of the Miter, Bevil, or Square Line, and with the Pricker ſtrike alſo a Line cloſe by the ſide of the Tongue through that ſide the upright piece. Theſe two Lines ſtruck on either *ſide* of the upright piece, ſhall be a Line on each ſide in which the edge of the Saw muſt run, to ſaw it ſtraight down.

S. 21. *Of the* Gage.

The *Gage* marked G {in *Plate* 4} The *Oval b* is fitted ſtiff upon the *Staff c*, that it may be ſet nearer or farther from the *Tooth a*. Its Office is to *Gage*

a Line parallel to any ſtraight ſide. It is uſed for *Gaging* Tennants, and for *Gaging* Stuff to an equal thickneſs.

When you uſe it, you muſt ſet the *Oval* to the intended Diſtance from the *Tooth*: If the Oval ſtand too near the tooth, Hold the Oval in your right hand, and knock the hinder end of the Staff upon the Work-bench, till it remove to its juſt Diſtance from the Tooth: If it ſtand too far off the Tooth, knock the fore end of the Staff {*viz.* The Tooth end} till it remove to its juſt Diſtance from the Tooth: If the Oval ſlide not ſtiff enough upon the Staff, you may ſtiffen it by ſtriking a wooden Wedge between the Mortes and the Staff: So may you apply the ſide of the Oval next the Tooth, to the ſide of any Table, or any other ſtraight ſide, with the Tooth Gage a Line parallel {or of equal Diſtance} all the way from that ſide.

S. 22. *Of the* Piercer.

The *Piercer* H, in *Plate* 4, hath *a* the *Head*, *b* the *Pad*, *c* the *Stock*, *d* the *Bitt*. Its Office is ſo well known, that I need ſay little to it. Only, you muſt take care to keep the Bitt ſtraight to the hole you pierce, leſt you deform the hole, or break the Bitt.

You ought to be provided with Bitts of ſeveral ſizes, fitted into ſo many Padds.

S. 23. *Of the* Gimblet.

The *Gimblet* is marked I, in *Plate* 4. It hath a Worm at the end of its Bitt. Its Office is to make a round hole in thoſe places of your work where the *Stock* of the Piercer by reaſon of its own Sholder, or a Sholder, or Butting out upon the work will not turn about. Its Handle is held in a clutched hand, and its Bitt twiſted ſtiff into your work. You muſt have them of ſeveral ſizes.

S. 24. *Of the* Augre.

The *Augre* marked K in *Plate* 4, hath *a a* the Handle, *b* the *Bitt*. Its Office is to make great round holes. When you uſe it, the Stuff you work upon is

commonly laid low under you, that you may the eaſier uſe your ſtrength upon it: for in twiſting the Bitt about by the force of both your Hands, on each end of the Handle one, it cuts great Chips out of the Stuff. You muſt bear your ſtrength Perpendicularly ſtraight to the end of the Bitt; as with the Piercer.

S. 25. *Of the* Hatchet.

The *Hatchet* marked L, in *Plate* 4. Its uſe is ſo well known {even to the moſt un-intelligent} that I need not uſe many Words on it, yet thus much I will ſay, Its uſe is to Hew the Irregularities off ſuch pieces of Stuff which may be ſooner Hewn than Sawn..

When the Edge is downwards, and the Handle towards you, the right *ſide* of its Edge muſt be Ground to a Bevil, ſo as to make an Angle of about 12 Degrees with the left *ſide* of it: And afterwards ſet with the Whetſtone, as the Irons of Planes, & c.

S. 26. *The Uſe of the* Saw *in general.*

In my former *Exerciſes*, I did not teach you how to chuſe the tools a Smith was to uſe; Becauſe it is a Smith's Office to make them: And becauſe in thoſe *Exerciſes*, I treated of making Iron-work, and Steel-work in general, and the making and excellency of ſome Tools in particular, which might ſerve as a general Notion for the Knowledge of all Smith's Workmanſhip, eſpecially to thoſe that ſhould concern themſevles with Smithing: But to thoſe that ſhall concern themſelves with Joinery, and not with Smithing; It will be neceſſary that I teach them how to chuſe their Tools that are made by Smiths, that they may uſe them with more eaſe and delight, and make both quicker and nearer Work with them.

All ſorts of Saws, for Joiner's Uſe, are to be ſold in moſt Iron-monger's Shops, but eſpecially in *Foſter-lane, London:* Chuſe thoſe that are made of Steel, {for ſome are made of Iron} for Steel of it ſelf is harder and ſtronger than Iron: You may know the Steel-*Saws* from Iron-*Saws* thus, The Steel-*Saws* are generally ground bright and ſmooth, and are {the thickneſs of the Blade conſidered} ſtronger than Iron-*Saws*: But the Iron-*Saws* are only Hammer-hardned, and therefore if they could be ſo

hard, yet they cannot be ſo ſmooth, as if the Irregularities of the Hammer were well taken off with the Grindſtone: See it be free from flaws, and very well Hammered, and ſmoothly Ground, {that is, evenly Ground,} you may know if it be well Hammered but the ſtiff bending of it, and if it be well Ground, {that is, evenly Ground, } it will not bend in one part of it more than in another; for if it do, it is a ſign that part were it bends moſt is, either too much Ground away, or too thin Forged in that place: But if it bend into a regular bow all the way, and be ſtiff, the Blade is good: It cannot be too ſtiff, becauſe they are but Hammer-hardned, and therefore often bow when they fall under unſkilful Hands, but never break, unleſs they have been often bowed in that place. The Edge whereon the Teeth are, is always made thicker than the Back, becauſe the Back follows the Edge, and if the Edge ſhould not make a pretty wide Kerf, if the Back do not ſtrike in the Kerf, yet by never ſo little irregular bearing, or twiſting of the Hand awry, it might ſo ſtop, as to bow the *Saw*; and {as I ſaid before} with often bowing it will break at laſt. When Workmen light of a good Blade thus qualified, they matter not much whether the Teeth be ſharp or deep, or ſet to their mind: For to make them ſo, is a Task they take to themſelves: And thus they perform it: They wedge the Blade of the *Saw* hard into the *Whetting-Block*, marked P, in *Plate* 4. with the Handle towards their left Hand, and the end of the *Saw* to the right, then with a three-ſquare file they begin at the left hand end, leaning harder upon the ſide of the File on the right Hand, than on that ſide to the left Hand; ſo that they File the upper ſide of the Tooth of the *Saw* a-ſlope towards the right Hand, and the underſide of the Tooth a little a-ſlope towards the left, or, almoſt downright. Having filed one Tooth thus, all the reſt muſt be ſo filed. Then with the *Saw-wreſt*, marked O, in *Plate* 4. they *ſet* the Teeth of the Saw: That is, they put one of the Notches marked *a a a* of the *Wreſt* between the firſt two Teeth on the Blade of the *Saw*, and then turn the Handle Horizontally a little about upon the Notch towards the end of the *Saw*; and that at once turns the firſt Tooth ſomewhat towards you, and the ſecond Tooth from you: Then skipping two Teeth, they again put one of the Notches of the *Wreſt* between the third and fourth Teeth on the Blade of the *Saw*, and then {as before} turn the Handle a little about

upon the Notch towards the end of the *Saw*, and that turns the third Tooth ſomewhat towards you, and the fourth ſomewhat from you: Thus you muſt skip two Teeth at a time, and turn the *Wreſt* till all the Teeth of the *Saw* are *ſet*. This *Setting* of the Teeth of the *Saw* {as Workmen call it} is to make the Kerf wide enough for the Back to follow the Edge: And is Set *Ranker* for ſoft, courſe, cheap Stuff, than for hard, fine, and coſtly Stuff: For the *Ranker* the Tooth is ſet, the more Stuff is wafted in the Kerf: And beſides, if the Stuff be hard it will require greater Labour to tear away a great deal of hard Stuff, than it will do to tear away but a little of the ſame Stuff.

The *Pit Saw*, is Set ſo Rank for courſe Stuff, as to make a Kerf of almoſt a quarter of an Inch, but for fine and coſtly Stuff they ſet it finer to ſave Stuff. The *Whip-Saw* is ſet ſomewhat finer than the *Pit-Saw*; the *Hand-Saw*, and the *Compaſs-Saw*, finer than the *Whip-Saw*; but the *Tennant-Saw*, *Frame-Saw*, and the *Bow-Saw*, & c. are ſet fine, and have their Teeth but very little turned over the Sides of their Blades: So that a Kerf made by them, is ſeldom above half a half quarter of an Inch.

The reaſon why the Teeth are filed to an Angle, pointing towards the end of the *Saw*, and not towards the Handle of the *Saw*, or directly ſtraight between the Handle and end of the *Saw*, is, Becauſe the *Saw* is deſigned to cut only in its Progreſs forwards; Man having in that Activity more ſtrength to rid, and Command of his Hands to guide his Work, than he can have in drawing back his *Saw*, and therefore when he draws back his *Saw*, the Work-man bears it lightly off the unſawn *Stuff*; which is an eaſe to his Labour, and enables him the longer to continue his ſeveral Progreſſions of the *Saw*.

Maſter-Workmen, when they direct any of their Underlins to ſaw ſuch a piece of Stuff, have ſeveral Phraſes for the ſawing of it: They ſeldom ſay *Saw that piece of Stuff*; But *Draw the Saw through it*; *Give that piece of Stuff a Kerf*; *Lay a Kerf in that piece of Stuff*; and ſometimes, {but moſt unproperly,} *Cut*, or *Slit that piece of Stuff*: For the Saw cannot properly be ſaid to cut, or flit the Stuff; but it rather breaks, or tears away ſuch parts of the Stuff from the whole, as the points of the Teeth prick into, and theſe

parts it ſo tears away are proportionable to the fineneſs, or rankneſs of the ſetting of the Teeth.

The Excellency of Sawing is, to keep the Kerf exactly in the Line marked out to be ſawn, without wriggling on either, or both ſides; And ſtraight through the Stuff, as Work-men call it; that is, in a Geometrical Term, perpendicular through the upper and under ſide, if your Work require it, as moſt Work does: But if your Work be to be Sawn upon a Bevil, as ſome Work ſometimes is, then you are to obſerve that Bevil all the length of the Stuff, & c.

S. 27. *The Uſe of the* Pit-Saw, *marked* M, in Plate 4.

The *Pit-Saw* is not only uſed by thoſe Workmen that make ſawing Timber and Boards their whole Buſineſs, but is alſo for ſmall matters uſed by Joiners, when what they have to do, may perhaps be as ſoon done at home, as they can carry or ſend it to the Sawyers. The manner of their working is both alike, for if it be a Board they would ſlit off a piece of Timber, or if they would take any Square, Quarter, or Batten, & c. off, they firſt ſet off their Scantlin: For Example, If it be an Inch {or more, or leſs} they would take off a piece of Stuff, they open the Points of their Compaſſes to an Inch Meaſure on their Rule, and ſo much more as they reckon the Kerf of the *Saw* will make, and from on ſide of their Stuff they ſet off at either end of the Stuff, the Diſtance of the points of their Compaſſes; at this Diſtance therefore they make with the points of their Compaſſes a prick at either end of the Stuff; Then with Chalk they whiten a Line, by rubbing the Chalk pretty hard upon it; Then one holds the Line at one end upon the Prick made there, and the other ſtrains the Line pretty ſtiff upon the prick at the other end; then whilſt the Line is thus ſtrain'd, one of them between his Finger and Thumb draws the middle of the Line directly upright, to a convenient height {that it may ſpring hard enough down} and then lets it go again, ſo that it ſwiftly applies to its firſt Poſition, and ſtrikes ſo ſtrongly againſt the Stuff, that the Duſt, or Atoms of the Chalk that were rubbed into the Line, ſhake out of it, and remain upon the Stuff. And thus alſo they mark the under ſide of their Stuff; This is called

Lining of the Stuff: And the Stuff cut into thoſe Lines ſhall be called *Inch-Stuff*, becauſe the Compaſſes that prickt the Stuff, were opened wider by the width of the Kerf than an Inch Meaſure upon the Rule: But had the Compaſſes been opened but an Inch exactly, that piece Sawn off ſhould, in Workmen's Language, have been called *Inch-prickt*, thereby giving to underſtand that it is half the breadth of the Kerf thinner than an Inch: And thus they call all other Scantlins 2 *Inches*, 2 1/2 *Inches*, 3 *Inches*, & c. *Sawn*, or *Pricked*.

When two Work-men are not at hand to hold the Line at both ends, he that Lines it, ſtrikes one point of this Compaſs, or ſometimes a Pricker, or a Nail aſlope towards that end into the prick ſet off, and putting the Nooſe at the end of his Line over his Compaſſes, & c. goes to the other end, and ſtrains his Line on that prick, and ſtrikes it as before.

The Stuff being thus lined is faſtened with wedges over the *Pit*, {if the Joiner be accommodated with a *Pit*} if he have none, he makes ſhift with two high Frames a little more than Man high in its ſtead, {called great *Truſſels*} with four Legs, theſe Legs ſtand ſpreading outwards, that they may ſtand the firmer: Over theſe two *Truſſels* the Stuff is laid, and firmly faſtned that it ſhake not. Its outer ſide from whence the Pricks were ſet off muſt be Perpendiculer which you muſt try by a Plumb-line, for ſhould the top edge of that ſide, hang never ſo little over the bottom edge, or the bottom edge not lie ſo far out as the top edge, the Scantlin you ſaw off would not be of an equal thickneſs on the top or Bottom: Becauſe the Saw is to work exactly Perpendicular. Then with the *Pit-Saw* they enter the one end of the Stuff, the *Top-man* at the Top, and the *Pit-man* under him: The *Top-man* obſerving to guide the *Saw* exactly in the Line: And withal drawing the *Saw* ſomewhat towards him when the *Saw* goes down; and the *Pit-man* drawing it with all his ſtrength Perpendicularly down; but not ſo low that the upper and lower Handles of the Saw ſink below both their Managements: Then bearing the Teeth of the *Saw* a little off the Stuff, the *Top-man* draws the *Saw* up again, and the *Pit-man* aſſiſts, or eaſes him in it, and thus they continue ſawing on till the *Saw* has run through the whole length upon the Stuff. But when the Kerf is made ſo long, that by

the working of the *Saw* the pieces of Stuff on either ſide will ſhake againſt one another, and ſo more, or leſs , hinder the eaſie Progreſs of the *Saw,* they drive a Wedge ſo far in the Kerf as they dare do for fear of ſplitting the Stuff, and ſo provide the *Saw* freer and eaſier Paſſage through the Stuff: This Wedging they continue ſo oft as they find occaſion.

MECHANICK EXERCISES;
OR,
The Doctrine of *Handy-Works*

Continued in the Art of JOINERY.

S. 28. *The Uſe of the* Whip-Saw, *marked* N *in Plate* 4.

The *Whip-Saw* is uſed by Joiners, to ſaw ſuch greater pieces of Stuff that the *Hand-Saw* will not eaſily reach through; when they uſe it, the Stuff is laid upon the *Truſſel*, marked O in *Plate* 5. in the Angles of it. Then two Men takes each an Handle of the Saw; He to whom the Teeth of the Saw points, drawing to him, and the other thruſting from him: And {as before} the Saw having run its length, is lifted gently over the Stuff to recover another ſtroak of the *Saw*.

S. 29. *The Uſe of the* Hand-Saw *marked* D, *the* Frame *or* Bow-Saw, *the* Tennant-Saw, *marked* O in *Plate* 4.

Theſe *Saws* are accommodated for a ſingle Man's Uſe, and cut forward as the other Saws do. The Office of the Cheeks made to the *Frame-Saw* is, by the twiſted Cord and Tongue in the middle, to draw the upper ends of the Cheeks cloſer together, that the lower end of the Cheeks may be drawn the wider aſunder, and ſtrain the Blade of the *Saw* the ſtraighter. The *Tennant-Saw*, being thin, hath a Back to keep it from bending.

S. 30. *The Uſe of the* Compaſs-Saw, *marked* Q *in Plate* 4.

The *Compaſs-Saw* ſhould not have its Teeth Set, as other *Saws* have; but the edge of it ſhould be made ſo broad, and the back ſo thin, that it may eaſily follow the broad edge, without having its Teeth *Set*; for if the Teeth be *Set*, the Blade muſt be thin, or elſe the Teeth will not bow over the Blade, and if it be thin, {conſidering the Blade is ſo narrow} it will not be ſtrong enough to abide tough Work, but at never ſo little an irregular

thruſt, will bow, and at laſt break; yet for cheapneſs, they are many times made ſo thin that the Teeth require a ſetting. Its Office is to cut a round, or any other Compaſs kerf; and therefore the edge muſt be made broad, and the back thin, that the Back may have a wide kerf to turn in.

S. 31. *Of the* Rule *marked* D *in Plate* 5.

The uſe of the *Rule* is to meaſure Feet, Inches, and parts of Inches, which for that Purpoſe, are marked upon the flat and ſmooth ſides of the Rule, and numbred with Inches, and hath every Inch divided into two halfs, and every half into two quarters, and every quarter into two half-quarters; ſo that every Inch is divided into eight equal parts; And theſe Inches are numbred from one end of the *Rule* to the other; which commonly is in all 24 Inches: Which is a Two-Foot *Rule*.

They have commonly both Board and Timber-meaſure, & c. marked upon them, for the finding both the ſuperficial and ſolid Content of Board or Timber: The uſe of which Lines and Tables havin been often taught by others, and being more Mathematical than Mechanical, is unproper for me to meddle with in this Place: but rather to refer to thoſe Books.

But the manual Uſe of it is, either to meaſure length with it, or to draw a ſtraight Line by the ſide of it, or to Try the ſtraightneſs or flatneſs of their Work with. They Try their Work by applying one of its Edges to the Flat of the wrought ſide of their Work, and bring their Eye as cloſe as they can, to ſee if they can ſee light between the edge of the *Rule* and their Work: If they cannot, they conclude their Work is *Try*, and well wrought.

S. 32. *Of the* Compaſſes *marked* E *in Plate* 5.

a a The *Joint*, *bb* the *Cheeks* of the Joint, *cc* the *Shanks*, *dd* the *Points*. Their Office is to deſcribe Circles, and ſet off Diſtances from their Rule, or any other Meaſure, to their Work.

S. 33. *Of the* Glew-pot *marked* F *in Plate* 5.

The *Glew-pot* is commonly made of good thick Lead, that by its Subſtance it may retain a heat the longer, that the *Glew Chill* not {as Work-men ſay when it cools} when it is to be uſed.

S. 34. *Of* Chuſing *and* Boiling Glew.

The cleareſt, drieſt, and moſt tranſparent Glew is the beſt: When you boil it, break it with your Hammer into ſmall pieces, and put it into a clean Skillet, or Pipkin, by no means greaſie, for that will ſpoil the Clammineſs of the Glew, put to it ſo much Water as is convenient to diſſolve the Glew, and to make it, when it is hot, about the thickneſs of the White of an Egg: The quantity of Water cannot be aſſigned, becauſe of the different Quality there is in Glew: Keep it ſtirring whilſt it is melting, and let it not ſtick to the ſides or bottom of the Veſſel: When it is well boiled, pour it into your Glew-pot to uſe, but let your Glew-pot be very clean. When it is cold, and you would heat it again in your Glew-pot, you muſt take great care that it burn not to the ſides or bottom of the Glew-pot, for that burning either turns to a thick hard skin, or elſe to a burnt Cinder-like Subſtance, which if it mingle with the Glew, will ſpoil it all; becauſe by its Subſtance it will bear the two Joints you are to Glew together, off each other.

When {with often heating} the Glew grows too thick, you may put more Water to it; but then you muſt make it very hot, leſt the Glew and Water do not wholly incorporate.

Some Joiners will {when their Glew is too thick, put Small-Beer into it, thinking it ſtrengthens it: I have tried it, and could never find it ſo, but think it makes the Glew weaker, eſpecially if the Small-Bear chance to be new, and its Yeſt not well ſettled from it, or ſo ſtale, that it be either Draggy, or any whit mingled with the Settlings of the Cask.

S. 35. *Of uſing the* Glew.

Your Glew muſt be very warm, for then it is thinneſt, and as it chills, it thickens: With a ſmall Bruſh you muſt ſmear the Glew well upon the Joint of each piece you are to Glew together; And before you ſet them as they are to ſtand, you muſt joſtle them one upon the other, that the Glew may very well touch and take hold of the Wood; and that the Glew on each Joints may well incorporate. Then fit the two Joints as they muſt ſtand; And when you ſet them by to dry, let the one ſtand upright upon the other; For if they ſtand a-ſlope, the weight of the Stuff when it leans upon two extream Edges, may make one end of the Joint *Open*.

S. 36. *Of the* Waving Engine.

The *Waving Engine* diſcribed in *Plate* 5. *Fig.* 7. Hath A B a long ſquare Plank, of about ſeven Inches broad, five Foot long, and an Inch and half thick: All along the length of this Plank on the middle between the two ſides, runs a *Rabbet*, as part of it is ſeen at C: Upon this Rabbet rides a *Block* with a *Groove* in its under ſide: This *Block* is about three Inches ſquare, and ten Inches long, having near the hinder end of it a wooden Handle going through it, of about one Inch Diameter, as D E: At the Fore-end of this *Block* is faſtned a Vice, ſomewhat larger than a great Hand-Vice, as at F: The *Groove* in the *Block* is made fit to receive the Rabbet on the Plank.

At the farther end of the Plank is erected a ſquare ſtrong piece of Wood, about ſix Inches high, and five Inches ſquare, as G. This ſquare piece hath a ſquare wide Morteſs in it on the Top, as at H. Upon the top of this ſquare piece is a ſtrong ſquare flat Iron Coller, ſomewhat looſly fitted on, having two Male Screws fitted into two Female Screws, to ſcrew againſt that part of the wooden Piece un-morteſſed at the Top, marked L, that it may draw the Iron Coller hard againſt the Iron marked Q, and keep it ſtiff againſt the fore-ſide of the un-morteſſed Piece, marked L, when the piece Q, is ſet to its convenient heighth; and on the other ſide the ſquare wooden Piece is fitted another Iron ſcrew, having to the end of its ſhank faſtned a round Iron Plate which lies within the hollow of this wooden piece, and therefore cannot in Draft be ſeen in its proper place; But I have deſcribed it a part, as at M. {Fig. 9.} Its Nut is placed at M, on the wooden Piece. On the farther ſide of the wooden Piece is fitted a wooden Screw called a *Knob*, as at N. Through the farther and hither ſide of the ſquare wooden Piece is fitted a flat Piece of Iron, about three quarters of an Inch broad, and one quarter of an Inch thick, ſtanding on edge upon the Plank; but its upper edge is filed round: {the reaſon you will find by and by:} Its hither end comes through the wooden Piece, as at O, and its farther end on the oppoſite ſide of the wooden Piece.

Upright in the hollow ſquare of the wooden Piece ſtands an *Iron*, as at Q, whoſe lower end is cut into the form of the Molding you intend your work ſhall have.

In the fore ſide of this wooden Piece is ſquare hole, as at R, called the *Mouth*.

To this Engine belongs a thin flat piece of hard Wood, about an Inch and a quarter broad, and as long as the *Rabbet*: It is disjunct from the Engine, and in Fig. 8. is marked S S, called the *Rack*: It hath its under flat cut into thoſe faſhioned Waves you intend your Work ſhall have: The hollow of theſe Waves are made to comply with the round edge of flat Plate of Iron marked O {deſcribed before} for when one end of the Riglet you wave, is, with the Vice, ſcrewed to the plain ſide of the Rack, and the other end put through the Mouth of the wooden Piece, as at T T, ſo as the hollow of the Wave on the under ſide of the *Rack* may lie upon the round edge of the flat Iron Plate ſet on edge, as at O, and the Iron Q, is ſtrong fitted down upon the Reglet: Then if you lay hold of the Handles of the *Block* D E, and ſtrongly draw by them, the Rack and the Riglet will both together ſlide through the Mouth of the wooden Piece: And as the Rounds of Rack rid over the round edge of the flat Iron, the Rack and Reglet will mount up to the Iron Q, and as the Rounds of the Waves on the under ſide of the Rack ſlides off the Iron on edge, the Rack and Reglet will ſink, and ſo in a Progreſſion {or more} the Riglet will on its upper ſide receive the Form of the ſeveral Waves on the under ſide of the Rack, and alſo the Form, or Molding, that is on the edge of the bottom of the Iron, and ſo at once the Riglet will be both molded and waved.

But before you draw the Rack through the Engine, you muſt conſider the Office of the Knob N, and the Office of the Iron Screw M; For by them the Rack is ſcrewed evenly under the Iron Q. And you muſt be careful that the Groove of the Block ſlip not off the Rabbet on the Plank: For by theſe Screws, and the Rabbet and Groove, your work will be evenly gaged all the way {as I ſaid before} under the edge of the Iron Q, and keep it from ſliding either to the right, or left Hand, as you draw it through the Engine.

S. 37. *Of* Wainſcoting *Rooms*.

A A A {in *Plate* 7.} The *Stiles*. B The *Baſe*, C The *Lower Rail*. D The *Sur-Baſe*. E E The *Middle Rail*, or *Rails*. F The *Frieſe Rail*. G The *Upper Rail*.

H The *Cornice.* I The *Lying Pannel.* K The *Large Pannel.* L The *Frieſe Pannel.*

In Wainſcoting of Rooms there is, for the moſt part, but two heights of Pannels uſed; unleſs the Room to be Wainſcoting be above ten foot high, as ſome are eleven or twelve Foot high, and then three Heighths of Pannels are uſed: As I the *Lying Pannel,* above the *Baſe.* K The *Large Pannel* above the *Middle Rail*: And L The *Frieſe Pannel* above the *Frieſe Rail.*

The *Frieſe Rail* is to have the ſame breadth the *Margent* of the *Stile* hath; The *Middle Rail* hath commonly two breadths of the *Margent* of the *Stile,* viz. one breadth above the *Sur-baſe,* and the other below the *Sur-baſe.* And the *Upper* and *Lower Rails* have alſo each the ſame breadth with the *Margent* of the *Stile.*

Thoſe Moldings above the Prickt Line on the Top, as H, are called the *Cornice.*

Sometimes {and eſpecially in low Rooms} there is no *Baſe* or *Sur-baſe* uſed, and then the *Middle* and *Lower Rail* need not be ſo broad: For the *Middle Rail* need not be above a third part more than the *Margent* of the *Rail*: and the *Lower Rail* you may make of what breadth you ſee convenient: They are commonly about three Inches and an half, or four Inches broad, yet this is no Rule: For ſometimes Workmen make only a flat Plinth ſerve.

You may {if you will} adorn the outer edges of the *Stiles* and *Rails* with a ſmall *Molding*: And you may {if you will} Bevil away the outer edges of the *Pannels,* and leave a Table in the middle of the Pannel.

An Explanation of Terms *uſed among Joiners*

When I firſt began to Print theſe Exercifes, I marked ſome Terms in *Joinery* with *ſuperiour Letters* {as Printers call them} thus $^{a\,b\,c}$ & c. intending, at the latter end of theſe Exercifes, to have explained the Terms thoſe Letters referr'd to: But upon conſideration that thoſe Terms might often be uſed in this Diſcourſe, when the Superiour Letter was out of ſight, and perhaps it Poſition {where} forgotten; I have changed my Mind, and left out the Superiour Letters beyond fol. 66. And inſtead of thoſe References

give you this Alphabetical Table of Terms, by which you may always more readily find the Explanation, though you often meet with the Term.

A.

Architrave. See Plate 6. *l.* is the *Architrave Molding.*

Augre S 24. Plate 4. fig. K

B.

Baſe. See Plate 6. *b.* And Plate 7. B.

Bead. See Plate 6. *a.*

Bed-molding. See Plate 6. *d.*

Baſil. The *Baſil* is an Angle the edge of a Tool is ground away to. See fol. 71.

Batten. Is a Scantling of Stuff either two, three or four Inches broad; and is ſeldom above an Inch thick: and the length unlimited.

Beak. The end of the Hold-faſt. See fol. 60, 61.

Bench-ſcrew. See Plate 4. A *g.* and fol. 60.

Bevil. Any ſlopping Angle that is not a ſquare, is called a Bevil. See fol. 60. 85. S19. And Plate 4. F.

Bitt. See S 22.

Bow ſaw. Plate 4. O.

C.

Capital. See Plate 6. *g.*

Caſt. Stuff is ſaid to Caſt, or Warp, when by its own Droughth or Moiſture, or the Droughth or Moiſture of the Air, or other Accident, it alters its flatneſs and ſtraightneſs.

Clamp. When a piece of Board is fitted with the Grain to the end of another piece of Board croſs the Grain the firſt Board is *Clampt.* Thus the ends of Tables are commonly *Clampt* to preſerve them from warping.

Compaſs-ſaw. See fol. 9. And Plate 4. Fig. R.

Cornice. See Plate 6. *q.* and Plate 7. H.

Croſs-grain'd-ſtuff. Stuff is Croſs-grain'd when a *Bough* or ſome *Branch* ſhoots out on that part of the Trunk of the Tree; For the *Bough* or *Branch*

ſhooting forwards, the Grain of that branch ſhoots forwards alſo, and ſo runs a-croſs the Grain of the Trunk; and if they be well grown together, it will ſcarce be perceived in ſome ſtuff, but in working; yet in Deal-boards, thoſe Boughs or Branches are Knots, and eaſily perceiv'd, and if it grew up young with the Trunk, then inſtead of a Knot you will find a Curling in the *Stuff* when it is wrought.

Curling-Stuff. If the Bough or Branch that ſhoots out of the Trunk of a Tree be large, and the ſtuff in that place ſawn ſomewhat a-ſlope, when that ſtuff comes under the Plane you will find a Turning about or Curling on that place upon the ſtuff; and in a ſtraight progreſs of the Plane the Iron will cut with, and ſuddenly *a-croſs* the Grain, and that more or leſs as the Bough grew in the Youth of the Tree, or grew more or leſs upright, or elſe ſlopping to the Trunk, or was ſawn ſo. Such ſtuff therefore is called *Curling-ſtuff.*

D.

Door-caſe. Is the Fram'd work about the Door.

Double-Screw. See fol. 60. Plate 4. fig. *g.* on the Work-bench A.

F.

Facia. See Plate 6. *b.*

Fence. See S 8. Uſe of the Plow, and Plate 4. fig. B. 6.

Fine-ſet. The Irons of the Planes are ſet Fine, or Rank. They are ſet Fine, when they ſtand ſo ſhallow below the ſole of the Plane, that in working they take off a thin ſhaving. See S 3.

Flat Frieſe. See Plate 6. *p.*

Fore-Plane. See S 2. And Plate 4. B 1.

Former. See S 10. And Plate 4. C 1. C 3.

Frame. See fol. 59, 60.

Frame Saw. See S 28. And Plate 4. O.

Free-ſtuff. See S. 3.

Frieſe. See Plate 6. *p.*

Frieſe Pannel. See Plate 7. L.

Frieſe Rail. See Plate 7. F.

Frowy ſtuff. See S 3.

G.

Gage. See S 21. And plate 4. G.

Gimblet. See S 23. And Plate 4. I.

Gouge. See S 14. C 6.

Groove. See fol. 69.

H.

Hammer-hard. See Numb. I. fol. 58

Handle. See S 15. And Plate 4. D *a.*

Hard Stuff. See S 3.

Hatchet. See S 25. Plate 4. L.

Head. See S 22. Plate 4. H *a.*

Hold-faſt. See S 1. Plate 4. H *d.*

Hook. See S 1. Plate 4. A *b.*

Huſk. See Plate 6. *n.*

I.

Inner-ſquare. See S 15. And Plate 4. D *d.*

Joint. See fol. 59.

Jointer. See S 4. And Plate 4. B 2.

Iron. See S 2. And Plate 4. B I *d.*

K.

Kerf. The Sawn-away ſlit between two pieces of ſtuff is called a Kerf. See fol. 95.

Knob. See S 36. fol. 104. And Plate 5. fig. 7. N.

Knot. See Plate 6. *o.*

L.

Large Pannel. See Plate 7. K.

Lying Pannel. See Plate 7. I.

Lower Rail. See Plate 7. H.

M.

Margent. See Plate 7. at A A A the flat breadth of the Stiles beſides the Moldings, is called the Margent of the Stiles.

Middle Rail. See Plate 7. E E.

Miter. See fol. 64.

Miter Box. See S 20. And Plate 5. fig. 1.

Miter ſquare. See S 18. And Plate 4. E.

Moldings. The ſeveral wrought-work made with Planes on Wood, is called *Moldings.* See Plate 6.

Molding Planes. See S 9.

Mortes. Is a ſquare hole cut in a piece of ſtuff, to entertain a Tennant fit to it. See S 17.

Mortes Chiſſel. See S 13. And Plate 4. C 5.

Mouth. See S 2. B 7. *a* The Mouth.

O.

Ogee. See Plate 6. *c.*

Oval. See S 21. And Plate 4. G. *b.*

Outer Square. See S 15. And Plate 4. D *c.*

P.

Pad. See S 22. And Plate 4. H *b.*

Pannel. In Plate 7. I K L are Pannels, but diſtinguiſhed by their Poſitions.

Pare. The ſmooth cutting with the Paring-Chiſſel is called *Paring.*

Par*ing-Chiſſel.* See S 11. And Plate 4. C 2.

Plaiſter. See Plate 6. f.

Pit-man. The Saywer that works in the Pit, is called the Pit-man.

Pit-Saw. The Pit-ſaw is a great Saw fitted into a ſquare Frame; as in Plate 4. M is a Pit-ſaw.

Planchier. In Plate 6. between *d* and *e* is the Planchier.

Plinth. See Plate 6.

Plow. See S 8. And Plate 4. B 6.

Pricker. Is vulgarly called an Awl: Yet for Joiners Uſe it hath moſt commonly a ſquare blade which enters the Wood better than a round blade will; becauſe the ſquare Angle in turning it about breaks the Grain, and ſo the Wood is in leſs danger of ſplitting.

R.

Rabbet. See S 7.

Rabbet Plane. See S 7. And Plate 4. B 5.

Rack. See Plate 5. fig. 8. Read S 36.

Rail. See Plate 7. A A A.

Rank. The Iron of the Plane is ſaid to be ſet Rank, when its edge ſtands ſo flat below the Sole of the Plane, that in working it will take off a thick ſhaving. See S 3.

Rank-ſet. See Rank.

Range. The ſide of any Work that runs ſtraight, without breaking into Angles, is ſaid to *run Range*: Thus the Rails and Pannels of one ſtraight ſide of Wainſcoting is ſaid to *run Range.*

Return. The ſide that falls away from the fore-ſide of any Straight or Rank-work, is called the *Return.*

Riglet. Is a flat thin ſquare piece of Wood: Thus the pieces that are intended to make the Frames for ſmall Pictures, & c. before they are Molded are called Riglets.

S.

Saw-wreſt. See S 26. Fol. 97. And Plate 4. O.

Scantlin. The ſize that your ſtuff is intended to be cut to.

Scribe. When Joiners are to fit a ſide of a piece of Stuff againſt the ſide of ſome other piece of Stuff, and the ſide of the piece of Stuff they are to fit to is not regular; To make theſe two pieces of Stuff join cloſe together all the way, they Scribe it, {as they phraſe it, } thus; They lay the piece of Stuff they intend to Scribe cloſe againſt the other piece of Stuff they intend to Scribe to, and open their Compaſſes to the wideſt Diſtance, theſe two pieces of Stuff bear off each other: Then {the Compaſſes mov-

ing ſtiff in their Joint} they bear the point of one of the ſhanks againſt the ſide they intend to Scribe to, and with the point of the other ſhank they draw a Line upon the Stuff to be Scribed; and then the points of the Compaſſes remaining unremov'd, and your Hand carried even along by the ſide of the piece to be Scribed to, that Line Scribed upon the piece intended to be Scribed, ſhall be parallel to the irregular ſide intended to be Scribed to: And if you work away your Stuff exactly to that Line, when theſe two pieces are put together, they ſhall ſeem a Join.

Shoot a Joint. See fol. 63.

Skew-former. See S 12. and Plate 4. C 4.

Smoothing Plane. See S 6. and Plate 4. B 4.

Sole. See Plate 4. B 7. *b a b* The under ſide of a Plane is called the *Sole.*

Square. See S 15. and Plate 4. D.

Staff. See S 21. and Plate 4. G c.

Staves. See S 8. and Plate 4. B 6. a a.

Stile. The upright Pieces AA in Pl. 7. are *Stiles.*

Stock. See S 22. and Plate 4. H *c.*

Stops. In Plate 6. *kk* are *Stops.*

Stuff. The Wood that Joiners work upon they call in general *Stuff.*

Sur-baſe. In Plate 7. D is the *Sur-baſe.*

Swelling-Frieſe. In Plate 6. *r* is the *Swelling-frieſe.*

T.

Table. In Plate 6. *f* is the *Table.*

Taper. All ſorts of Stuff or Work that is ſmaller at one end than at the other, and diminiſhes gradually from the biggeſt end, is ſaid to be *Taper.*

Tennant. Is a ſquare end fitted into a Morteſs. See S 17.

Tennant-Saw. In Plate 4. O. would be a Tennant-ſaw, were the flat of the Blade turned where the edge there ſtands.

Tongue. See S 16. and Plate 4. D *b.*

Tooth. See S 21 . and Plate 4. G *a.*

Top-man. Of the two Sawyers, the uppermoſt is called the *Top-man.*

Tote. See S 2 and Plate 4. B I *a.*

Traverſe. See fol. 69.
Truſſel. See fol. 100. and Plate 5. Fig. 3.
Try. See S 13.

V.

Vaws-Cornice. See Plate 6. *e.*
Upper Cornice. See Plate 6. *t.*

W.

Warp. The ſame that *Caſt* is.
Waving Engine. See S 46. And Plate 5.
Wedge. See S 2. and Plate 4. B 1. C.
Whetting-Block. See Plate 4. P.
Whip-Saw. See Plate 4. N.
Wreſt. See S 26. and Plate 4. Q.

Thus much of Joinery. The next Exerciſes will be of *Carpentry.*

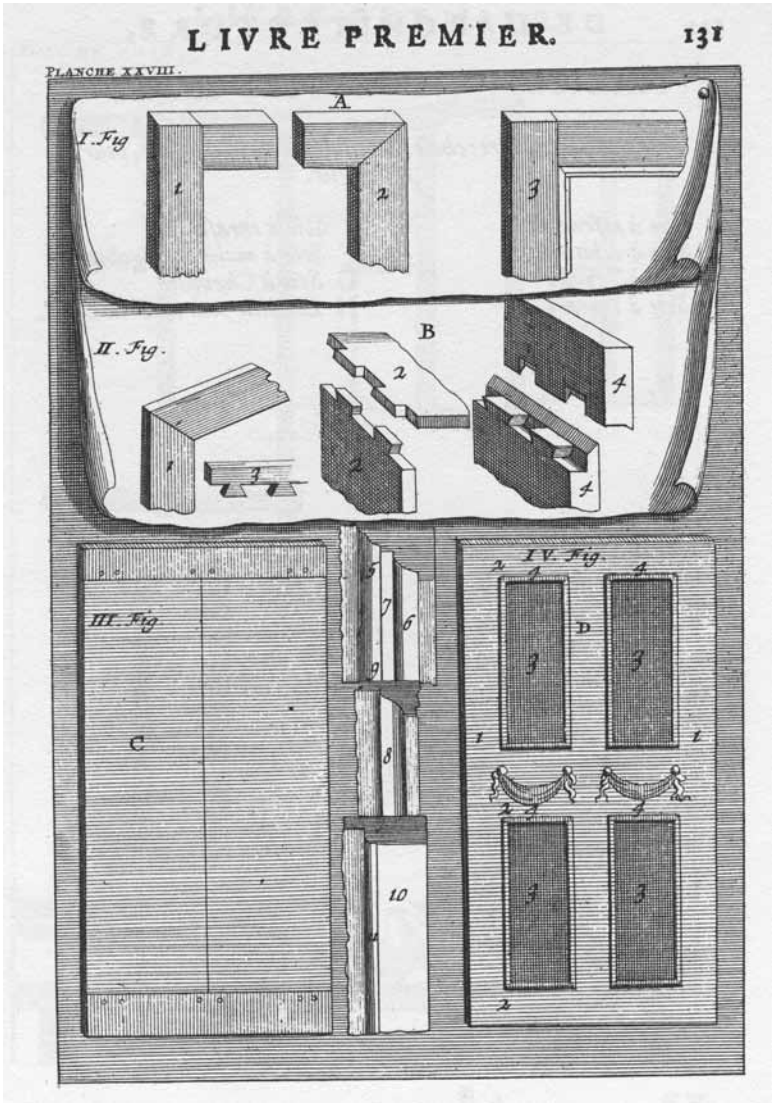
APPENDIX

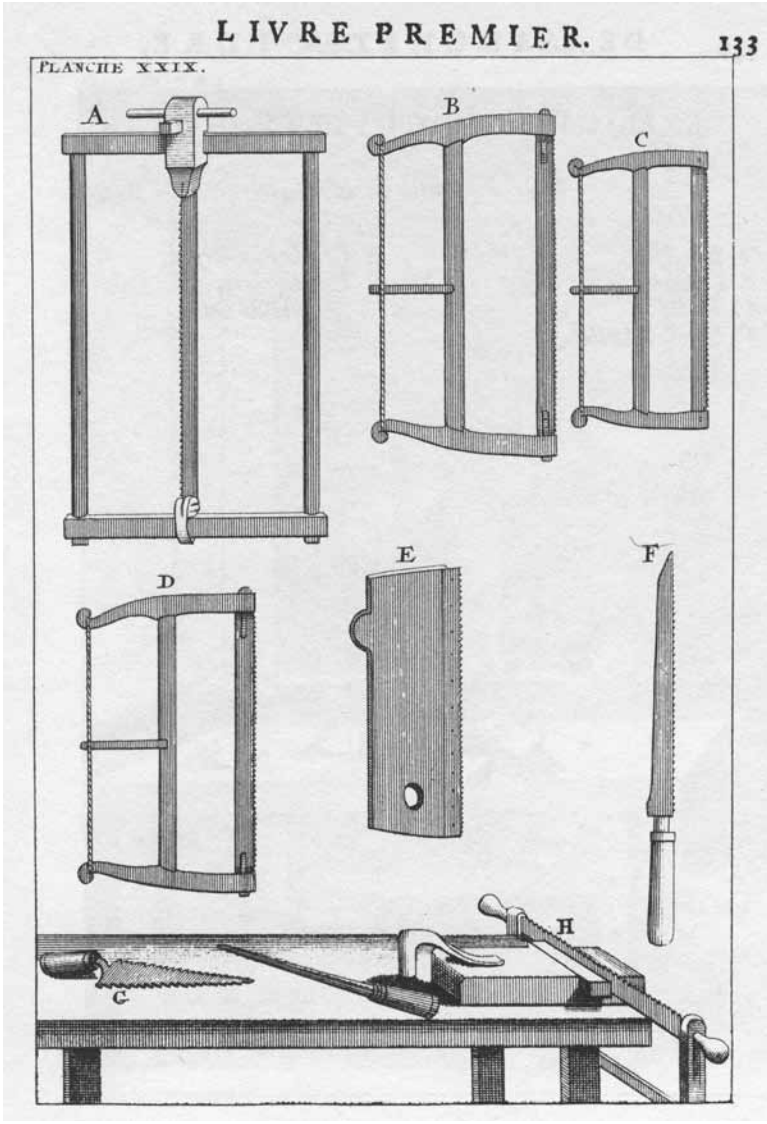
Select Plates from André Félibien

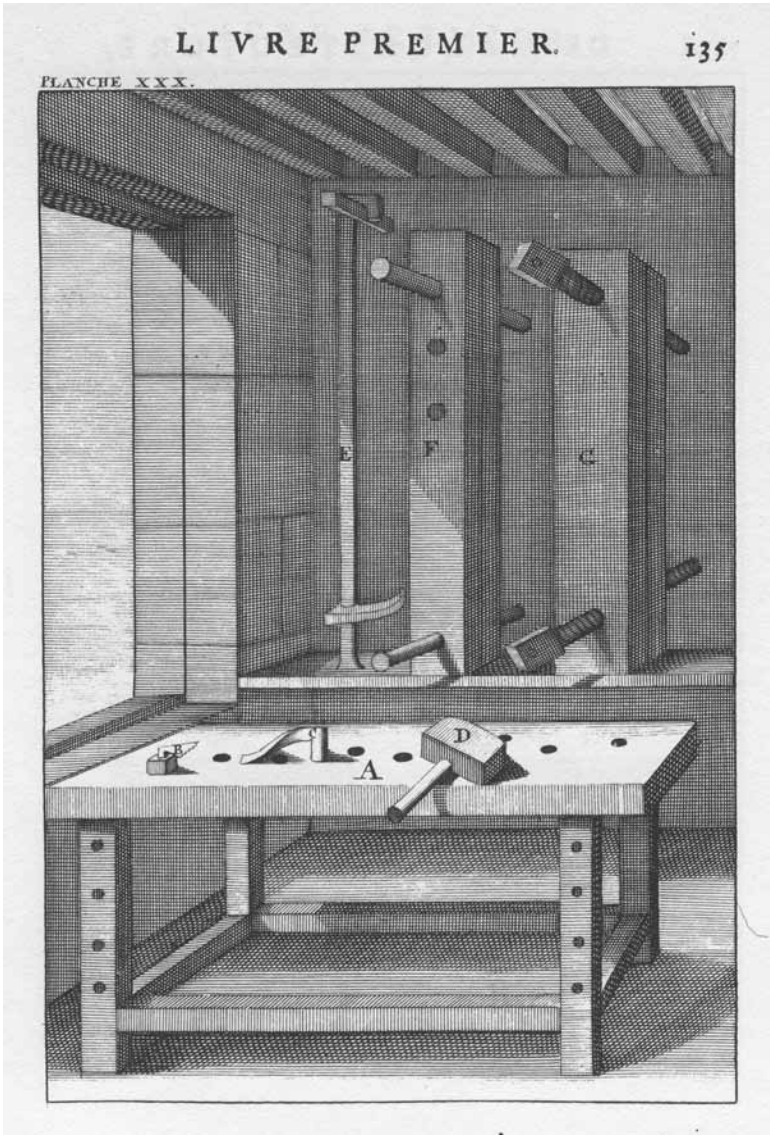
It has been widely reported that the plates in Moxon were copied from André Félibien's "Principes de L'architecture..." (1676). Félibien is sometimes noted as an architect, though that is in doubt.

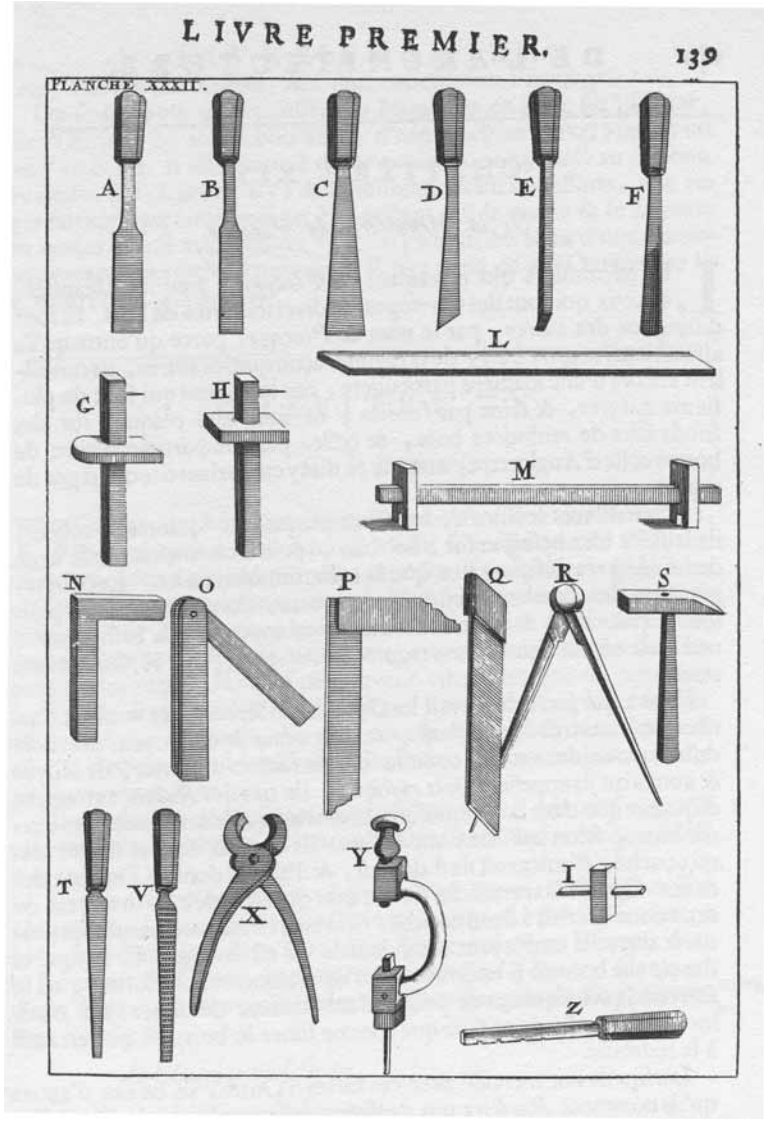
What is known is that he was a prolific chronicler of the arts in France. His book (the complete title is "Des principes de l'architecture, de la sculpture, de la peinture, et des autres arts qui en dependent: Avec un dictionnaire des termes propres à chacun de ces arts") was published anonymously before the publication of Moxon's "Mechanick Exercises."

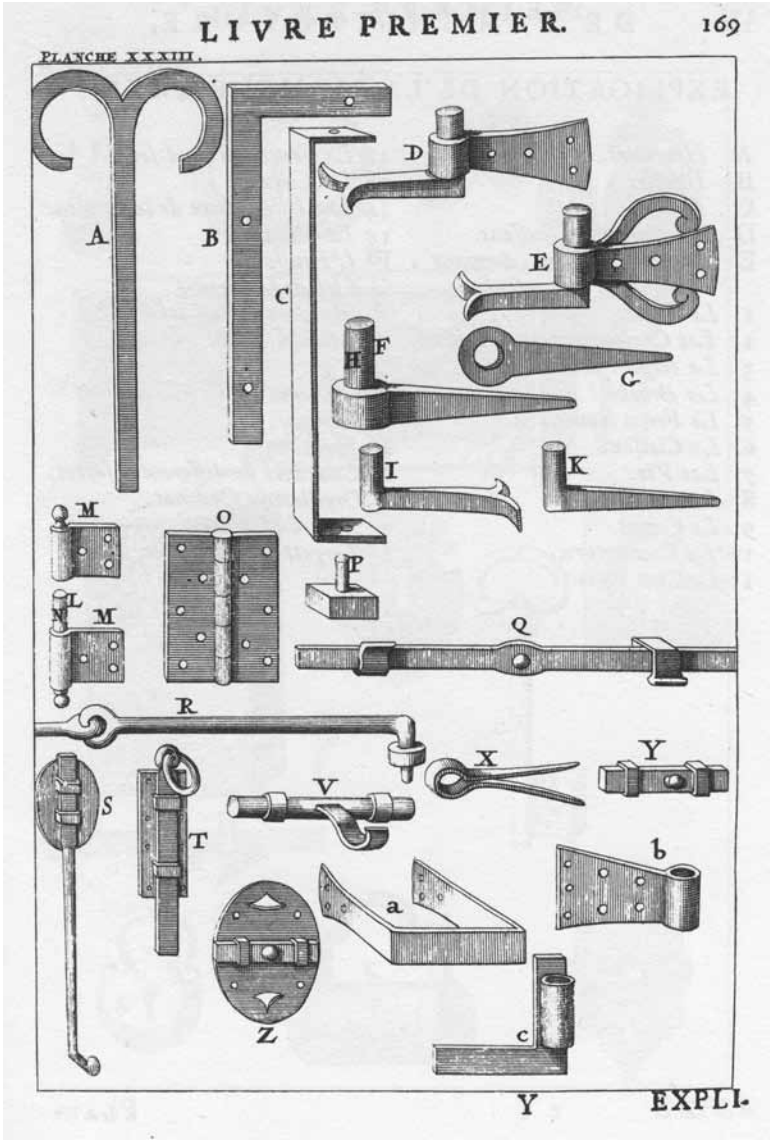
What follows is a selection of plates that show tools that are relevant to the building trades and joinery for you to examine.


LIVRE PREMIER. 131
PLANCHE XXVIII.
I. Fig
A
II. Fig.
B
III. Fig.
C
IV. Fig.
D


LIVRE PREMIER. 133
PLANCHE XXIX.
A
B
C
D
E
F
G
H


LIVRE PREMIER. 135
PLANCHE XXX.
E
F
C
B
A
D


LIVRE PREMIER. 139
PLANCHE XXXII.
A
B
C
D
E
F
L
G
H
M
N
O
P
Q
R
S
T
V
X
Y
I
Z


LIVRE PREMIER. 169
PLANCHE XXXIII.
A
B
C
D
E
F
G
H
I
K
M
L
N
O
P
Q
R
S
T
V
X
Y
Z
a
b
c
Y
EXPLI.

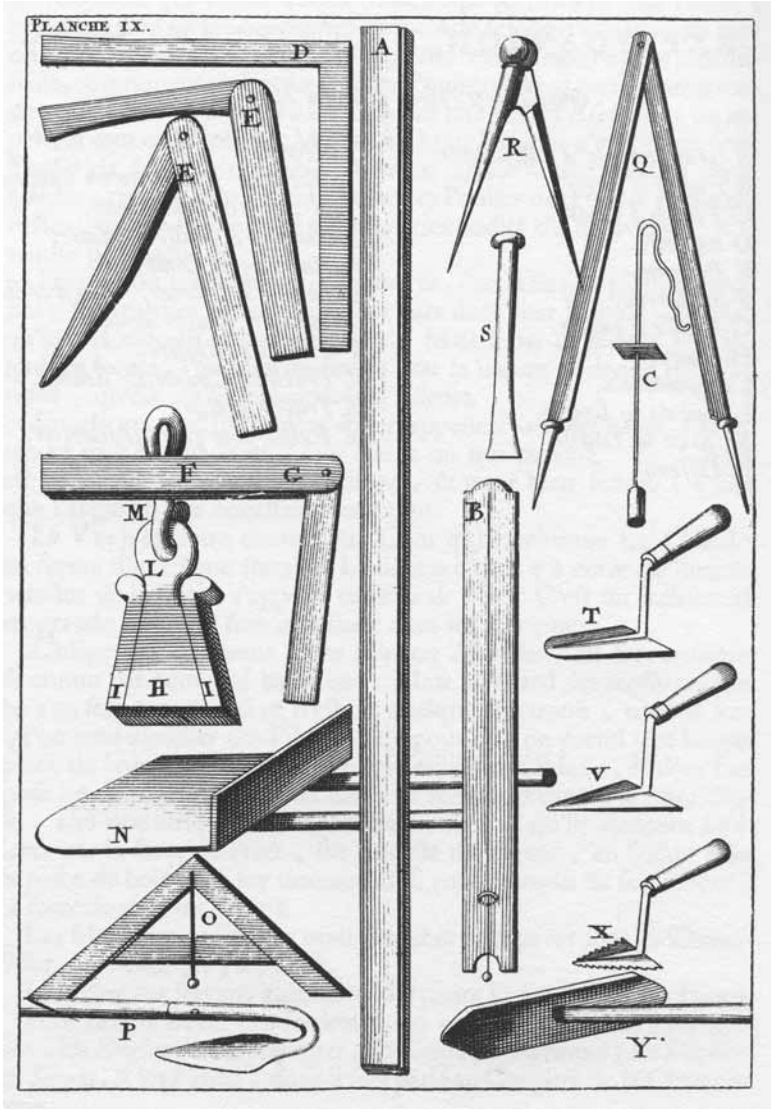


PLANCHE IX.
D
A
E
E
R
Q
S
C
F
C
M
L
B
T
I
H
I
V
N
O
X
P
Y

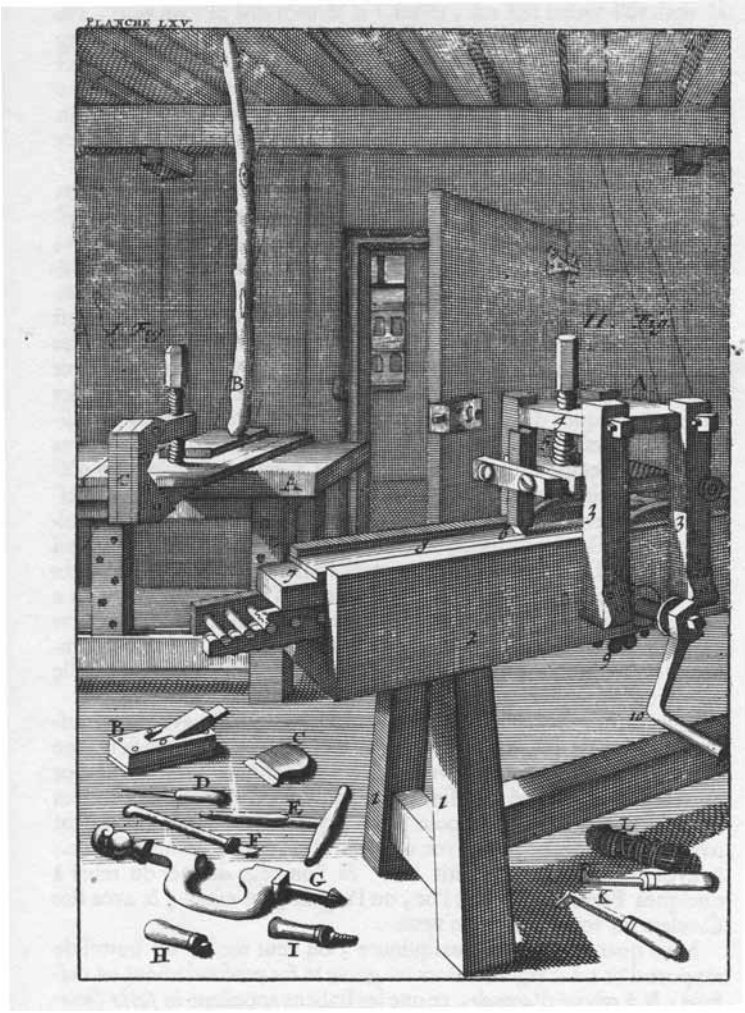
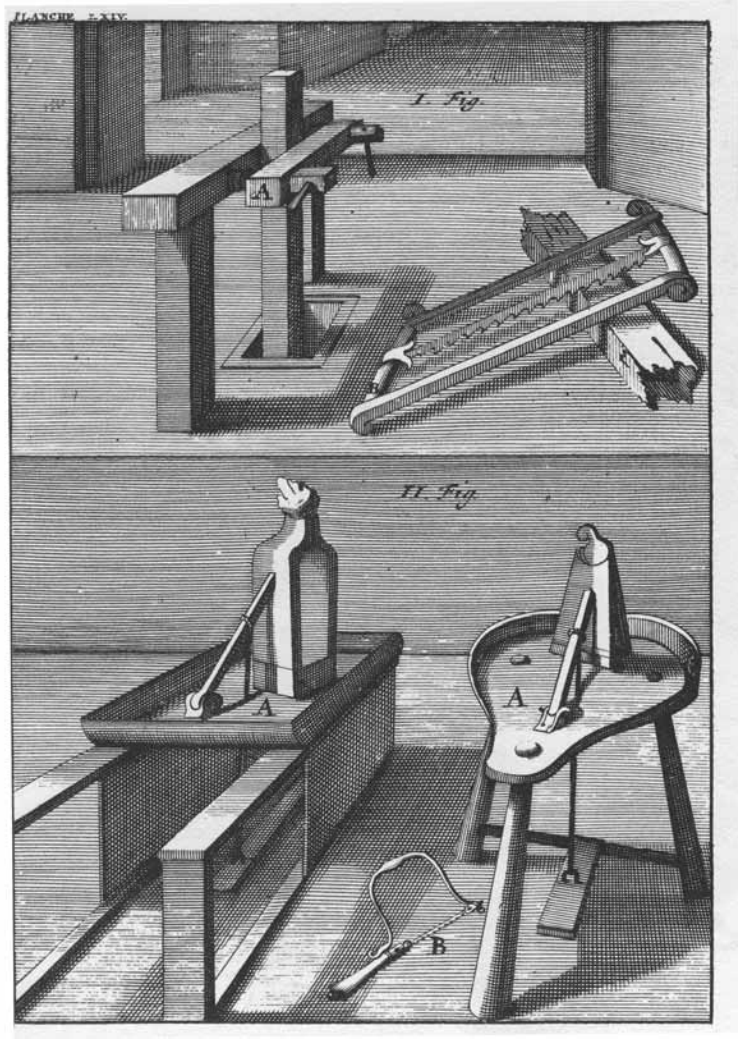
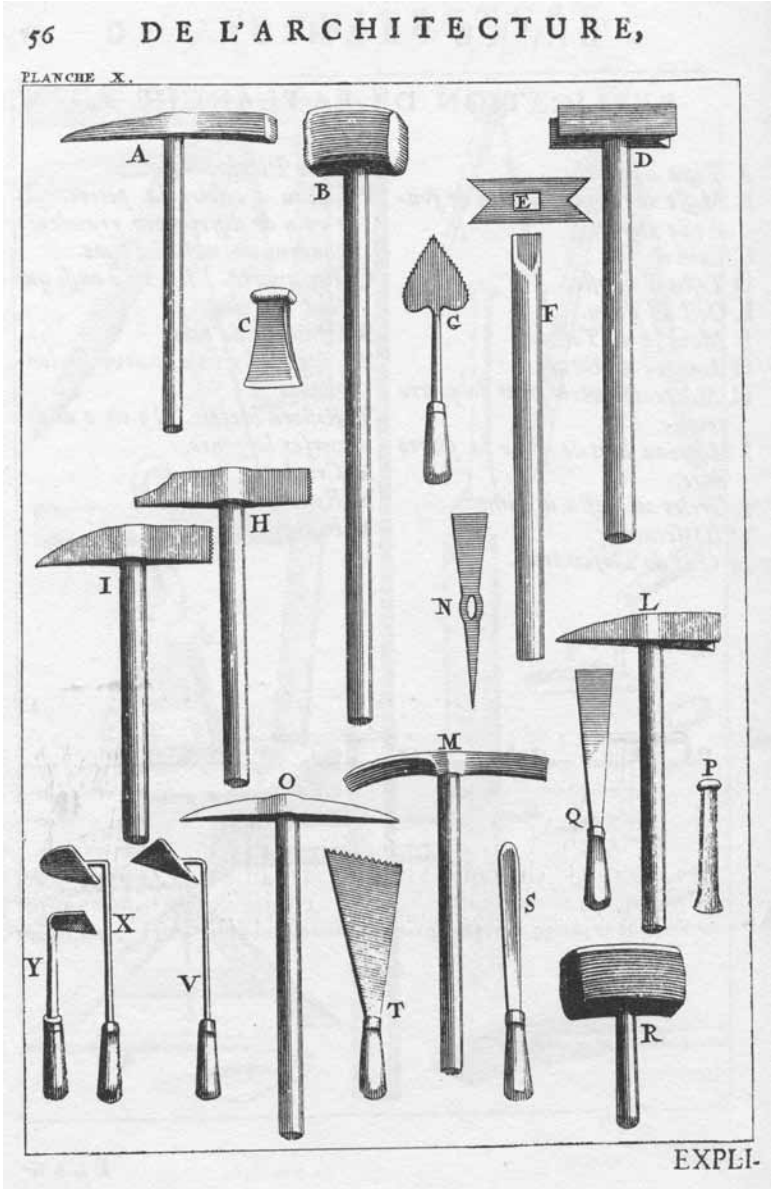
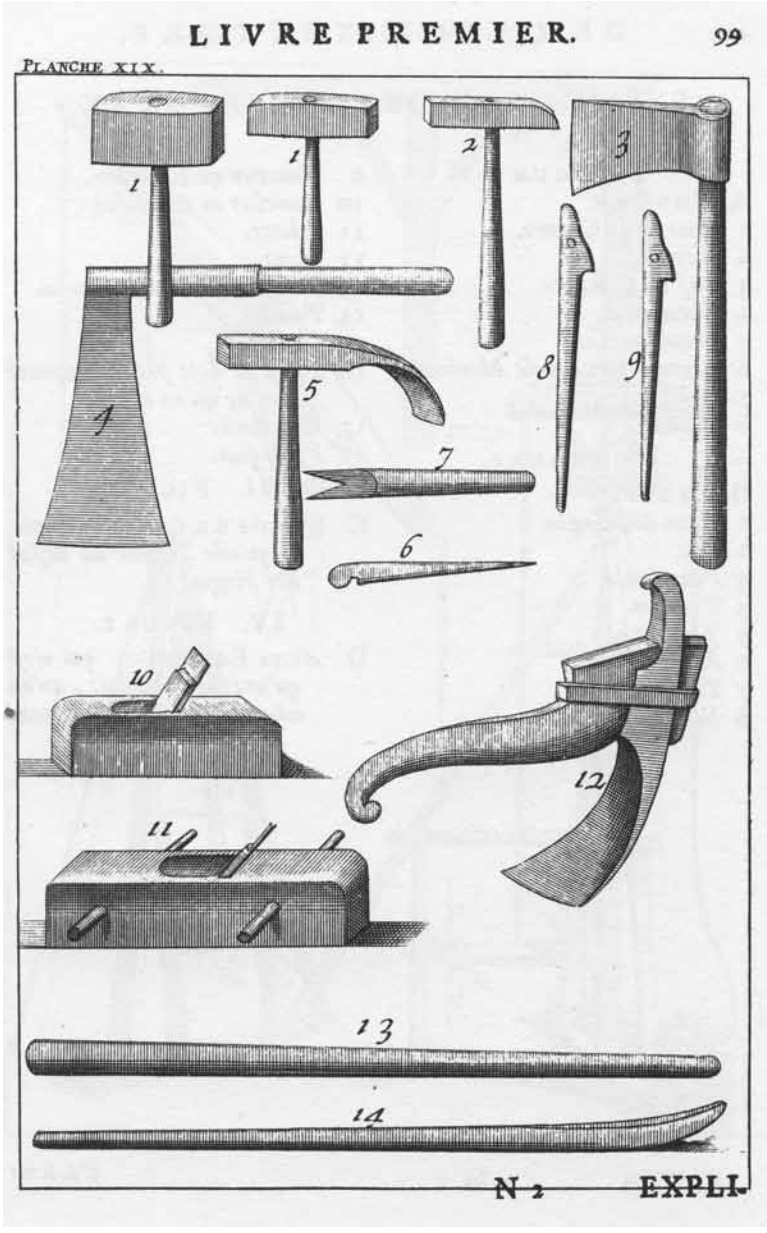
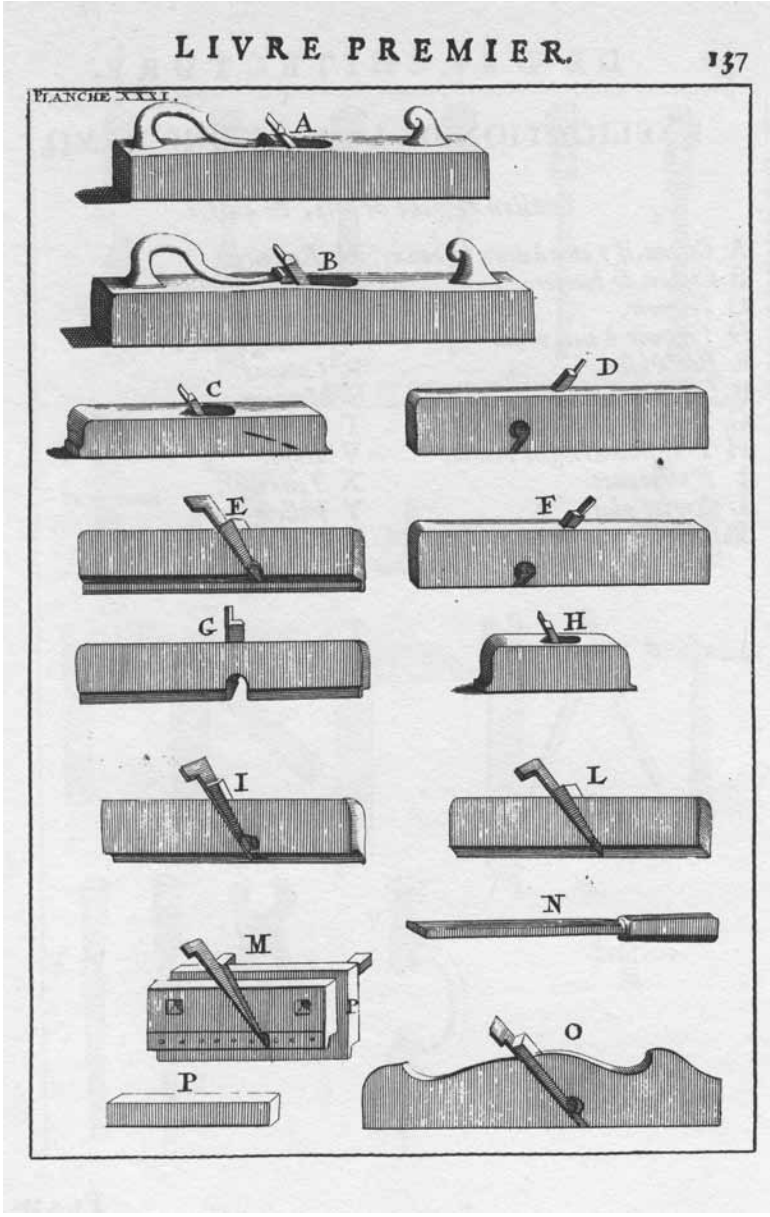


PLANCHE LXV.
A
B
C
D
E
F
G
H
I
K
L


I. Fig.
A
II. Fig.
A
A
B


56 DE L'ARCHITECTURE,
PLANCHE X.
A
B
C
C
D
E
F
H
I
N
L
M
O
P
Q
S
T
V
X
Y
R
EXPLI-


LIVRE PREMIER. 99
PLANCHE XIX.
1
1
2
3
4
5
6
7
8
9
10
11
12
13
14
N 2
EXPLI.


LIVRE PREMIER. 137
PLANCHE XXXI.
A
B
C
D
E
F
G
H
I
L
N
M
O
P

INDEX

References to Moxon's original text are in parentheses.
Figures are noted in *italics*.

A

Alexander, Jennie, 4, 75

auger, 60-61 (121-122), *60, 61, 94 Pl.4 fig K*

B

bench hook, 1 (99), *3, 94 Pl.4 fig A-b*

bevel, 50-55 (117-119), *51, 52, 53, 54, 94 Pl.4 fig F*

- eight-sided frame, 53, 54-55, *54, 95 Pl.5 fig 3*
- function and use, 50-52

brace. *See* piercer

C

chisels, 30-34 (107-109), *94 Pl.4 fig C1-6*

- former (firmer), 30-31 (107-108), *30, 94 Pl.4 fig C1, C3*
- gouge, 34 (109), *34, 94 Pl.4 fig C6*
- mortise-and-tenon exercise, 44-45, 47, *48*
- mortise, 33 (109), *33, 94 Pl.4 fig C5*
- paring, 31-32 (108), *31, 32, 94 Pl.4 fig C2*
- skew, 33 (109), *33, 94 Pl.4 fig C4*

compass, 74-75 (129), *46, 75, 95 Pl.5 fig E*

- *see also* mortise-and-tenon exercise
- versus dividers, 75

D

dawks, vi, 6, 37 (100, 111, 112)

F

Félibien, André: "Principes de L'architecture," 2, *Appendix 141-152*

Follansbee, Peter, 4, 75

G

gimlet, 59-60 (121), *59, 60, 94 Pl.4 fig I*

glossary, annotated, 82-92 (133-140)

glue, 75-77 (130-132)

- choosing and boiling, 75-76
- using, 76-77

glue pot, 75, 76 (129), *76, 95 Pl.5 fig F*

H

hatchet, 61-62 (122), *61, 62, 94 Pl.4 fig L*

- blade, 62
- ladder chops, 41, 62, *41*

holdfast, 2, 5 (99), *3, 94 Pl.4 fig A*

- *Le Raboteur* (Carracci), 5

Holme, Randle: "The Academy of Armory," 10, 72

- bow saw, 92
- compass, 75
- English planes, 10
- Hand-saw, 67
- odd saws, 72

I

irons
- *see also* under planes
- pitches for moulding planes, 26, 27 (106)
- setting the iron, 7-8, 11
- fine-set, 84 (135)
- rank, 88 (138)
- strike button, 11
- sharpening, 28-30 (106-107), 28

J

jack plane. *See* fore plane under planes

L

ladder chops. *See* under hatchet

lumber thievery, 70

M

marking gauge, 57-58 (120-121), *41, 57, 94 Pl.4 fig G*
- planing and squaring exercise, 38-39, 41, 43, *45*

miter box, 55-57 (119-120), *55, 95 Pl.5 fig B*

miter square, 49-50 (117), *49, 50, 94 Pl.4 fig R*

mortise-and-tenon joint exercise, 42-49 (113-117), *45, 46, 48*
- equalize the strength of the components, 42, 46
- sizing, 42-43, 46

moulding machine. *See* waving engine

N

Neve, Richard: "The City and Country Purchaser," 15

P

paring to a joint, 1 (98)

piercer, 58-59 (121), *58, 59, 94 Pl.4 fig H*

planes, 5-27 (99-106), *viii, 94 Pl.4 fig B1-6*
- coffin smoothing plane, 19, 94 *Pl.4 fig B7*
- fore plane, 5-13 (99-102), *viii, 7, 94 Pl.4 fig B1*
  - function and use, 5, 6, 8-10, 19
  - iron, 5-6, 7-8
  - shavings, hard and soft woods, 8, 10-11, 9, 11
  - traversing, 9-10, 11, 13, 12
- jack plane, 6
- jointer plane, 13-16 (102-103), *viii, 13, 15, 16, 94 Pl.4 fig B2*
  - function and use, 13-14
  - iron, 14-16,
  - shooting board, 14
  - traversing, 14, 15, 16
- moulding planes, 25-27 (106), 26
  - function, 27
  - irons, 26, 27
  - types, 25-26, 27
- moving fillister plane, 21
- plow plane, 22-25 (104-106), *22, 23, 24, 94 Pl.4 fig B6*
  - comparison to 19th c. versions, 24-25
  - function and use, 22, 23-24
  - setting the fence, 23, 25
- rabbet plane, 20-21 (104), *viii, 20, 21, 94 Pl.4 fig B5*
- smoothing plane, 18-19, *viii, 18, 94 Pl.4 fig B4*
- standing fillister, 21
- Stanley No. 5, 7
- Stanley No. 6, 6
- Stanley "scrub plane," 7
- strike block plane, 16-18, (103-104), *viii, 17, 94 Pl.4 fig B3*
  - cleaning up miters, 17-18

function, 16-17, 18
planing and squaring exercise, 37-42 (111-113), *40-42*
planing stop, 4-5
pricker, 35, 36 (110-111), 95 Pl.5 *below fig E*

R

Roubo, A.-J.: "L'Art du menuisier," 4, 35, 36
rank. *See* under irons
rule, 73-74 (129), *73, 95 Pl.5 fig D*

S

saw expressions, 65 (124)
saw wrest. *See* under saws
sawing trestle, 71, *95 Pl.5 fig O*
saws, 63-73 (122-129), *63, 64, 67, 69, 71, 72, 73, 94 Pl.4 fig E, M, N, O, P, Q*
choosing, 63, 66
compass saw, 72 (128-129), *73, 94 Pl.4 fig E*
filing and setting the teeth, 64-65, 66-67
saw wrest, 63, 64, *94 Pl.4 fig Q*
whetting block, 63, *94 Pl.4, fig P*
hand saws, 71, (128), *72, 94 Pl.4 fig O and above fig P*
pit saw, 67-70 (125-127), *69, 94 Pl.4 fig M*
whip saw, 70 (128), 71, *94 Pl.4 fig N*
sharpening
grinding and honing irons, 28-30 (106-107)
moulding planes, 26-27 (106)
shooting of a joint, 1 (98)
square, 34-36 (110-111), *35, 36, 94 Pl.4 fig D*
see also planing and squaring exercise

T

traversing. *See* under planes

V

vises, 1-2, 3-4 (99)
bench (single-screw), 1-2 (99), *3, 94 Pl.4 fig A-f*
double-screw, 2, 3-4 (99), 3, 4, 94 Pl.4 fig A-g

W

wainscoting rooms, 80-82 (132-133), *81, 97 Pl.7*
waving engine, 77-80 (131-132), *78, 95 Pl.5 fig 7-9*
Thornton, Jonathan (modern reproduction), 80
whetting block. *See* under saws
workbench, 1-5 (99), *vii, 3, 94 Pl.4 fig A*