
Dequevauviller

André-Jacob Roubo

With All the Precision Possible

Roubo on Furniture Making

Donald C. Williams, Michele Pietryka-Pagán & Philippe Lafargue

Lost Art Press

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With All the Precision Possible: Roubo on Furniture Making
A translation of *L'Art du menuisier*

Published by Lost Art Press LLC in 2017
26 Greenbriar Ave., Fort Mitchell, KY 41017, USA
Web: http://lostartpress.com

ISBN: 978-0-9978702-2-0

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Copy editing: Megan Fitzpatrick, Kara Gebhart Uhl
Photography: E.M. Ginger/42-Line for the plates; Authors of essays for shop photos
Book design and production: Wesley B. Tanner/Passim Editions
Index: Suzanne Ellison
Distribution: John Hoffman

This book was printed & bound in the United States of America
Printing by Signature Book Printing, signature-book.com

In memory of Melvin J. Wachowiak Jr.

Friend, colleague and Fellow Traveler on the

road named "I wonder if…"

Donald C. Williams

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*Annotations by Christopher Schwarz, Don Williams, Michael Mascelli, Philippe Lafargue and Jonathan Thornton noted in **bold***

Preface

The challenge of the Roubo Experience is that his unparalleled treatise, *l'Art du menuisier* is both paralyzingly complex and complete while being frustratingly laconic. This paradox is due in great part to the purpose of the tomes, namely to instruct and reveal the process of integrating the design of furniture with the task of building it. This is demonstrated nowhere better in *With All the Precision Possible: Roubo on Furniture Making* than the chapters near the beginning of our volume wherein he assumes the reader's competence in executing fundamental joinery. While in our contemporary missives there are exhaustive and sometimes overheated expositions on this or that particular joint – and there are even entire volumes and videos on the execution of one specific joint – Roubo undertakes no such trifle. His confidence that the reader who picks up his volumes is already well familiar with (and competent in) the design, function and fabrication of the joinery necessary is jarring to our sensibilities because he does not coddle us through the process.

Perhaps the briefest chapter in *Roubo on Furniture Making* is the one titled "The Art of Assembly, Its Uses and Proportions." To the extent that Roubo provides any general instruction on joinery, this 2,000-word essay is all there is. As for the dovetail, from which all things flow for modern woodworking cognoscenti, Roubo expends the grand total of fewer than 500 words; for mortises and tenons, around 800 words, and all of that being consumed with exhortations of making beautiful transitions from one axis to the other via integral mitered mouldings; for scarf joints, also around 800 words but only if you include his brief recitation on scarf-joined arches (modern manufacturers will no doubt be delighted at his illustration of doweled joints in *Plate 10, fig. 12*).

I took great delight in the 18th-century French representation of "Jupiter's Thunderbolts" and its related siblings in *Plate 10*, and challenge any reader to distinguish between those and Chinese furniture-making joints of the 17th century, or Japanese temple builder's joints of the centuries preceding even that. I am not suggesting any relationship other than that the creativity of the human experience when applied to the identical materials science and engineering problems often results in similar if not identical responses.

As a reader of Roubo myself I find the theme presented throughout *Roubo on Furniture Making* is one of unity, unifying what I know about the character of wood, what I know about the processes of fashioning wood into pieces for functional performance, and unity of the eye, heart and soul in seeking beauty as the end result of bench work. I am not suggesting or even implying that Roubo's treatise is not profoundly practical. Though never formulaic, unless that is called for, he attempts to guide the craftsman to accomplish in reality what was to that point only a vision, a dream, an idea.

In the vernacular of the moderne, he did not major in the minors. Were he to devolve into detailed expositions on tool sharpening or a puerile question as to the pins-first vs. tails-first debate he would have never accomplished his goal. I am fairly certain that such a rhetorical exercise would have been nonsensical to him and his contemporaries.

Instead his starting point is often our ending point. The probable response in the ateliers of his day to a craftsman admiring a nicely made dovetail would have been a smack on the head. Skilled execution of tasks was simply the expectation and lexicon of that era. Exactly what the specific task was to be accomplished was an entirely different element in the equation then and now, and it is where he expended his didactic energies.

Certainly like many craftsmen I revel in those few times where he goes deep into the "how" of doing. For most of my contemporaries, woodworking and furniture making is avocational, a pleasant distraction from the vulgarity of the world around us and an undertaking wherein we are in control. Most of us do not have to be even the least bit efficient in our tasks in the shop, beyond that necessary to alleviate our impatience or forestall boredom. Not so with Roubo's mates in the atelier; efficient workmanship was what kept them ahead of starvation. To that end he shared a wealth of knowledge, idiosyncratic to be sure, on his understanding of the best way to get something done. Hence his wonderful commentary on timbering and sawing, for instance. Of seasoning and selecting woods. Of affixing hardware to doors such that it performed flawlessly and unobtrusively. Of layout and proportioning. Of gluing, clamping and cutting mouldings.

This volume contains two captivating sections on the selection and use of tools themselves, and the work processes in an 18th-century Parisian atelier. While *Plate 11* is often extolled for its detailed presentation of "The Roubo Bench," adjacent passages describe the spatial organization of the shop itself in order to yield the highest output efficiency. This snapshot into the daily lives of craftsman of the era is a compelling and engaging narrative, certain to bring about considered reflection on the part of an attentive reader. Further, *Plates 12-20* and*308-320* provide in-depth descriptions of the arcane tools (and machines) of the trade employed to create the beautiful objects elsewhere in the volume, and for example *Plates 228-230* render perhaps the most concise and comprehensible instruction on the topic of woven cane-bottomed seats I have ever seen. Several other brief passages scattered throughout the book yield true informational treasures about the processes inherent in the making of furniture. These nuggets of wisdom are priceless tutelage regardless of the particular form an individual furniture makers chooses to work.

Still, this insistence on skillful execution is subservient to the purpose of that skill, which is to create functional yet stylish, dare I say beautiful, furnishings for his patrons. Yes, Roubo gives detailed explanations for the installation of show covers on chairs, but only in concert with providing the context for how chairs are used in the domestic patterns of their users. Building beds and case pieces and tables and chairs and desks is explained more in reference to making them elegant rather than merely making them as a craft exercise. It was not enough to make a bed or sofa well, it must be made well in The Polish Style, in The Turkish Style or in The French Style, etc.

Readers will be disappointed if their expectation here is for Roubo to instruct them in some elegant mythology of Parisian joinery circa 1765. I celebrate the maturity and sophistication he presumes and imposes on the craftsmen of his time, and hope it will serve the same purpose in ours. In short, throughout *l'Art du menuisier*, Roubo provides detailed construction information only when he believes it is necessary to facilitate the craftsman's journey toward the integration of technical excellence with the achievement of beauty and elegance.

But what a journey it is. I hope you will join me on it, and be as inspired as am I by the observations from an era long past that remain transformative to this day.

Donald C. Williams

A Key to the Text

While reading *With All the Precision Possible,* here are some helpful tips about the structure of the book and some unfamiliar terms used in this published English translation.

The pages are set up much like the original 18th-century edition. As in the original printing, the margins of the pages contain references to page numbers and plates. Page numbers refer to the pages in the French work; they allow readers to find passages in the original and compare our English version with Roubo's French.

The plate numbers also duplicate the structure of the original. In the French text, the plates were printed in a separate section of the book, so the plate numbers helped the 18th-century reader locate the illustrations that matched the text. We have included the plate numbers because Roubo also used them as a way to jump to a new topic.

At times you will find different kinds of parenthetical comments in the text. Comments that are surrounded by parentheses are written by Roubo. Comments in brackets are from the translators. Footnotes in the text are from the original French edition and are Roubo's words.

Modern readers might also be bemused by the number of words in italics and the structure of the individual sentences. The italicized words are reproduced from the original. The goal of this translation was to reproduce the structure and feel of the original French work as much as possible – not to edit Roubo into 21st-century English. As such, you will find some sentences that have an elaborate structure. You will quickly develop an ear for the way Roubo writes.

You also will find essays inserted in the book that were written by Donald Williams and other authors. These essays, which explore a tool or process in detail, are set in a slightly smaller typeface. These essays are accompanied by photos and, of course, the voice changes to one of a 21st-century woodworker and researcher.

Instead of converting all of Roubo's measurements to U.S. Customary Units (or metric), we decided to use his original terms. As such, you will find the units of "thumbs" and "lines." A thumb is just slightly more than our modern inch – 1.066". The thumb is further divided into 12 "lines." Each line is equivalent to .088" today. The French foot is 12.792".

Christopher Schwarz
Editor

left. You must always take care to push straight and toward the inside the workbench rather than the outside. You should never leave the right hand off from the top of the half-plane, and on the contrary to hold it [with the right hand] on the jointing plane except to drive it and release it with each pass so that you can push it the full length [extension] of the right arm. Look at *Fig. 21, Plate 17*, which represents a man smoothing wood. [Actually, the figure cited illustrates one man sawing and the other chopping a mortise. He might be instead referring to *Fig. 19, Plate 14*.]

When you work wood, you must hold yourself straight and turned toward your work, the body a bit separated from the bench [with] the left leg held in front, and the right toward the back. The fillister plane is pushed a bit like the jointing plane, except that you hold the right hand at one end, and the left holds the other end of the fillister plane all along its width, the thumb being held in the notch which is made on top.

The plane is held in the right hand, which grasps and presses from above. The left holds completely in front and should reach to about a thumb from the bottom. You must note to press on the right hand when beginning to plane a piece of wood, and conversely lift and press on the left at the other end. This observation is essential, especially when you are re-planing some panels or other works where the ends must be sharp and even. Plate 14

Section IV
The Tools for Marking and Making Joints

Once the wood is dressed [smoothed], you start to mark the pieces up just as you did in cutting them, with the exception that you use some black or red stone, because chalk erases too easily. You lay them out, that is to say, you determine the width of each piece, relative to the place that it occupies, the cuts, and the space for the joinery.

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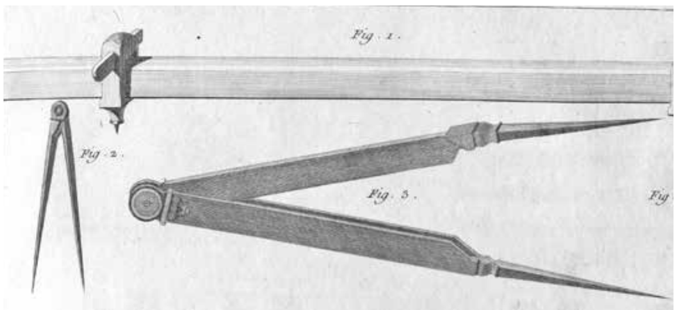
Plate 15 *Tools Needed and Methods for Marking Joints*

The tools appropriate for layout are one or more compasses, the large marking gauge or compass with a handle, a scribing point, triangles both right-angled and mitered, the false square, and the marking gauge with a single point and the joinery gauge [to mark mortises with two points or two adjustable shafts on the same body to mark both side of the mortise at once].

The compass is an instrument too well known for me to undertake a description. All I will say about it is that those that are normally used by Joiners are of iron, of a round form when they are closed, of about 7–8 thumbs in length. There is one of the same shape which is 15–20 thumbs, which serves for dividing sections, for which it is very good (as well as the others) [to set with] steel points that you temper. In general, all these sorts of compasses are of a very soft iron, and without steel points will become dull easily and consequently prevent you from dividing accurate sections, see *Fig. 2*.



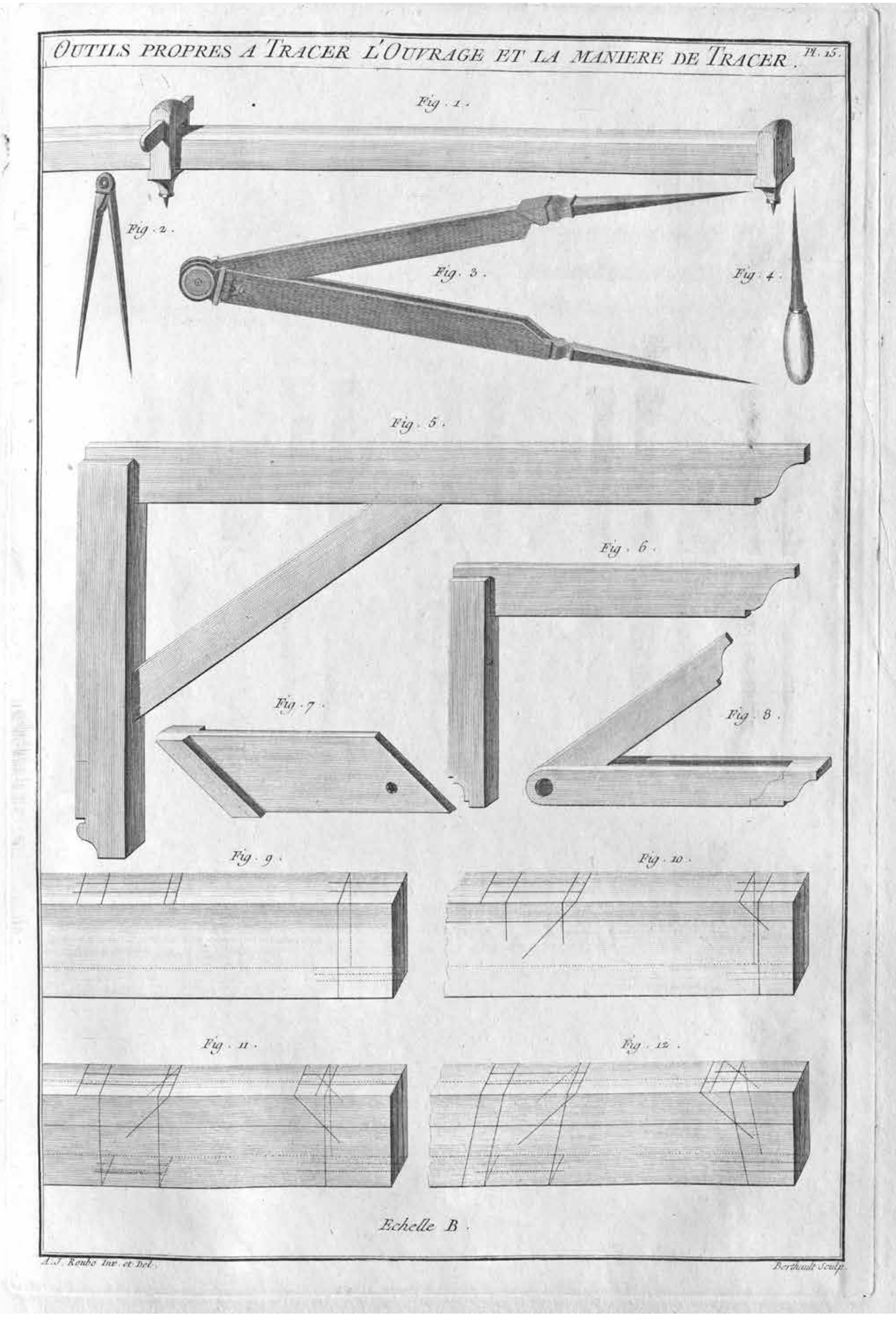


Plate 15. *Tools Needed for Drawing and Methods for Marking Joints*

We still make use of another compass of flat iron, which is much more solid than the others because the width of its arms prevent their bending, and consequently they do not spread out. This compass normally is 2 to 2–and-half feet in length and is called a *false square* in workman's terms, see *Fig. 3*.

The beam compass [trammel point compass] is a shaft of wood which normally is a thumb squared, (although it would be better that it be wider than it is thick, so that it bends less) by 6 or 8 or even 12 feet in length, and at one of its ends is attached a piece of wood which protrudes by about 2 thumbs. This piece of wood is rounded at the end and is finished with an iron point. The other end of the rod enters into another piece, which is a good thumb thicker, and which is pierced with a square hole in the center of its width, above which and in the opposite direction [perpendicular to the shaft] is pierced with a [tapered] mortise, which serves for placing a key in the same manner as ordinary marking gauges. The bottom of this piece is furnished with an iron point, and is of length and shape equal to the first. You use this tool for marking large curves, which you can do at all possible distances since the second piece of wood is mobile on the rod, and is held by means of the key, *Fig. 1*. Plate 15

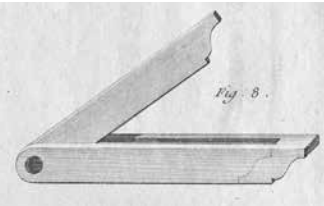
The scribing point is nothing other than a piece of steel ending in a point and which is finished with a handle for holding it or, better said, to prevent its being lost. Joiners normally use their old tri-point files, which are rounded and tempered for this use, *Fig. 4*. *Page 70*

The square is composed of a base and a blade. The base is normally 9–10 thumbs in length by 1–and-a-half thumbs wide and about 10 lines thickness. The blade should be a foot to 15 thumbs long, by 3–4 lines thick and 2 to 2–and-a-half in width. It should be assembled perfectly square in the middle of the thickness of the base by an open mortise and tenon [cut] on its width, and to extend over the [top] edge by a half thumb at the end, *Fig. 6*.

Large squares do not differ from these except that they are larger, having 2 or 3 feet of blade and even more and in that the blade is supported by a brace, which equals it in thickness and which is assembled by mortise and tenon, both in the base as in the blade of the triangle, *Fig. 5*. In general, the usage of squares that I just spoke of is to apply or mark the point for marking right angles on the wood.

The angle square [miter square] is composed of a blade of thin wood about 1 foot in length by 4–5 thumbs in width at one end of which is assembled an angle of 45°, [plus] another piece of wood which borders it by 3–4 lines on each side of its thickness so as to rest against the wood and serve to align it [the square]. This tool serves to mark the cut of the mouldings when the work is assembled at right angles, *Fig. 7*. There is still another little angle square, of which I made the description in speaking of tools appropriate for smoothing the wood (see *page 65*).

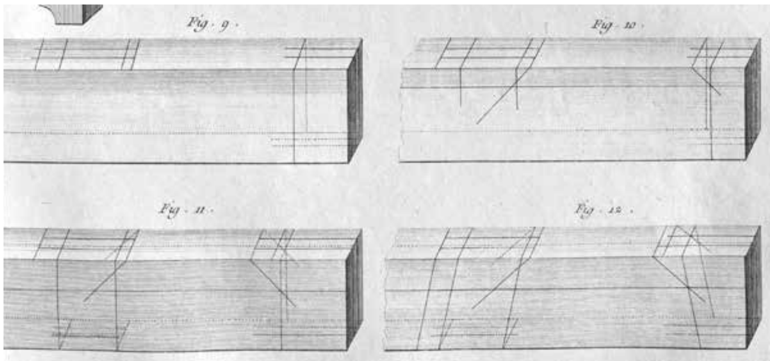
The false square, or bevel gauge, is composed like the square of a base and a blade, with the exception that the base is open along the middle of its thickness by a type of forking which is the same thickness as the blade, which should be about one third of the base width [thickness] and the length of the blade, observing to keep an angled cut on the end of the latter, matching the one at the base of the forking so that the blade cannot go through and it remains level with the base when closed. The base and the blade are held together by means of a screw or a rivet such that the blade is



movable and can open or close as needed. This tool serves for laying out all irregular [angled] cuts; that is to say, it makes neither [only] right angles, nor 45° or mitered cuts, *Fig. 8*.

In general, the wood for squares, at least the blades, should be of service-tree wood [*Sorbus domestica* L.] or [hard] walnut [with] straight grain [to prevent wear] so that consequently these tools are always accurate.

I spoke previously of marking gauges [and joinery gauges]. Look at what I said on page 65. In general, one should know before laying out a joint that the mortises are placed, at least normally,



in the stiles, and the tenons on the rails. The stiles are always placed vertically [and plumb] and the rails are placed horizontally or level, which is the
Plate 15 same thing, and only the stile, while plumb, can be fitted [to receive] tenons at their ends [can have tenons of the rails inserted at the ends of the stiles which have been outfitted with corresponding mortises]. As to the manner of laying them out, look at *Figs. 9, 10, 11 & 12*, on which are represented all sorts of joints and cuts.

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Plate 16 *Tools Appropriate for Making Grooves*

After having laid out the wood, and before making the joints, you begin to use moulding planes or scratch stocks/beading planes or other planes used to clear the way [removing excess wood], when the work is accomplished by adjusting one or the other [referring to tool options mentioned above], and by making the necessary removal/planing of wood.[3]

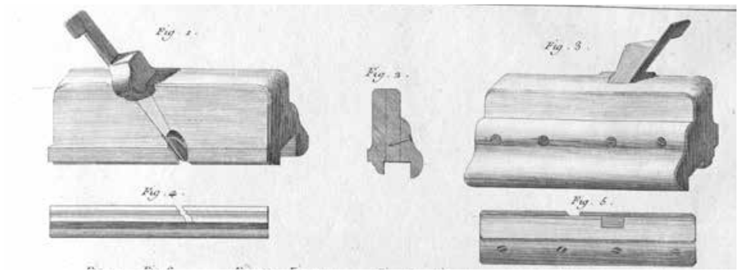
The tools appropriate for this use are the gorge and gorget [types of moulding planes] that are similar [gorges are larger planes to shape concave mouldings with a double fillet or double square bead, and gorgets are smaller planes to shape concave mouldings with a single fillet or single square bead], and the scratch stocks/beading planes of all shapes and sizes, the two-piece planes [plough or grooving planes you adjust for width of the workpiece and you can set different blades depending the work], the rabbet planes and the ordinary planes [both the block plane or what was called the end-grain plane].

In general the gorge [scotia moulding plane with double fillet] and the gorget [scotia moulding plane with single fillet] as well as all the other tools appropriate for creating the mouldings, are composed of an iron/blade and a body of 9 thumbs in length, by 2–and-a-half to 3 thumbs in thickness/height, not including the projection of the moulding [contour of the negative moulding shape of the sole], and a thickness relative to the latter. That is to say, it is necessary that there remain 8–9 lines thickness of the body [at] the base of the throat [or mouth], so that it does not twist, and that

3. By *ravaler le bois*, we understand the way to trim [thin or diminish] the thickness in certain places, so as to give contour to mouldings [accentuate the mouldings].

it can withstand the pressure of the wedge. For the angle of the throat, you give it at least 50° inclination, just like those of the jointer plane. You will note to always direct it to the outside [configure it with a side escapement], so as to facilitate the exit of the shavings, which is a general rule for all moulding planes, as I just said earlier in speaking of the throat of the fillister plane.

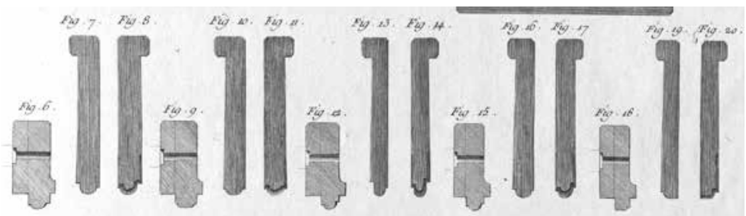
As for gorges [see above description for gorge] and gorgets [see above description], scratch stocks/beading planes and plough planes [to cut grooves], one must take care to make a fence at the pressure point in the front, so that the plane bears equally on both sides [body and fence], which makes them easier to push. At the same time, this prevents the groove from being unequal, especially at the rear. Normally, you apply on the side of the gorge opposite the escapement, a piece



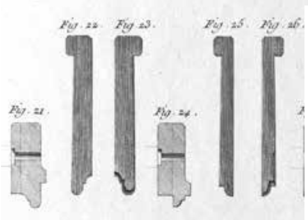
of wood that we call a *fence* [literally "cheek," to be used as a guide], or sometimes you even [build] it in the [body of the plane]. (*Figs. 1, 2, 3, 4 & 5.*) Plate 16

But since the widths of the mouldings are never the same you are always required to change fences, which is very inconvenient. That is why we have deVised not to do it at all, but to set up a moving fence with screws. This is very convenient, given that you can open or close them according to your need.

As for the moulding plane blades, you will not find any at the Merchants. That is why Joiners are obliged to make them themselves, that is to say, they buy the iron that they [un]-temper, and to which they give the appropriate shape, after which they re-temper them. There are those who put to good use many irons in the same plane; that is to say one which forms a square and another the cavity, which is subject to great inconvenience, as these irons pull out sometimes [move up or down the throat during use], which makes the profile of an uneven shape, both on the width and depth. That is why it is better to use only one iron with which you shape squares, which you sharpen with a file. For the body, it is made with very dry oak so that it does not warp and that it is lighter, onto *Page 72*
which you attach a female piece of service-tree or other hard wood for making the contour [profile] and the fence, [unless] you want to make the entire thing of the [same piece of wood], which is



not necessary. This observation is general for all moulding planes. Look at *Figs. 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25 & 26*, where are represented all types of gorges and gorgets



with their irons viewed from both faces. For beading planes, since they are very fragile, it is good to attach there strips of end-grain wood which form the skate. It would be even better to attach there an iron sole, which is attached with a screw, which would better support the iron than would a shaft all of wood, especially [in such] small parts. (Look at *Figs. 27, 28 & 29.*) *Figs. 30, 31 & 32* represent a grooving plane; those of *33, 34 & 35* a tongue plane, where the distance between the fence and the iron is equal to the width of the latter, so that two pieces of grooved wood with this plane can easily fit together. This plane is also named a *grooving plane*. In this case you make the iron a bit larger than the void/fence [to make the groove slightly larger than the tongue], so that the wood pieces that you groove fit easily together, however they differ from the [tongue] plane that should be exact without any play.

The plane with a moveable fence is one of the tools the most necessary to woodworkers, given its application to all forms of work. It is composed of a principal piece or driver [body with the blade and various profiles as needed] and another piece that you change when it is necessary [that would be the fence] of two shafts and two keys.

The body, *Figs. 36, 37, 38* [a fenced plow plane], should be 9–and-a-half thumbs in length by 3–and-a-half thumbs in height, 16 lines thick at the end of the fence section, [which is] the lower section that glides and serves as a guide when held against the work, and 10 lines [of thickness] minimum. This fence should be 9 lines in width at least and be carved out below to be able to place the ends of the fingers of whoever is holding it. In the middle of the width, and at 23 lines from the ends, are pierced two holes or mortises of 10 lines squared through which pass the shafts. Above these holes and in the opposite directions [perpendicular], that is to say, on the width of the piece are pierced two mortises which are positioned to receive the keys, which [tighten] and hold the shafts [similar to] marking gauges. You must note that the one at the back *Fig. 38* is inside the shaft and the other one outside it so that they do not annoy the worker who is holding the plane, which would happen if they were positioned otherwise. The shafts should be 7–8 thumbs in length by 11 lines squared. One of their edges [of the shafts] should be chamfered, one on top and the other below, so that they do not injure the hand. One should take care that they enter straight into their mortises [they fit precisely and squarely], where you will note to leave full the angles which will be worn down by the shafts, and that they be well pierced perpendicularly so that the shafts be truly parallel themselves, and at right angles with the plane body. The end of the shafts is assembled by double-tenon in the fence, and you will take care to make a [shoulder] on each side [of the tenon], so that it carries equally on both sides. Look at *Fig. 37*, which represents the cutaway view of a plane of two sections.

Plate 16

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The body should be 9 thumbs in length so that the fence projects by 3 lines at each end, which is necessary in order to be able to hit it [the fence] with the hammer to open it. Its width [height] should be 2 thumbs 8 lines less the projection of the [skate], such that the [top] of the two pieces are level, and that they be about one line of play between the bottom of the second [body] and the top of the first [fence we are talking here of the L shape at the bottom of the fence]. As for the thickness of the body, it should be determined by that of the skate, plus that of the cheek, which should be 7–8 lines, as I just said.

For the skates, they should be of two sorts: one of wood, the other of iron.

The first are from 3 up to 6 or 8 lines [in] thickness and are part of the body which should be

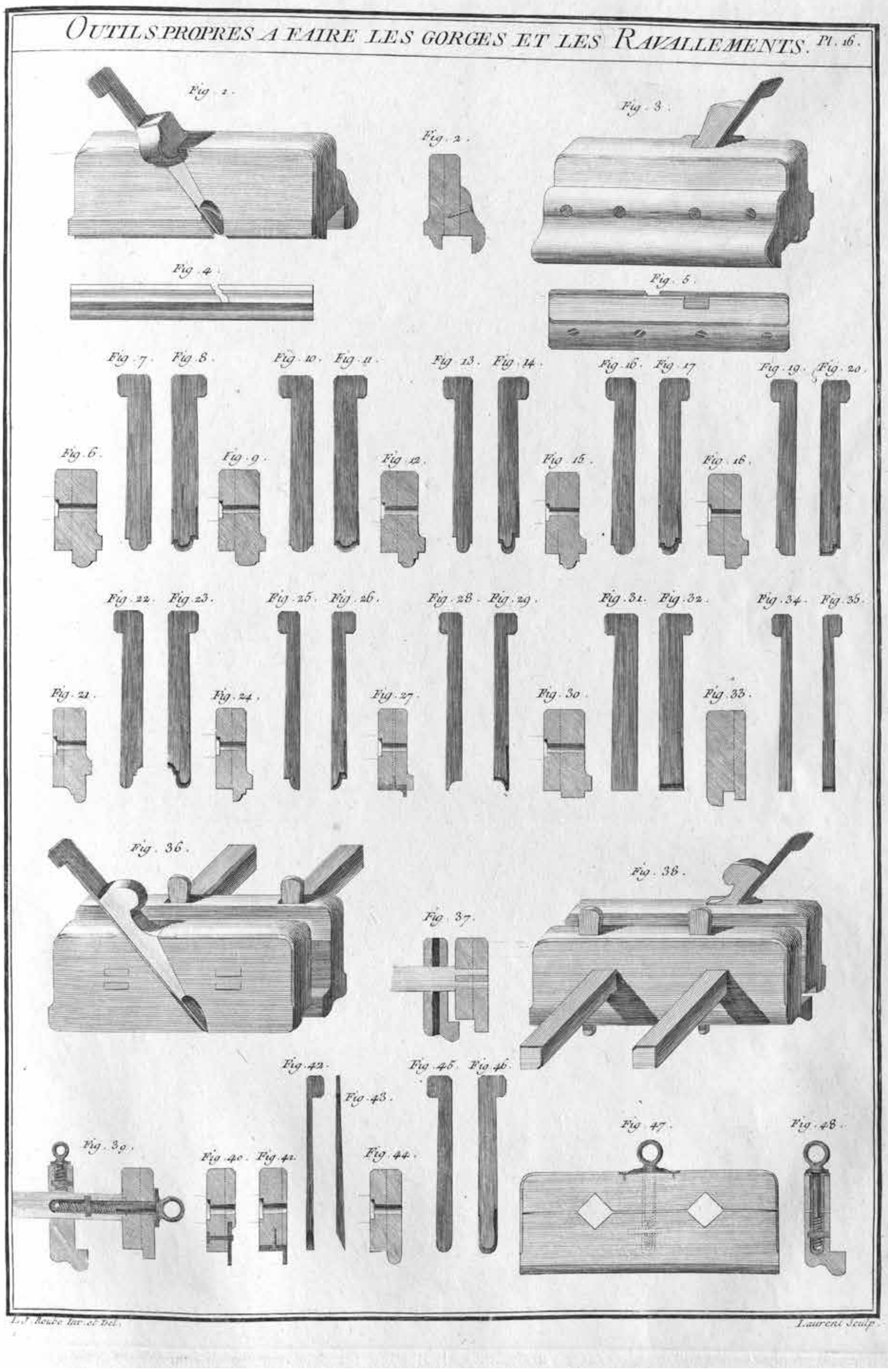
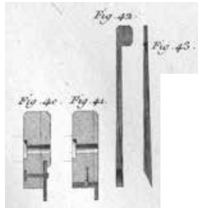


Plate 16. *Tools Appropriate for Making Grooves*

of a pliant [not brittle] and hard wood, so that it can resist the pressure of the iron [blades/knives] (look at figures above).

The second is made of iron blades, which are attached on the cheek with some screws or wrought nails. These [skates] are normally of two pieces, and are separated by the [mouth]. It would be much better to make this of a single piece in which you make a notch [at the location of the mouth], and which would be attached below the piece with some screws with countersunk heads. (*Figs. 40 & 41.*)

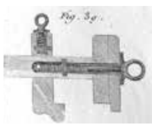
We also make some skates with copper, but those of iron are preferable because they heat up less and consequently drag less in the wood. In general, the skates of iron or copper project from the bottom of the body by 6–7 lines. For thickness, they vary from 3/4 of a line up to 2 lines. The angle of the throat [bed] of [moulding] planes should be 45° to 48°. You place the mouth at 5 thumbs from the back of the skate on the bottom, which is the same for all moulding planes, and you should take care that it incline a bit to the outside [side escapement]. The iron in two-piece planes, as well as the others *(Figs. 42 & 43)* should be as thin as possible, especially those that are more than
Plate 16 3 lines in width. One should take care that they be highly sharpened on both sides and that they project a bit [from the plane body], which should be itself [the body] parallel with the fence. It is, however, good that it [the distance between body and fence] open a bit more at the rear than the front, so that it be easier to drive [push or use the plane]. The width of the iron should diminish a bit up top, so that it not grab the wood.



Page 74 One should take care that it be well placed in its shaft, so that it not be subject to shifting.[4] One should take care to round well all the corners of plane [bodies], as well as all other planes so to make them easy to handle. For wood appropriate to make planes of two pieces, it should be firm and dry. That is why the service tree is preferable to all others.

The two-piece planes with a screw do not differ from those I was just speaking of except that their shafts are held stationary in the [fence] with some screws, which close them and hold them by means of a screw-nut which is placed in the middle of the thickness of the shaft. The top of these screw-nuts is finished with a flange of about 9 lines in diameter, which bears on a plate or roundel/flange of iron, which prevents that on closing the screw-nut the roundel entering into the wood. The head is pierced in the form of a screw-eye in order to be able to close them more conveniently. It is necessary that the shafts enter by 2–3 lines into the piece in front, observing to make [a shoulder] all around so they bear squarely (*Fig. 39*).

These types of planes are very useful because not only can you make cheeks of different thickness, but also grooves of all types, and [use them to make] other tools appropriate for gouging and smoothing the wood. What's more, they spare making a great number of planes, which are often by the size of their bodies, rough and difficult to manage. That is why all the plane side-views [of planes with cheek/skate] that are on this plate are arranged in this manner.

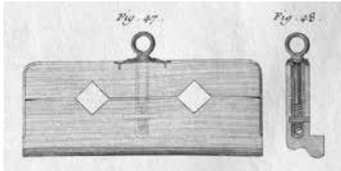


There are two-piece planes where you do not have any keys but only two screws, which are held

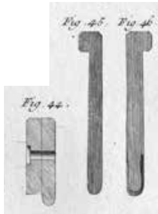
4. In workman's terms, we say that a tool has shifted when it has moved from its place, and that it cannot be pushed completely parallel.

by screw-nuts on the top of the plane, and in tightening them put pressure on the shafts, noting to put between it and the latter a little piece of thin iron, which is held in the mortise and prevents the end of the screw from entering into the wood (*Fig. 39*).

There is still another way to tighten the shafts of planes, which is to make the fence of two pieces joined together by tongue and groove and to place the shafts diagonally in the middle of this joint. You must take care to make a bit of a hollow on its length and to make it bear equally on both sides. After that, you close it with a strong screw which is placed in the middle of its length and which passes in the middle of its thickness and is held in the part of the bottom with a screw-nut (*Figs. 47 & 48*).



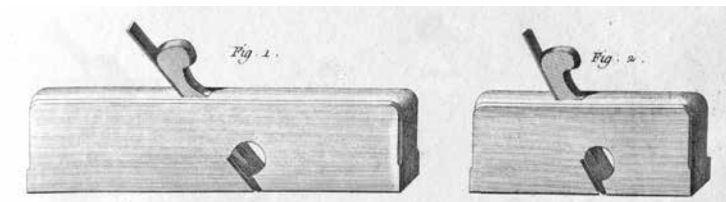
They also make planes of two pieces, curved in both plan and elevation, which do not differ at all from the previous ones, except that the fence or even the bottom of the bodies are curved. There is still another type of plane that we call *bouvet a noix* [moulding plane with rounded blade, *Figs. 45 & 46*, to make grooves with rounded bottoms] that does not differ from the others that I spoke of above except that the skate is rounded. Plate 16
This plane serves to make grooves and other various profiles for muntins, rails and stiles for casement windows and other opening pieces. It is in width from 4–8 lines, and a line more in depth than it is in width. Its iron [blade] should be sharpened on both sides, to prevent its shifting (*Figs. 44, 45 & 46*).

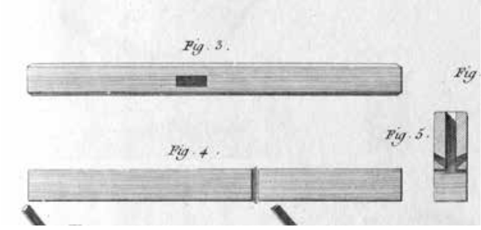


The planes of two pieces are pushed by a single man, but when the irons of the moulding planes are too large, it takes two to push [drive] them, one in the back who holds the body and the fence, and the other in front, who pulls it by the body in the left hand, and with the right hand pulls the end of the screw, or by a peg that you place in the cheek in front of the body. *Page 75*

The rabbet plane is composed of a body, an iron blade and a wedge. The body is normally 15–16 thumbs long, below which and at about 9 thumbs from its end [referring to the heel or rear of plane] is pierced a mouth, which occupies all its width up to about 15 lines in height, after which it ends with a throat in the shape of a wedge of 4–5 lines thickness. This throat should be at an equal angle to those of trying planes, except that the angle of the end [end grain] rabbet plane should be 60°. It should be the most narrow possible at the mouth, that is to say that it only allows for the thickness of the iron and the passage of the shavings. After this, it ends rounded toward the beginning of the throat in the form of a funnel so that the shavings leave more easily.

Plate 17
Tools Appropriate for Cutting Joinery and Their Use





Look at *Figs. 1, 2, 3, 4 & 5*, which represent a rabbet plane viewed on its side, in plan and cross-section. You should make this bed a bit hollow in its length so that the iron sits well on its end. However, you must avoid making it too hollowed because although the iron lifts up at the end,

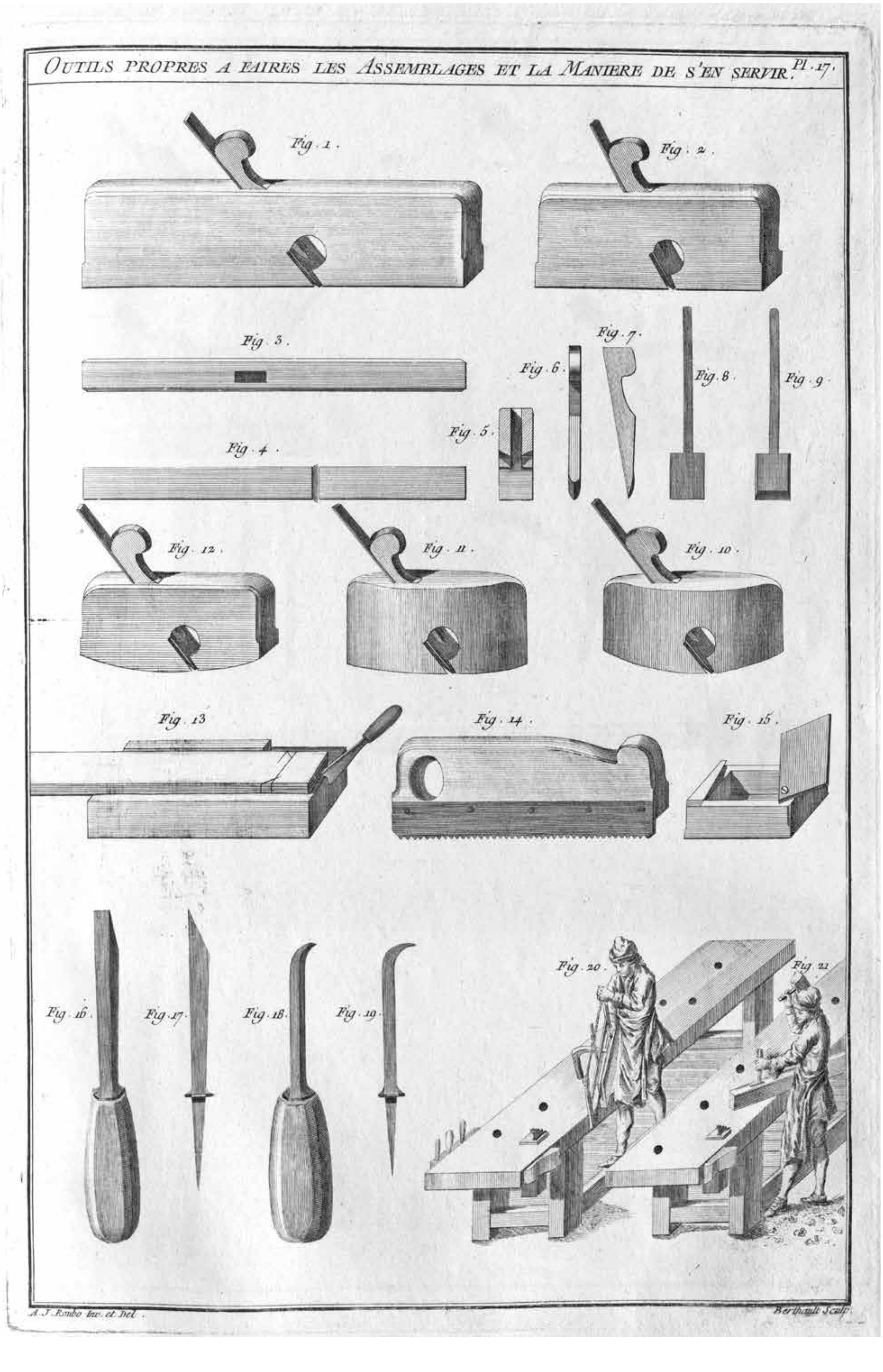


Plate 17. *Tools Appropriate for Cutting Joinery and Their Use*

instead of bearing as it would naturally, the force you use to close the wedge to lock the blade firmly will split the rabbet plane. As for the wedge, it only has a thickness of 4–5 lines, which is the width of the mouth. It projects over the top of the rabbet plane by about 2 thumbs, and you make a notch at the top for pulling it [the wedge], which is better than hitting on the side of the plane with a hammer to release the wedge. The wedge is made to extend to the bottom of the blade as far as possible so that the iron is held better, see *Figs. 6 & 7*.

The iron blade of a rabbet plane is made in the shape of a shovel. It should be absolutely square, a bit sharpened on its [long] edges, and a bit tapered on each side of the shaft, *Figs. 8 & 9*.

The curved rabbet plane, whether along its length or width, does not differ from those that I just spoke of except that they are shorter and have a shape similar to that of a shuttle [from a weaver's loom]. That is why you call it the *shuttle plane*. Look at *Figs. 2, 10, 11 & 12*, where are represented all the types of rabbet planes, flat as well as curved.

The wood being thus prepared, you make joinery, that is to say, the mortises and tenons, the grooves and joints.

Plate 17
Page 76

Before making any tenons you saw the shoulders. For this, you take a piece of wood of 3–4 thumbs thickness onto which is attached a cleat, against which is placed the wood that you wish to saw. This piece is called *entaille a scier les arrachements* [bench hook], which is held on the bench with a holdfast. You sink against the end of the bench hook a double-side beveled chisel or [regular] chisel, which serves to hold the end of the cross-piece and to help the workman, who holds it against the bench hook with the left hand, and saws the cut-out with the right, which should be done the most squarely [upright] as possible, so that the joint aligns evenly everywhere. The saw for sawing cut-outs is only as long as 22 thumbs or 2 feet. There are even smaller ones for smaller wood and other small works, which are made with spring [steel]. Generally, the teeth of the [crosscutting] saws have almost no rake angle [the rake angle at the front and back of the tooth is the same/on cross section are like triangles perpendicular to the baseline] and should be only a bit reclined, so that it is less rough, and you should give it very little set, *Fig. 13*.

The crosscuts are sawn across the [work] bench, although a bit inclined going up the side of the bench hook, so as not to annoy your comrade. There is still a saw for crosscuts which is called *a crosscut backsaw*, which is composed of a wooden body [block] of about 9–10 thumbs in length, on which is attached a saw blade of the same length. This tool serves to saw the crosscut of doors [think about an exterior door not built with rail-and-stile but only tongue-and-groove boards, each board finished with a "tenon" that will end up in the groove of the cross-piece at top and bottom; there is a lot of cross cutting here, for the length of board as well as tenon shoulder] and other tenons of a large size, by pressing it against a wooden fence that you secure the length of the mark [as pencil mark], *Fig. 14*. But in general, an ordinary saw makes the same thing when it [the saw] is well set [properly adjusted].

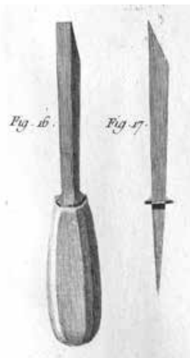
The tenons and open mortises [straddling or bridle joints] are made with a saw. At one time you would make them with a chisel and you would clean them up later with a rabbet plane [for the tenons], while the open mortise you would make with a mortise-chisel and you would clean [it] up with a bench chisel.

The method for making tenons with a saw is preferable, not only because it is faster, but also because the sawing renders the tenon rough and textured, which makes it hold better in the mortise. There are therefore only tenons of a very large size that you should make with a chisel. For the open mortises, after having given two cuts of the saw on the two sides to the necessary depth, you hollow out the remaining wood between the cut out sides with a mortise chisel, and you dress [shape or trim][5] with a chisel.

The saw for tenons should be 26–28 thumbs in length. The slant of its teeth should be between the saw for ripping and that of the saw for crosscutting. One should give it a reasonable set and take care that its teeth be very straight.

When you wish to make tenon [cheeks], you begin by holding the cross-pieces or uprights [stiles] on the bench with the holdfast, such that the tenon projects outside in the direction of the bench hook as much as possible. Then you take the handle of the saw in the right hand [toward the same side where the head of the holdfast is located at two-thirds of the length of the stile] and you press against
Page 77 the thumb of the left hand to guide the beginning of the cut. After that, you join the left hand by the
Plate 17 arm of the saw [near the tension cord of the bow saw being used in this description] and you saw both sides of the tenon diagonally, that is to say, from the [end] to the crosscut-shoulder cut, observing not to remove the mark, but to pass it on the side. When the tenon is thus sawn on one side, you turn it over and you make the same operation until the two sides fall away from themselves.

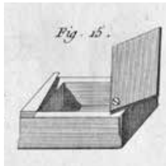
When you saw tenons, you should not remain on the ground, that is to say, work at the level of the workbench; on the contrary, you should elevate the work by 5–6 thumbs because in it being thus elevated you will tire less and you have more strength. The tools appropriate for making mortises are the mortise chisel of all sizes, the mallet and the bench chisel. The mortise chisel is a tool of iron, which is in length from 6 up to 9–10 thumbs, and in width from 5 lines up to 9 or 10, according to different thicknesses, which are from 1 line up to 9–10, as I said earlier. The mortise-chisel is fitted with a wooden handle of oak or hornbeam, from 5–6 thumbs in length and a size relative to that of the tool. You should take care that it is well-centered and fitted equally on the base, so that when struck it does not split. For a mortise chisel to be well made it must not be too large, and it should thin a bit in its thickness without being too thin, which is a defect. Look at *Figs. 16 & 17*. As to the choice of these tools, that is very difficult to do because you can only know them perfectly by using them.

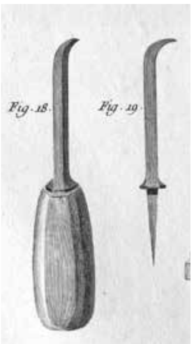


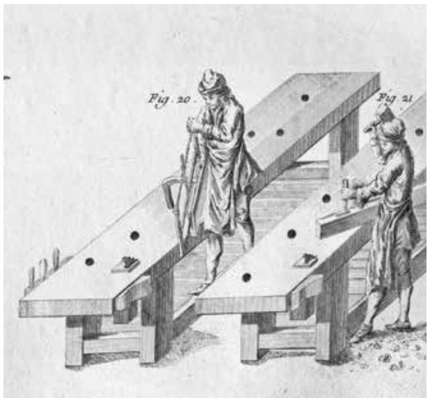
You should reject those that have metal defects and are likely to split along the length of their shafts, especially at the place where the steel is joined to the iron. You should also take care that the steel and the iron are well-joined together because once it begins to separate, there is no way to fix it and it will separate the entire length. You should also take care that the tang be well-made and straight with regard to the rest of the tool. The mortise chisel's handles can still have the fault of being too dry or too soft. It would be better that they are dry because this fault is corrected with use of the tool, rather than the soft handle that continues to disintegrate.

5. In workman's terms, we understand the word *recaller* to mean to join and trim [dress, shape] a tenon or mortise with the chisel. We also say *recaller* the cuts and miters.

When you wish to make mortises, you begin by fastening the work on the bench with the holdfast and as close to the workbench legs as is possible so that the hammering has the strongest support [from beneath] for the cuts [chop mortises over the strongest part of the bench]. Then you take the mallet in the right hand and the mortise chisel in the left [with] the bevel turned toward the end of the bench, and you begin the mortise by hitting first straight on, then at a slant toward yourself, to deepen the mortise and lift up the shavings. When it is deep enough, you turn it in the opposite direction, that is to say, the bevel toward oneself, then you drive it in straight, beginning in the bottom of the mortise and backing out until one reaches the end. One should observe not *Page 78* to remove too much wood, to move the mortise chisel in the mortise at each strike that is made, and to pull out the shavings at the same time. You must also from time to time take care to dip the mortise chisel in a box of grease, which you have at your side on the bench, so that it grabs less in the mortise, *Fig. 15*. When the mortise is thus dug out, you empty it with an even thinner mortise chisel or, even when it is straight, with a hooked mortise-chisel, *Figs. 18 & 19*, which is done with mortises in small [pieces of] wood. When the mortises pass through the wood, you chop them first just Plate 17 to the middle [to half of the depth], and you turn the workpiece over so as to pierce them more accurately. You need to also take care in making the mortises to put the facing of the work toward yourself and the longest piece of the upright [stile] at the back, especially for the mortises at the end of the work, so as to drive the mortise chisel toward the shoulder side of the piece rather than the opposite side [to avoid tear-out on the short end grain]. This observation is essential, especially for the mortises of casement windows. He who makes the mortises should hold himself straight in front of his bench, the left leg a bit forward, and the body held away from the mortise chisel as much as is possible. When the contours are of a certain length, you cut a mitered-angle moulding, and you make at that place on the mortise a notch the depth of the tenon and the width of the cross-piece, which shortens the depth of the mortise, and makes the assembly more accurate. Look at Figs. *20 & 21*, which represent two workmen, one making tenons and the other some mortises.







When the joints are made for assembling frame-and-panels, you begin by establishing the tongue shoulders equally on the panel edge. Then you cut a groove on the frame as is necessary, which is done with the *grooving plane* or fillister place, as I just said. After that, you assemble the panels [by tongue-and-groove joinery], which is done with planes called grooving planes, which are of two types, namely, those which are two separate pieces [moving-fence plow planes] and which are appropriate for joining wood from 1 thumb thickness up to 15 or 18 lines, and the others where the two pieces are but one and the skates are of iron. The latter are appropriate for joining wood panels from three up to 9 lines thickness.

Plate 18
Tools and Methods for Jointing and Gluing of Wood

Page 79 The bodies of the first type of grooving planes, as well as those of those of the second, should be 9 thumbs in length at least (having sometimes up to 10 or 11 thumbs, according to their use in joining wood that is very thick), by 3–and-a-half in height. Their mouths are positioned such as those of the other planes that I just spoke of, such as the fillister planes, the moulding planes, etc. As for their blade angle, it should be 50°. You should take great care that the cheeks of the planes should be perfectly equal, that is to say that the distance between the iron and the cheek of the plane which makes the groove should be equal to the width of the front of the iron of the plane which makes the tongue, not including that which enters into the iron of the stock of the plane. You should also take great care that the tongues fit accurately because when they are too thick they split the shoulders of the grooves. One should also pay attention that the tongues fit well at the bottom of the grooves so that when they are exposed, as in the case of edge-banding or other edge treatments ["elegissement" from the verb "elegir," refers to pieces of wood that have been thinned, lightened in some areas (e.g. tapered edges) of the work where it was not necessary for these pieces to be so thick], you do not see daylight through the joint. One must not cut down/flatten or, better, chamfer the ridges of the grooves to facilitate the Plate 18 entrance of the tongue during assembly, especially in the case of thin wood, because that diminishes the strength of the joint and prevents its bearing equally. The cavities that have the chamfers are subject to being exposed in the re-planing of the work, *Figs. 1, 2, 3 & 4*. For those where the groove plane cuts both the tongue and the groove, it is the same function as these [other planes], as you can see in *Figs. 5, 6 & 7*. As for the iron blades of grooving planes, you must take care that they are truly accurate, that is to say that the plane which makes the tongue makes it so that it enters accurately into the groove, and that it even be a bit snug, especially for very thick joints, where it is good that the joints not be too tight, or too hard to fit, *Figs. 8, 9, 10 & 11*.

As far as the manner of joining panels, after they have been dressed or smoothed, according to whether they are more or less thick, you begin by trimming them and making them equal width, observing to eradicate all types of sapwood, knots and splits, after which you set them up according to the different widths that they should have. You should take precaution to put the planks of a similar color together, the narrowest (which we name *alaises*) in the center [of the panel], and the edges of the plank that are softer [wood closer to sapwood] should be used in the groove joints [in the frame]. After they have been thus set up, you begin making the joints by cutting the grooves, then you make the tongues. After having taken the precaution to position the plank where you have made the groove against where you wish to make the tongue, to see if both of them are truly straight, then you make the tongue. When the wood is thick, you trim the back of the tongue by chamfering [it] with the half-plane [jack plane], so that the plane [the tongue plane] is easier to push. When the wood is rough and very thick, you need two workmen in order to push it, as I said in speaking of planes of two pieces, but the more it can be done by a single workman, so much the better for the work.

It is also necessary to take care that the joints be straight on the edges of the panels and that they fit equally on each side of the groove, even when the work is just a facing [a decorative panel, not structural]. Joints thus well brought together prevent the air from penetrating and, consequently, from warping the panels.

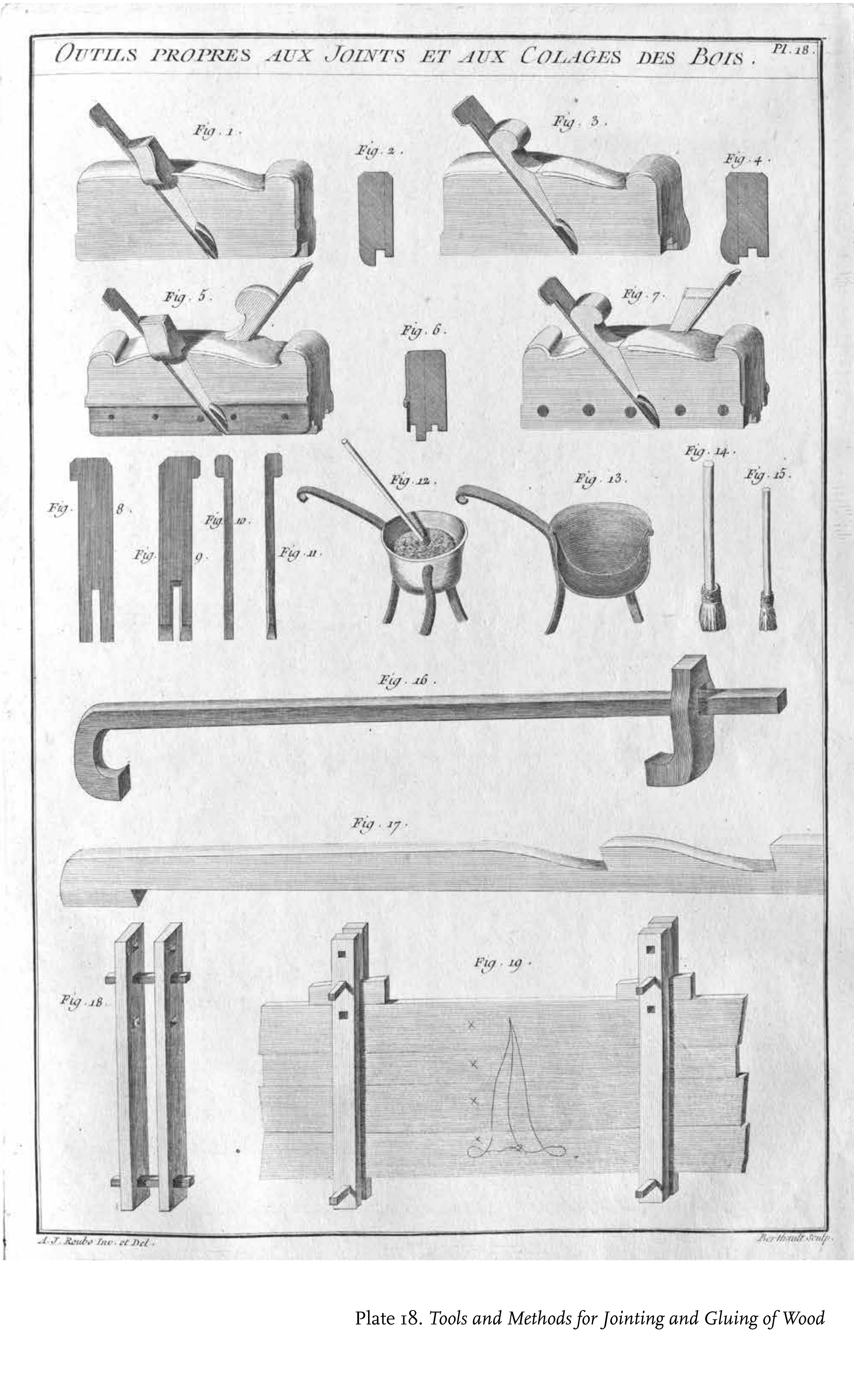


Plate 18. *Tools and Methods for Jointing and Gluing of Wood*

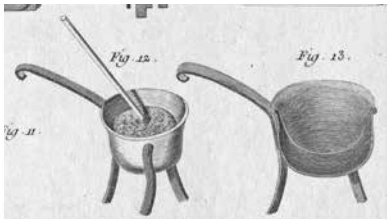
After having made the joints with all the precautions that I spoke about previously, you glue them together; and for this, you disassemble the boards from each other, after having numbered them, so as not to confuse the panels of one panel with those of another. After this, you heat the joints so that the heat opens the pores of the wood, preparing them better to take the glue and hold on to the joints. It is necessary, however, to pay attention that the wood not be too hot because it
Page 80 will dry the glue too promptly and prevent it from holding. As for the glue, it cannot be too hot [in other words, the hotter the glue, the better] because the heat makes all the glue components finer and delicate [less viscous] and consequently better to penetrate in all the pores of the wood.

The glue that Joiners use is called *hard glue*, which is of two types, namely that of England and that of Paris. These two types of glues are made with the sinew and feet of beef that you boil and melt into gelatin, after which you mold it into sheets of 8–9 feet in length by 5–6 in width and 2–3 lines thickness. When it is completely dry and it is of a good quality, it is both hard and also fragile as glass. That from England is the best, not only because it makes half again as much profit, but also because it holds better and its color being a clear yellow means that is does not appear in the
Plate 18 joints when they are well done. You also have the glue of Paris that is not so strong, is black and muddy and it always shows in the joints, no matter how well made.

When you wish to melt the glue, you begin by breaking it in little pieces and you put it to soak in some water for 5–6 hours, after which you melt it on a fire in a copper cauldron.

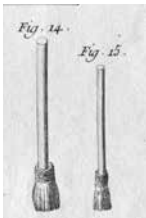
You must observe not to put [in] too much water at first because it will remove some of its quality. You must also take care to stir it up with a wooden stick while it is melting, and when it is completely melted you let it boil on a low fire so as to make it re-heat. You should never leave the glue unattended once it begins to boil because at this time the force of the heat makes it froth and boil over out of the cauldron, which you prevent by adding a little fresh water when it is ready to boil over. The glue is easy to spoil and becomes tainted while you are melting it. That is why this task is best left to one individual man.

Dry glue is sold by the pound, and woodworkers who have a lot of work take care to provision it so that it always remains dry [unspoiled]. When you wish to melt it, you should take care not to melt too much at once, that is, you must not have melted more glue than you can use in eight days, especially in the summer because it molds and loses its quality. You heat it in a copper pot, which has three feet and an iron handle. The feet should be splayed to give it a stable position, but [they



should] not [be] hooked and elevated at the ends because being thus configured [the cauldron] is subject to carrying some of the hot coals with it and to making [coals] fall in the wood shavings [when moving the cauldron around the shop], which is greatly to be feared. Cabinetmakers use a double-boiler pot, in
Page 81 the outer chamber they put the water and the glue in the inner one. This way of heating the glue is called a *bain-marie* [hot bath] and is very convenient because the water being very hot maintains the heat of the glue longer, while preventing the glue from burning at the edges of the pot, *Figs. 12 & 13*.

When the glue is hot, you spread it on the joints with a brush made of wild boar hair, which should be more or less large according to different works. Look at *Figs. 14 & 15*. Then you drive the joints together with a mallet. When there are many joints [complex joinery with many joints being assembled simultaneously] and you fear ruining them with the mallet, you turn them over and hit them on the bench, lifting first one end of a panel and making it fall straight with force on the bench. Then you do the same at the other end, which you continue to do until the joints are perfectly in place. Then



you put them flat on the bench where you stop them using a bar/straightedge of the full length of the panel [that is] secured with holdfast, and you tighten the whole panel with clamps or on edges with clamps and bars, which holds them all along their length and closes them. Bar clamps are iron tools which are made of a bar of iron where the end is curved in the form of a hook, which passes through another piece of iron which is called the *foot of the clamp*, which glides along the length of the bar according to how you judge appropriate. The end of this clamp is curved in the form of a hook, as is the other end of the bar, and is textured at the face like a rasp, so that it [will] not slip when you tighten it but it [instead] holds onto the wood.

The mortise or eye of the jaw should be as accurate as possible, especially on its width, and Plate 18

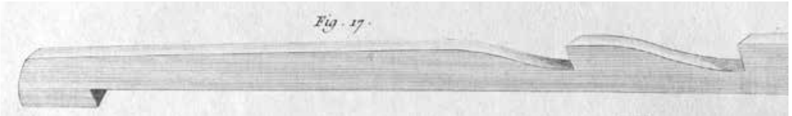
be made a bit slanted on the inside of the foot on the side of the hook, so that when the bar clamp is tightened, the foot will always be at a right angle to the shaft, as least as much as possible. The end of the shaft/bar is hammered back to create a ridge [is "mushroomed"] so the hook cannot get past or get lost. Like most of the regular clamps you cannot remove the moving foot, *Fig. 16*.

This tool serves to hold the joints for both panels and for assembled pieces. You close it by hitting on its movable foot with a mallet below the bar, and you loosen it by hitting the latter on top with the hammer, that is to say, in the opposite direction. [It operates in a manner conceptually identical to the holdfast.]

The length of the bar clamps varies from 18 thumbs up to 6 and even 8 feet in length. As for the width of the bar, it should be from 9 lines up to a thumb-and-a-half, according to the different lengths, and their thickness should be two-thirds of the width. The foot should exceed the upper part of the bar by 3–4 thumbs for the smallest, and from 6 thumbs for the largest. The iron of the bar clamp parts should be soft and without any type of welding, especially the foot, which should be forged with all the care possible.

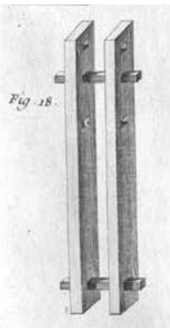
It is good that joinery shops be well furnished with bar clamps, especially those shops with many workmen, which is very convenient for accelerating the work. There are shops where there are up *Page 82*
to 20 lengths of bar clamps of all sorts. When the work is of such great width that one cannot close it with bar clamps, you use a marking rod of wood, which is called a *notch for elongating sergeants* [bar clamp extender], which is 3–4 thumbs in width by 8–9 feet in length and a thumb-and-a-half thickness at least. At one end is made a hook, made equal to the width of the wood, which serves to close the work. On the other side of its width, and in the opposite direction, are many notches

placed at 12–15 thumbs from each other, in which you place the end of a bar clamp, which is tight-



ened on the other edge of the work. You must pay attention that the notches are made at a sharp angle, so the bar clamp jaw stops there and does not come out, *Fig. 17*.

There is still another way to clamp panels, which is done with wooden tools called *straighteners* [from the verb *etreindre*, or to close tightly]. They are composed of two of pieces of wood called *twins* of 4–5 feet in length by 4–5 thumbs in width and 2 thumbs thickness, in which [at] 6–8 thumbs from the ends is pierced a squared mortise of about a thumb-and-a-half, which is in the center of its width, and through which you pass a shaft of 8–9 thumbs in length.

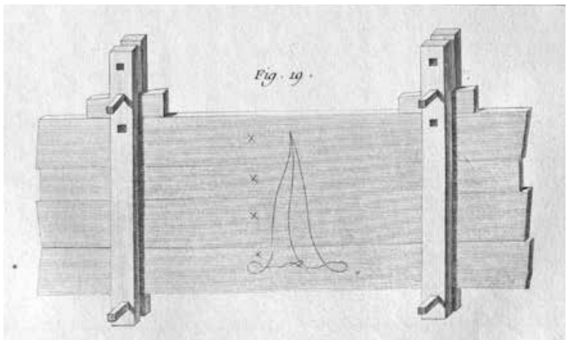


In the upper part of straighteners are pierced two or three other mortises similar to the first ones through which you pass another shaft of the same shape and length as the first one, *Fig. 18*.

Plate 18

When you wish to make use of straighteners to clamp a panel, you begin by placing [the parts] between the two twins, resting the panel on the lower inserted shaft. You then press the twins together to hold the panel flat. You then insert the shaft through the mortises above and closest to the panel, and with a mallet drive in a wooden wedge between the panel and the shaft.

There must be two straighteners at least to clamp a panel, and when it is long enough, you really should make use of three. Besides, the use of these tools is excellent, because they clamp panels without damaging them, which happens sometimes with bar clamps. But still, they hold the panels very straight, and they leave you the liberty to view them from both sides, which you cannot do when the panels are laid flat on the workbench, *Fig. 19*.



Section V

The Tools for Fretwork, and those for Cutting the Straight and Curved Mouldings

Page 83

Plate 19 *The Tools Appropriate for Cutting Outlines*

When the Joiner is apt to include irregular contour/shapes on the cross-pieces, one ordinarily cuts the outlines only after the joints are made, especially when the curves are well defined, so as to avoid their breaking while making the joints. You cut out the contours with the turning saw, as I said above. After that you set the mark, and you make it square with the curved plane, at least as much as possible. The curved areas where the plane cannot reach are made with the chisel and the wooden rasp and are finished with a scraper.