Double Bevel Marquetry, by Don Rowland

For woodworkers interested in making marquetry with a scroll saw or fretsaw, the double bevel technique contributes to high quality work by eliminating the saw kerf. Reproduced here is a series of five articles, from *The Marquetarian*, on using the technique. The articles are as follows:

1. **How it Works** (Issue 273)

2. **Using Spacers** (Issue 274)

3. **Preparing for Sawing** (Issue 275)

4. **The Book Method** (Issue 276)

5. **Further Applications** (Issue 277)

Parts 1 and 2 introduce the technique and explain how to determine the sawing angle. Part 3 deals with scroll saws and saw blades suitable for marquetry and describes a practice project. Part 4 focuses on the main steps in making double bevel marquetry. Finally, part 5 discusses making detailed components of a marquetry design separately then sawing them into a background veneer.

This series of articles was first published, during 2020 and 2021, in *The Marquetarian,* the quarterly journal of the UK's Marquetry Society. Thanks to the Marquetry Society for permission to reproduce the articles.

DOUBLE BEVEL MARQUETRY: HOW IT WORKS

by Don Rowland

Introduction

The double bevel technique is well-known among people who make marquetry with a scroll saw, because it can eliminate gaps between pieces. The technique involves sawing the background and insert veneers together at an appropriate angle (Figure 1). It dates from the 18th century in Europe where it became known as 'conical sawing'.

Although the technique is long established, finding a quick way of determining the sawing angle remains a challenge. The solution has probably been rediscovered many times, but it has seldom appeared in print. Finding the sawing angle by trial and error is a common approach, but there is a faster, more accurate way. The aim of this article is to show how double bevel marquetry works and why a relatively simple formula provides a quick method of finding the correct sawing angle.

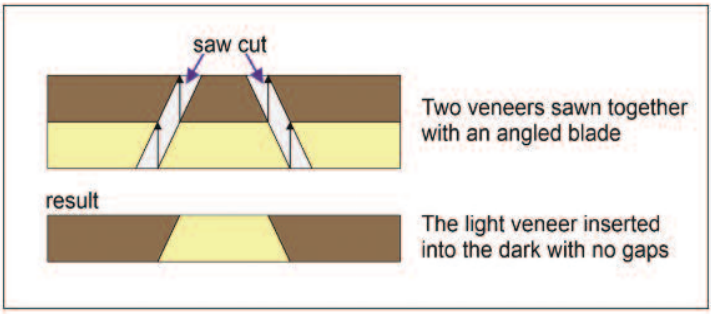


Figure 1. Double Bevel Joinery

Setting Angles

To make double bevel marquetry the scroll saw must be adjustable to cut at an angle. Depending on the type of scroll saw, either the table stays horizontal while the saw frame tilts, or the blade stays vertical while the table tilts. If the table is horizontal, the sawing angle is set as the departure of the blade from vertical. If the table is tilted, the sawing angle is set as the departure of the table from horizontal, as in Figure 2.

Both produce the same result. For scroll sawing, a small protractor is suitable for setting the angle of the blade.

In Figures 3 and 4, the saw table is assumed to be horizontal while the saw frame tilts. Also, the designs to be sawn are assumed to be face up. Figure 3 illustrates the two ways of sawing double bevel marquetry. The diagram on the left illustrates the background on top method – where the background veneer is placed above the insert veneer during the sawing. The insert travels upward when the marquetry is assembled. If the insert veneer is 0.6mm thick, the insert will need to travel 0.6mm to become flush with the back of the background.

Similarly, the diagram on the right depicts the insert on top method. Here the insert moves downwards to fit exactly into the background. If the background veneer is 0.7mm thick the insert will need to travel 0.7mm to become flush with the back of the background. In both methods, it is important to measure the thickness of the lower veneer because this always denotes the distance that the insert moves when assembling the marquetry.

Double Bevel Geometry

Figure 4 shows how the technique works in both the background on top and the insert on top methods.

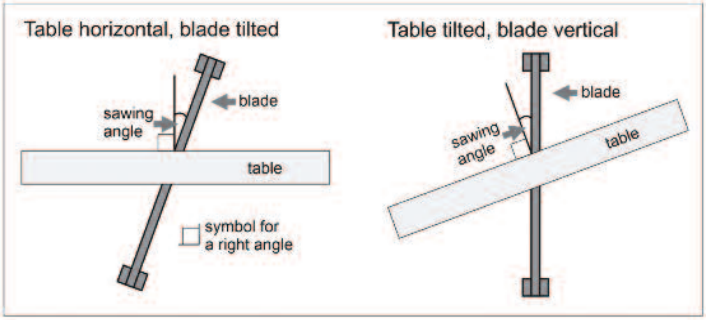


Figure 2. Setting Angles

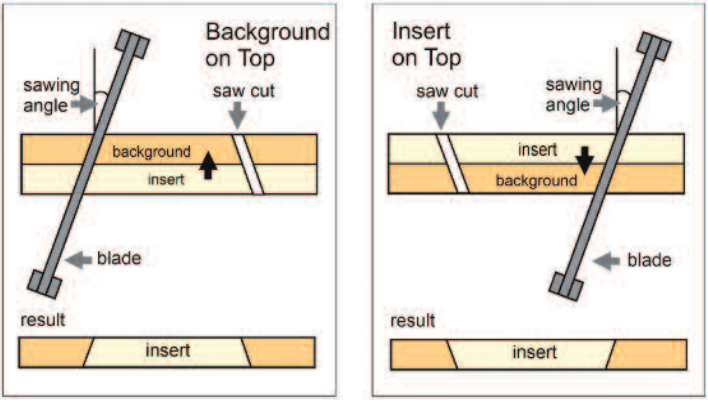


Figure 3. Two Methods

Each drawing depicts larger-than-life cross-sections of two veneers with a sawcut through them. The triangle labelled ABC contains the information needed to calculate the sawing angle.

•The length of the line AB in each diagram is equal to the thickness of the lower veneer. When points A and B meet, the insert veneer will fit exactly into the back of the background veneer.

•The line BC is the width of the blade across the set of the teeth.

•The line CA has the same angle as the saw cut.

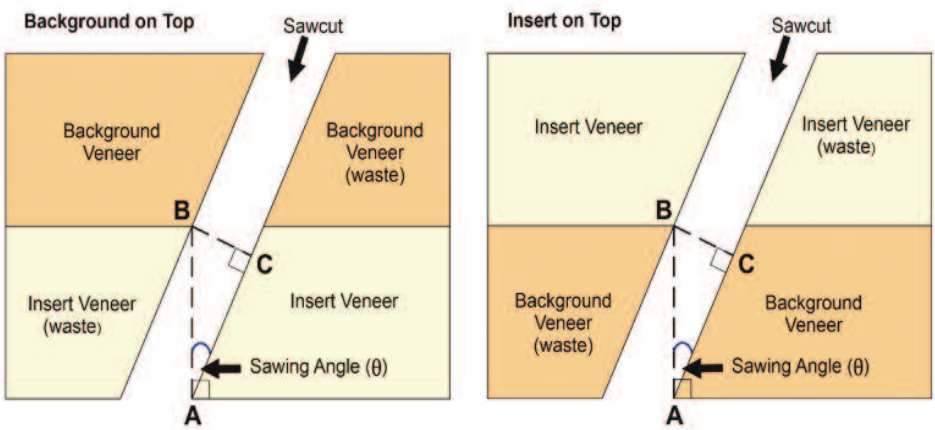


Figure 4. Cross-Sections of Saw Cuts

●The angle at point A is the sawing angle, labelled theta (θ).

Finding the Sawing Angle

The sawing angle is obtained through the following four steps:

1.Write down the blade width (b), e.g. b = 0.26 (BC in Figure 4). The blade width is found either on the packaging the blades came in or on the manufacturer's website. Commonly used for marquetry are 2/0 jewellers' blades, which are likely to be 0.26mm wide across the set of the teeth.

2.Write down the thickness of the lower veneer (v) (AB in Figure 4), e.g. v = 0.6mm. Use a Vernier calliper to measure the veneer. Alternatively, use a ruler to measure the thickness of a small packet of pieces of the same veneer, then divide the total by the number of pieces.

3.Divide b by v and record the answer, e.g. (b/v) = (0.26/0.6) = 0.43333.

On a scientific calculator, or a calculator app or website, enter the value of (b/v), i.e. 0.43333, and press the inverse sine key labelled $\sin^{-1}$. The result is the sawing angle: 25.7 degrees. The following section provides a brief explanation of the maths.

The Maths

The triangle ABC contains a right-angle and we know the length of two sides of the triangle (BC, the width of the saw blade, and AB, the thickness of the lower veneer). When the lengths of two sides of a right-angle triangle are known, using trigonometry we can calculate the angles in the other corners. In the triangle ABC, the sine (or sin) of the sawing angle (θ) is equal to the length of the side opposite the angle (BC) divided by the length of the hypotenuse (AB), which is the side opposite the right angle (BC/AB = b/v). In other words:

$\sin \theta = (b/v)$

In the earlier example, sin θ = 0.43333. The inverse sine of this number is the angle whose sine is 0.43333. The formula for the sawing angle is:

$\theta = \sin^{-1}(b/v)$

The sawing angle is equal to the inverse sine ($\sin^{-1}$) of the saw blade width divided by the thickness of the (lower) veneer . In the example, the angle is equal to the inverse sine of 0.43333. This is easily obtained from a calculator, the result being 25.7 degrees.

Using the Technique

To use the double bevel technique there are several settings that must be observed to maintain the geometry of the saw cut, as shown in Figure 5. These take account of differences in the order in which veneers are arranged for the background on top and the insert on top methods. The sawing direction refers to the route taken by the saw blade as it travels around the shape of the insert.

	Background on Top	Insert on Top
Set the sawing angle:	Tilt the table to the left or the saw frame to the right.	The same as for background on top.
Position the piece to be cut:	To the right of the blade.	To the left of the blade.
Note the sawing direction:	Counterclockwise.	Clockwise.

Figure 5. Scroll Saw Settings for Double Bevel Sawing.

The position of the piece to be cut and the sawing direction can be worked out from the diagrams in Figure 4. Referring to the background on top diagram, the angle of the saw cut indicates that the blade in the scroll saw is tilted to the right and the insert to be cut is on the right of the blade. Keeping the insert on the right, the only direction the saw can travel (rotate) is counterclockwise. Similarly, referring to the insert on top diagram, the angle of the saw cut indicates that the blade in the scroll saw is also tilted to the right but the piece to be cut is on the left of the blade. Keeping the insert on the left, the only direction the saw can travel (rotate) is clockwise.

Conclusion

Eliminating the saw kerf is a useful and satisfying aspect of double bevel marquetry. It can be achieved through making just a few calculations. Most remarkable is that the geometry operates at a tiny scale, producing joints that are almost invisible. Although the use of maths implies high precision in angle cutting, double bevel sawing is reasonably accommodating and need not require perfect measurement of angles and materials. Sawing a test piece is advisable, but after that a whole project may be cut without needing to adjust the angle. Be sure to put the insert veneer into the hole in the background veneer, not vice versa, otherwise there will be a large gap, double the width of the saw kerf.

A later article will supplement this one, showing how to reduce steep sawing angles. It will also provide a reference set of angles for double bevel work that should meet most requirements.

A CHRISTMAS SPECIAL

A picture by one of our six founders Cliff Penny from circa mid 1950's which was recently found by one of our website visitors at a garage sale in New Zealand

DOUBLE BEVEL MARQUETRY: USING SPACERS

by Don Rowland

Introduction

The previous article on double bevel marquetry discussed how the technique works and how to find the correct sawing angle (see issue 273). When working with thin materials the angle will always be steep, which can lead to awkward sawing and fragile bevels. A simple way of reducing the sawing angle is to use a spacer. This is a piece of veneer or cardboard that is placed between the background veneer and the insert veneer. As well as reducing the angle, the spacer reinforces the veneers during sawing and makes it easier to negotiate details and sharp turns.

The effect of a spacer on the sawing angle is considerable. For example, working with 0.6mm veneer and a 2/0 jewellers' blade (0.26mm thick), the exact sawing angles for double bevel joinery are:

25.7 degrees without a spacer

12.5 degrees with a 0.6mm spacer

10.0 degrees with a 0.9mm spacer

Although veneer can be used as a spacer, cardboard, such as from a breakfast cereal box, is cheaper and serves equally well. The spacer can be omitted when using relatively thick veneers which, alone, would require a sawing angle of 10 degrees or less.

How Spacers Work

When using the formula for the sawing angle, $\theta = \sin^{-1}(b/v)$, the thickness of the spacer is added to the thickness of the lower veneer in the packet of materials. In assembling the marquetry, the distance that the lower veneer travels to close the joint is now equal to the thickness of the lower veneer plus the thickness of the spacer. The insert still lands exactly flush with the glue side of the background veneer, as in Figure 1.

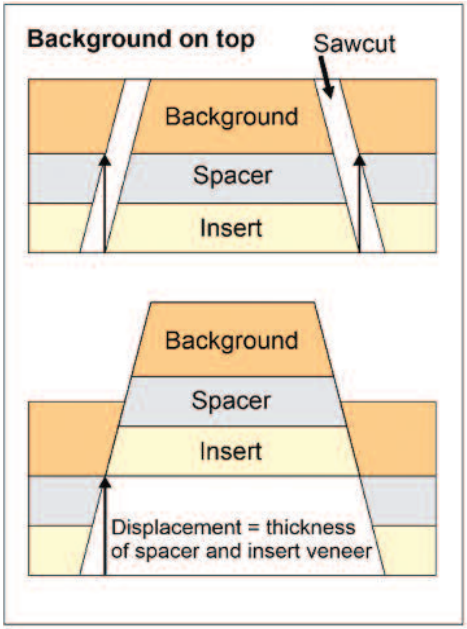
Thus, assuming the veneer is 0.6mm thick, and the spacer is 0.9mm thick, the insert will travel 1.5mm to become flush with the back of the background veneer. Sometimes sanding will be needed to level the top surface of the marquetry, but the important point is that the glue side of the marquetry will be flat.

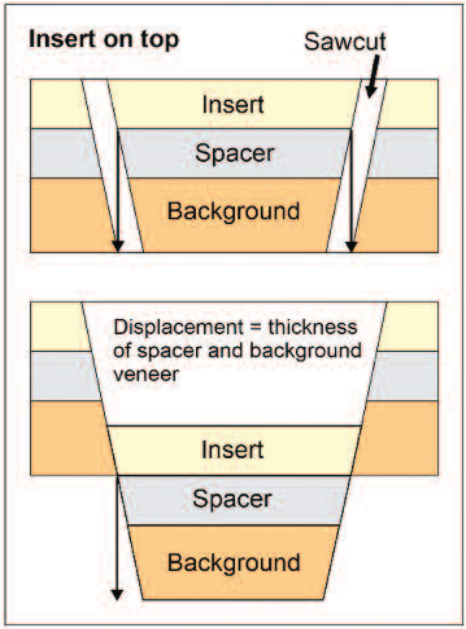
In the diagram on the left-hand side of Figure 1, the insert veneer is at the bottom of the packet. The distance it moves to its position is equal to the combined thickness of the insert and the spacer. This contrasts with the diagram on the right, where the background veneer is at the bottom of the packet. The distance that the insert moves when assembling the marquetry is now equal to the combined thickness of the spacer and the background veneer.

Determining Angles

The article on *Double Bevel Marquetry: How it Works,* explained the calculation of sawing angles, but the Angle Finder in Figure 2 covers the great majority of needs for work with thin veneers. Across the top it lists blade thicknesses commonly associated with each blade size, though there are variations between manufacturers. The blade thickness is equal to the width of the saw cut and is the same as the width of the blade measured across the set of the teeth.

The figures in the left-hand column refer both to veneer thickness and to the combined thickness of a veneer and a spacer. For example, the figure of 1.2mm may refer to a single thick veneer or to a 0.6mm veneer plus a 0.6mm spacer. To obtain the angle for sawing, find the column for the thickness of the saw blade, then find the row for the thickness of the insert, and spacer if used. Where the row and the column intersect is the required angle.





↑*Fig 1. Double Bevel Joinery with a Spacer*↑

↓*Fig 2. Angle Finder*↓

Angle Finder for Double Bevel Marquetry

Blade size:	4/0	3/0	2/0	0
Blade thickness (mm):	0.22	0.24	0.26	0.28
Thickness of insert and spacer (mm)	Sawing Angle (degrees)			
0.5	26.1	28.7	31.3	34.1
0.6	21.5	23.6	25.7	27.8
0.7	18.3	20.1	21.8	23.6
0.8	16.0	17.5	19.0	20.5
0.9	14.1	15.5	16.8	18.1
1.0	12.7	13.9	15.1	16.3
1.1	11.5	12.6	13.7	14.7
1.2	10.6	11.5	12.5	13.5
1.3	9.7	10.6	11.5	12.4
1.4	9.0	9.9	10.7	11.5
1.5	8.4	9.2	10.0	10.8
1.6	7.9	8.6	9.4	10.1
1.7	7.4	8.1	8.8	9.5
1.8	7.0	7.7	8.3	8.9
1.9	6.6	7.3	7.9	8.5
2.0	6.3	6.9	7.5	8.0

Editor's Note: Due to a, shall we say, hiccup in the formatting of part one of Don's 'Double Bevel Marquetry' mini series here, there was an unintended small error in three of the formula's shown on page 18 of the winter edition of The Marquetarian.

We will let Don explain: *"Those aforementioned problems on page 18 occurred in three places, where sin^{-1} in the original manuscript had been replaced by sin-1 or something totally different.*

Hopefully readers can work out what has happened. This was most probably due to the seldom use of maths in marquetry."

So, thanks Don for pointing out the error. Neither I nor my two proof readers spotted that one. I usually copy and paste submitted text, but QuarkXpress reformatted the 'superscript' without me noticing, hence that crafty little error creeping in!

DOUBLE BEVEL MARQUETRY 3: PREPARING FOR SAWING

by Don Rowland

The Way of the Saw

Over hundreds of years, woodworkers have used saws to make marquetry for furniture, clock cases and other decorative pieces. A key development in Europe was the invention, in the late 1500s, of fine saw blades hand-filed from clock springs. The fretsaw, using these blades, was one among several early types of saws invented for marquetry. For contemporary double bevel work fretsaws are still popular, as are modern scroll saws. The latter originate from decades of experimentation in making mechanical fretsaws. This article discusses getting started in selecting and using a scroll saw and the fine blades needed for marquetry. It also presents a marquetry project for initial practical experience relevant to double bevel work.

About Scroll Saws

Besides being well-suited for cutting veneers at constant angles, which is essential for double bevel work, scroll saws offer other advantages for marquetry making:

1. The saw blades enable the use of the full range of timber veneers, whether thick or thin, or hard or soft, without any need to repeat cuts. The same blades are also suitable for making marquetry with metals and seashell material.

2. The blades can cut two or more veneers at once, and readily handle tight curves and complicated shapes that are difficult to cut with a knife.

3. Sawing avoids the extra work of separately cutting windows, followed by the pieces to go into them. Saws can cut both together and routinely produce an accurate fit.

4. Other techniques make it possible to dispense with the reversed patterns and carbon paper commonly used to transfer designs to veneers.

Despite these advantages scroll saws vary in their ease of operation. The saw table, or the saw frame, must be able to tilt to do double bevel sawing. The saw needs variable speed control and should run without pronounced vibration. Ideally, the saw should have simple arrangements for fitting plain-ended blades, such as accessible and 'easily-operated' blade clamps on the upper and lower arms of the saw. These are more convenient for blade changes and blade threading than saws with detachable blade clamps or a lower blade clamp that is difficult to access. Also, a lever at the front of the saw is useful for quickly tensioning the blade. This saves frequent resetting of the blade tension by adjusting a knob at the back of the saw.

Saw Blades

Jewellers' blades have long been used for making marquetry. They are 5⅛in (130mm) long, plain-ended and narrow enough to thread through small starting holes. They are available by the dozen or, more economically, in packets of 12 dozen, over the counter or online from jewellers' suppliers and specialist hardware stores. Good quality round-back jewellers' blades last well and cut curves and turns smoothly. A 2/0 blade (0.26mm thick, 0.52mm wide) can handle most marquetry making with standard veneers. Related applications of jewellers' blades are in making hand-crafted jewellery and ornamental inlays for musical instruments. Fine scroll saw blades, such as the Olson 3/0 blades, are also suitable for marquetry.

Blade Threading

Threading the blade through the work piece is normally done with the blade detached from the clamp on the upper arm of the scroll saw. Holes with a diameter of about 1.5mm make it easy to thread the blade; drilling into waste wood and areas of overlap enables later removal of entry holes.

Sometimes it is not possible to start from waste wood and the blade must enter where a drilled hole would show. A little magic comes into play here as needle holes may be employed instead. The needle's great advantage is that it separates the wood fibres, rather than removing them. The entry holes normally close when moistened or during gluing to a substrate with PVA glue. Use a hand-sewing needle a little wider than the saw blade. Hold the needle in a pin vice, which is simply a small handle with a chuck or collet at one end that can hold a fine drill or needle.

To make the needle hole, place a cork sanding block under the packet of materials and push the needle through where you want to start sawing. Ensure that the hole is made at the angle you are using for sawing. An alternative to a pin vice is a small Archimedes drill, obtainable from hobby shops and jewellers' suppliers. *(An example of an antique Archimedes drill is shown here. This demonstrates the principle perfectly)*

Like the pin vice it has a collet that will hold a needle, but it also has a screw mechanism that spins the collet. This drilling action enables the needle to penetrate more rapidly with less pressure. Using a high-speed electric drill instead, however, may compact the wood fibres and prevent the needle-hole from closing later.

Setting Up a Scroll Saw

When setting up a scroll saw for the first time, ensure that the saw teeth face the operator and point down. The blade should be perpendicular to the saw's table when it rests against the saw table's stop, if it has one. This will enable vertically cut pieces to fit together uniformly and will permit a quick return of the blade to vertical whenever needed. Check the angle with a protractor, a set square or a small tri-square.

The opening for the blade in scroll saw tables is sometimes too big to support detailed sawing. If this is so, replace the table insert with a disk of thin acrylic or MDF. Where a table is without a removable insert, an alternative is to make a table cover. For this, cut a piece of 3mm MDF the same size and shape as the table. Drill a 6mm hole for the blade to go through and attach the cover to the scroll saw table with thin double-sided adhesive tape.

Packet Sawing

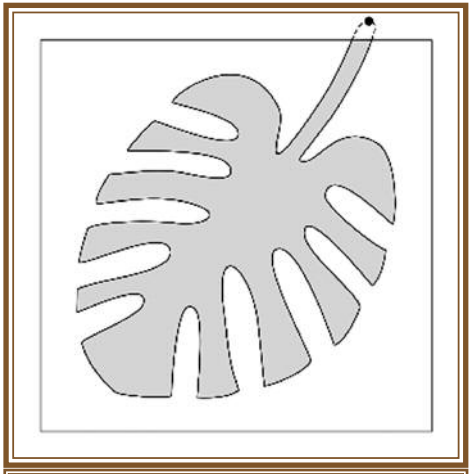


Figure 1. Monstera (125 x 125mm)

This final section discusses the making of a small project using packet sawing (Figure 1). It provides relevant practice for starting double bevel sawing, especially for anyone who has never used fine saw blades. Packet sawing involves vertical

sawing of two or more layers of veneers, producing two or more items at once.

The blade must be perpendicular to the saw table, otherwise the sawn pieces will not fit together uniformly. Although the sawing creates a gap or saw kerf around each piece, the gap can be made to disappear! Well almost, but a little-known phenomenon is that when adjacent contrasting dark and light veneers are glued to a substrate the narrow saw kerf between them normally becomes inconspicuous.

A coaster or plaque featuring a monstera leaf is a suggested practice piece (Figure 1). The design is 125mm square. It includes a 10mm wide waste-wood border, to allow for possible thinning of the edges of the veneer during sanding.

Figure 2. Veneer Taping, Shown after Sawing

The packet consists of two layers of veneer sandwiched between two pieces of cardboard. The cardboard stiffens the packet and protects the veneers. All the pieces of veneer and cardboard are the same size as the design and are prepared as follows:

- On the front is a piece of stiff cardboard, about 0.6mm thick, such as from a large breakfast cereal packet. Glue the design to the cardboard with a glue stick and trim it to size when dry.
- In the middle are two contrasting pieces of veneer, each 125mm square. Apply veneer tape to the face side of the veneers to reinforce the fragile areas where the stem and the edges of the leaf will be (Figure 2).
- At the back is a piece of stiff cardboard, about 1.0mm thick. Thin cardboard is less suitable as a backing because it will not prevent the packet from flexing.

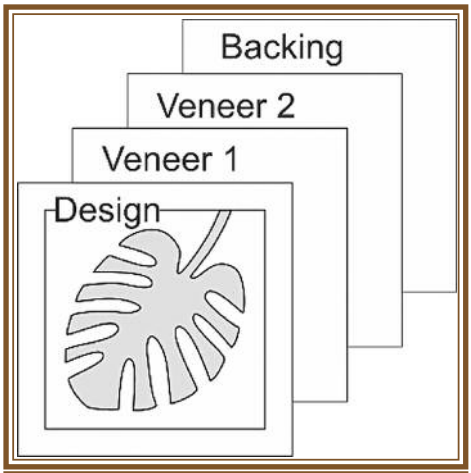


Figure 3. The Layers of the Packet

To assemble the packet, check that the grain runs parallel on the sheets of veneer and fasten the layers together securely with sticky tape on all four edges. The tape needs to prevent the layers from moving out of alignment during sawing. Use of clear sticky tape ensures that pattern lines stay visible. The black dot in the border indicates where to drill a hole large enough to enable easy blade threading. The monstera leaf can be sawn in either direction.

After finishing the sawing, carefully separate the layers of the packet with a knife. Turn the veneers face down and assemble the pieces, positioning them so that, as far as possible, all the gaps between them are the same width. A sheet of black paper underneath helps with this. Secure the pieces in place with masking tape on the back. Apply veneer tape to the face side.

Figure 4. Completed Coasters

Conclusion

This article has introduced marquetry sawing and aspects of the method of making double bevel marquetry, which is the subject of the next article in this series. The aspects that the packet sawing and the double bevel technique have in common include using a copy of the design to guide all the sawing, using cardboard to reinforce the veneers, and sawing the background material and inserts together.

MARQUETRY TOOLS

Stringers (inlay stringing)

Stringers, or inlay stringing, consists generally of 1.5mm fillets of black or whitish veneer supplied in one metre lengths intended for outlining (basically being a visual outer box or border) of a marquetry picture prior to applying a main border of some sort.

The stringers can be used in a decorative fashion by using combinations of contrasting colours in a sandwich configuration to give a black, white, black effect and suchlike other variations.

White boxwood and dyed black sycamore are often used in the preparation of stringers. You can purchase commercially made stringers, or if you have your own cutting jig, you can easily produce your own stringers in your workshop.

If you glue a black and a white stringer together lengthwise and cut say, one or two cm pieces from them, you can reverse

↑ Standard Black & White Stringers ↓

each section to make a decorative inlay banding in the manner as you see above.

Do try it and have fun experimenting. Stringers can be amazingly versatile.

DOUBLE BEVEL MARQUETRY 4: THE BOOK METHOD

by Don Rowland

Introduction

This article explains the book method, a new and simplified way of using the double bevel technique. The book method is suitable for beginners as well as others with more experience. It builds on the setup for packet sawing, as described in the third article in this series (Issue 275: pp.15-18). Whereas packet sawing works with layers of veneers and cardboard taped together, the book method has similar layers hinged together with masking tape to make a book. Today's thin veneers, mostly 0.6mm thick, need the support of cardboard to prevent breakages and provide traction for the blade, especially when sawing only two veneers at a time. With reference to examples of projects, this article describes the making of a book and its applications (Figure 1).

Making a Book

Fig 1. A Book for Sawing the Flower Design

The arrangement of the book's pages varies according to whether the background veneer is on top of the insert veneer, or vice versa (see Issue 274: p.17, Figure 1). Background on top, discussed in this instalment, provides a straightforward approach to making marquetry. Whole projects can be constructed using just this one technique. Insert on top is discussed in the next instalment.

A valuable application of it is for cutting in detailed parts of a picture that have been made separately, such as a butterfly. Sometimes it is more convenient to do this than to saw details directly into a large picture.

The sawing for both approaches is done with the design and the veneers face side up. For background on top, the pages of the book are arranged as follows (Figure 2):

Page 1: A copy of the design glued to cardboard about 0.6mm thick.

Page 2: The background veneer, reinforced with thin marquetry tape on the face side as needed.

Page 3: A cardboard spacer, about 1.0mm thick. The spacer reduces the sawing angle and stiffens the book (see Issue 274: pp. 16-17).

Page 4: A second copy of the design glued to cardboard. This is the same as page 1. A larger project may require thicker cardboard here.

Assemble the pages with a masking tape hinge on the longer side. Tape the hinge outside and inside to ensure that the pages stay aligned. One or two small pieces of masking tape on the right will keep the book closed during sawing. The insert veneers are taped to page 4 for sawing, after which they are taped into position in the background veneer.

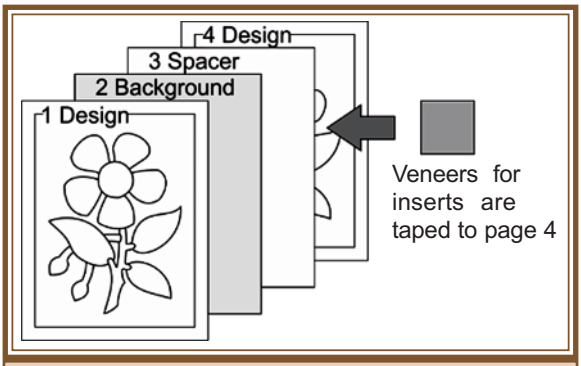


Figure 2. Arrangement of Pages for the Background on Top Approach

If the sawing angle is correct, the inserts will fit flush with the back of the background veneer.

Planning the Sawing

Planning the sawing benefits the pace and precision with which projects are made. The following are two complementary ways of working:

Work from the back of the design to the front.

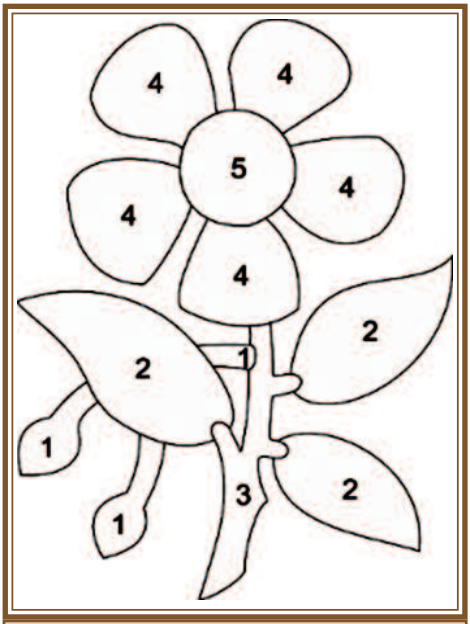


Figure 3. Flower Design with Numbered Layers

In the flower design the numbering of the pieces derives from imagining it as a picture made up of 5 layers, with layer 1 at the back and layer 5 at the front (Figure 3). The pieces are sawn in the numbered order, as far as possible starting each one from a drill hole in another piece. For example, the shoots in layer 1 are sawn from a drill hole in a leaf on layer 2, then the leaves are cut starting from drill holes in the stem on layer 3. Waste wood and drilled areas are removed as adjacent pieces are sawn.

Overcut pieces where possible.

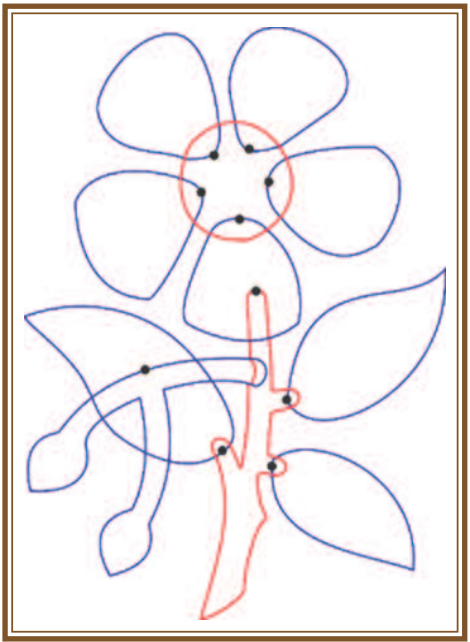


Figure 4. Location of Drill Holes for the Flower Design

Overcutting involves starting and finishing the sawing of a piece within the border of an adjacent piece. In the flower design, sawing of each petal begins and ends in the flower's centre, as shown in Figure 4, where black dots represent the drill holes. When the flower's centre is sawn from a needle hole the overcut

areas are removed. Every piece of this design, apart from the flower's centre, can be overcut. As needed, draw extra lines on page 1 to guide the overcutting.

Overcutting may not be possible where a design has some enclosed spaces, such as parts of a background enclosed by the branches of a tree. Inserts for such spaces are usually sawn first, starting from needle holes; they are then secured in the background veneer. This can avoid creating fragile areas to be sawn later.

Setting the Sawing Angle

After preparing the book and planning the sawing, the next step is to set the angle of the saw blade. This is discussed in the second article in this series which also provides an Angle Finder, a table showing the sawing angles for a wide range of blade sizes, spacers and veneers (see Issue 274: p. 17). For many projects, the sawing angle needs to be set only once – if you keep using the same type of saw, the same size blade, and veneers of similar thickness. The sawing angle depends on the blade thickness and the combined thickness of the spacer and the lower veneer in the book. For the background on top method, the lower veneer is always the insert veneer.

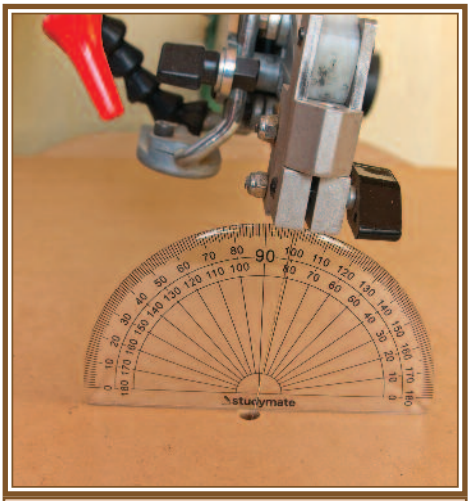


Figure 5. Setting the Sawing Angle

Referring to the Angle Finder, if the combined thickness of the spacer and the insert veneer is 1.5mm, and the blade (2/0) is 0.26mm thick, the exact sawing angle will be 10.0 degrees. Reducing the angle by up to half a degree (i.e to 9.5 degrees) can make the pieces easier to assemble, while still closing the gap. To set the sawing angle on the scroll saw, use a protractor and tilt the scroll saw table to the left, or the saw frame to the right (Figure 5). The angle will be measured correctly even if the base line on the protractor, which runs across its width, is above the table, as in Figure 5.

Making a Test Piece

To check the sawing angle, a test piece can be cut quickly. To do this, with a pencil draw a shape in the middle of one of the larger parts of the design on page 1 of the book, such as a leaf or a petal in the flower design. Tape a piece of the insert veneer in the corresponding position on page 4 of the book and tape the book closed. Drill a starting hole on the pencil line and saw the test piece. Keep the pattern to the right of the saw blade and saw counterclockwise with the scroll saw.

If the test piece fits perfectly into the background veneer all is well. If the sawn test piece is too small, increase the angle slightly, if it is too big reduce the angle, then saw another test piece somewhere else. It is essential that the piece cut from the insert veneer goes into the hole in the background veneer, not vice versa.

Sawing the Marquetry

The main sawing proceeds in a similar way:

1. Open the book at page 4 and sticky tape, to that page, pieces of veneer for the first inserts.

2. Tape the book closed. On page one, mark the pieces to be sawn and draw pencil lines to follow for overcutting.

3. Drill the starting holes, then saw the inserts counterclockwise with the pattern to the right of the scroll saw blade.

4. When a cycle of sawing is completed, open the book and trim away the waste veneer on page 4. Sticky tape the newly sawn inserts into the back of the background veneer.

5. Tape the cut-outs from the other pages in their original positions. Apply the sticky tape to the back of page 1 to keep the front clear for drawing pencil lines.

6. Both copies of the design will now be intact again and ready for the next cycle of sawing.

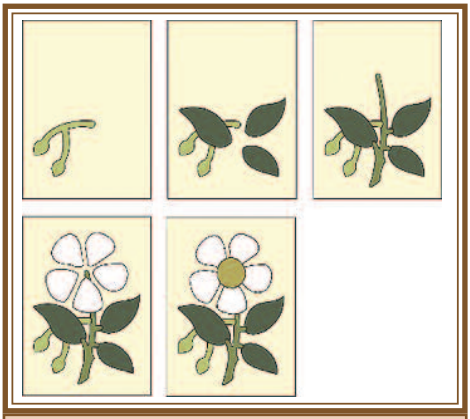


Figure 6. Stages in Sawing the Flower

A Larger Project

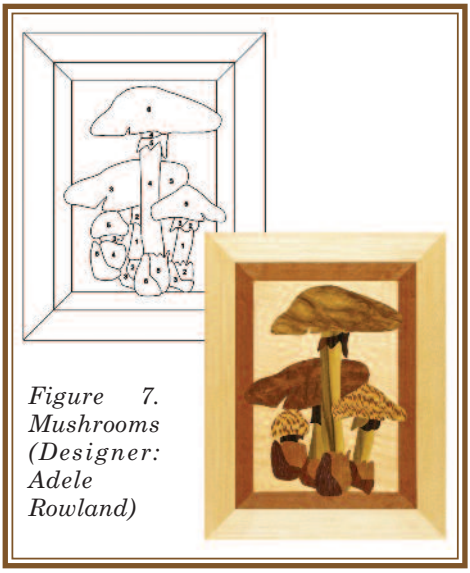


Figure 7. Mushrooms (Designer: Adele Rowland)

Making the larger double bevel project in Figure 7 proceeds in the same way. Prepare the book for the background on top method as described before. Make the pages the size of the background and the first frame. The outer frame can be added when the sawing is finished. The completed panel measures 200 x 255mm. Saw the pieces on each layer of the design in turn, starting with layer 1. The only parts that need to be sawn from needle holes are the two mushroom caps numbered 5, and the two pieces numbered 6.

Conclusion

In using the book method, double bevel cutting of marquetry generally settles into a routine of sawing inserts, fitting them into the background veneer, and restoring the other pages of the book. The book method differs from alternative methods in that it does not use windows and reversed designs, and it does not require continual redrawing of sections of the design using carbon paper.

Instead of cutting windows, the background and insert veneers are sawn together, which is a time-saver that can also produce a perfect fit. What is absent here are opportunities to obtain preferred alignments of grain by viewing an insert veneer through a window in the background veneer. When unable to look through a window, a suitable alternative involves printing or photocopying the design onto tracing paper or transparent film. Align the transparent copy of the design with the printed copy on page 4, then put the insert veneer between them to choose its best position before taping it in place. Suppliers of A4 transparency film can be found on the internet.

The next instalment will complete this series on double bevel marquetry. It includes information on component sawing and using a fretsaw for marquetry. It also presents a handy single-page poster on the essentials of double bevel marquetry. The latter is to copy and keep with your saw.

DOUBLE BEVEL MARQUETRY 5: FURTHER APPLICATIONS

by Don Rowland

OVERVIEW

This series of five articles on double bevel marquetry is intended to enable readers to delve into the subject and make their own double bevel projects. Before discussing the final instalment, the following summary shows how the series fits together.

The first article, in issue 273, explained how double bevel joinery eliminates gaps between pieces. It also introduced the two main arrangements of materials in double bevel marquetry, namely with the background veneer on top of the insert veneer(s) or with the insert veneer(s) on top of the background veneer. Following this the second article, in issue 274, discussed spacers, which make sawing easier by reducing blade angles. The article also explained how to calculate blade angles and included a table of angles to meet most requirements. The third article, in issue 275, focussed on using a scroll saw for marquetry. It dealt with the advantages of cutting marquetry with a scroll saw, choosing a scroll saw for marquetry, and making a practice project. The fourth article, in issue 276, introduced the 'book method' of making double bevel marquetry and provided a step-by-step account of how to use it. This fifth article, in issue 277, first describes the application of the book method to sawing detailed components of a marquetry picture. Then, because of the continuing interest in fretsaws, the article discusses using a fretsaw for double bevel marquetry. Finally the article presents a one-page Quick Start Guide listing the five steps to making double bevel marquetry with either of the two arrangements of materials and with a scroll saw or a fret saw. It is intended as a handy reference, summarising all the key information (Figure 9).

The previous article discussed the book method and the background on top approach to arranging the materials. Figure 1 shows an example of a setup for the insert on top approach. This also produces gap free marquetry that can be glued down flat, with no voids underneath.

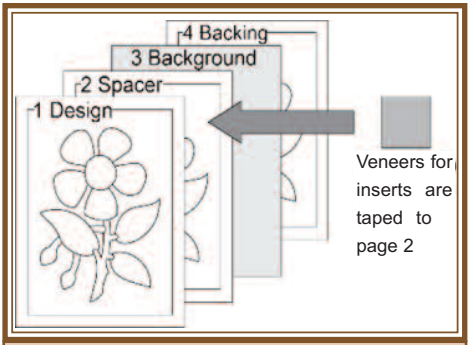


Figure 1. Arrangement of Pages for the Insert on Top Approach

Figure 2. Design for a Waratah Panel (30 x 40cm)

A useful application of insert on top is to set a complex component into a larger piece of marquetry. An example of this is the making of a marquetry waratah, an Australian plant that has a large flower head consisting of many small florets (Figure 2).

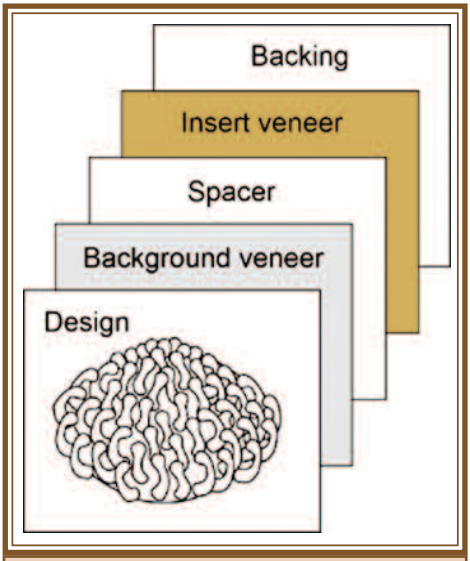


Figure 3. Setup for Sawing the Florets

The marquetry was made in two parts, one for the flower head, the other for the rest of the plant. The book method, with the background on top, was used first for both. Figure 3 shows the arrangement of the materials for making the flower head with 53 florets cut into the background veneer.

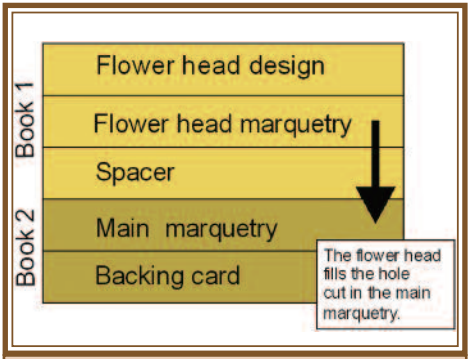


Figure 4. Setup for Sawing the Flower Head into Position

When the sawing of both parts was completed, a single saw cut was needed to install the flower head. A simple arrangement of materials, in layers rather than hinged pages, enabled this to happen (Figure 4).

From book 1 the following three layers were taken: first, a copy of the design, to guide the saw cut around the perimeter of the flower head (originally page 1). This was followed by the untrimmed flower head marquetry (page 2) and a spacer to reduce the sawing angle (page 3). The three layers were taped together to keep them aligned. Similarly, the much larger main marquetry and the backing cardboard were removed from the second book and taped together. The two sets of materials were then stacked and taped as in Figure 4.

It was important to keep the layers accurately aligned. A transparent copy of the design can help with this.

Figure 5, the Completed Waratah (detail)

Finally, insert on top was used to set the flower head into the rest of the marquetry. The sawing angle was determined with reference to the thickness of the blade and the combined thickness of the spacer and the veneer for the main marquetry.

The materials were then sawn in a clockwise direction keeping the piece to be cut on the left of the blade. Figure 5 shows the outcome.

Multiple Components

The process of making a single component can be extended to making projects with multiple components. An example of this is a butterfly wing design with seven sections in various woods (Figure 6). Separate patterns for the seven were cut out and glued to a piece of cardboard, which served as page 1 of a book for making all the components together. When the components were completed, each was sawn into the background veneer, which produced the veins in the wing. Working with components provided advantages in making the details efficiently and cutting the long curves smoothly, all gap free.

Figure 6. Butterfly Design with Seven Components

Fretsaw Marquetry

While most of this series has focused on scroll sawn marquetry, the fretsaw is a time-honoured alternative. Scroll saws can enhance productivity in marquetry making, but a simple fretsaw can still provide a satisfying way of working. Fretsaws are compact and portable and use the same blades as scroll saws. Fretsaws are also suitable for double bevel cutting. The ways of working differ from the scroll saw because the fretsaw blade faces away from the operator and the saw table is separate. For fretsawing, the table is set at the required angle while the saw blade is kept as close as possible to vertical.

Figure 7. Homemade Fretsaw Tables: Tabletop Version and Vice-Held Version

Figure 7 shows two types of tables for use with fretsaws. One type has a base that is clamped to a table; to set the angle, the top pivots on a bolt and is secured with a wingnut.

The other has a top fixed to a post; the post is held in a vice at the required height and angle. Fretsaws are less accurate than scroll saws for sawing angles but practice in keeping the fretsaw vertical produces satisfactory results. There are also rigs to aid fretsawing with the blade held perpendicular or at an angle. Some feature in William Lincoln's Marquetry Manual as well as in issues of the Marquetarian (see Fretsaw machines). A recent development is the Knew Concepts company's Marquetry Saw, which has a starting price of more than US$2000!

Figure 8. A Home-Made Device for Setting Fretsaw Table Angles

A mobile phone app, or a store-bought angle gauge, can be used to set the angle of a fretsaw table. Equally suitable is an inexpensive home-made angle gauge (Figure 8). This consists of a protractor, fastened to a thick block of wood with small escutcheon pins, and a washer suspended on a piece of cotton. The straight edge of the protractor must be parallel to the base of the block.

The fretsaw has the potential to cut shapes in veneer quite quickly, because most of the blade is available, while scroll saws typically have a blade stroke length of about 19mm (¾in).

Nevertheless, a reasonable standard in fretsawing marquetry is to use about 50mm (2in) of blade much of the time though, as detail increases, stroke length reduces. With practice, the fretsaw can be tamed. A few hints are: (1) The up and down stroke should come from the elbow rather than the wrist. (2) Follow the pattern line by rotating the workpiece rather than the saw. (3) Avoid very short strokes, except where there are tight curves or points to negotiate. (4) Try to keep the saw blade vertical.

Quick Start

The Quick Start Guide summarises the steps in getting ready to make double bevel marquetry with a scroll saw or fretsaw (Figure 9). It is intended for copying (enlarged) and keeping near your saw for quick reference. The Guide is in two halves, with instructions for working (1) with the background on top or (2) with the insert on top.

The steps in using each approach are numbered 1 to 5. In each half there are sections for scroll saw users and fretsaw users. The settings for left-handed fretsawing are the opposite of those for right-handed fretsawing. Near the bottom of the guide is an extract from the Angle Finder published in Issue 274, page 17.

The extract lists the possible sawing angles when using 2/0 blades, which are suitable for most marquetry projects. The guide shows the profile of the sawn inserts for each approach. Background on top has a wider base profile, while insert on top has a narrower base. The seemingly minor differences between the profiles make possible contrasting applications of double bevel marquetry.

To start, first read the instructions, 1 to 5, for background on top and scroll saw. These instructions are likely to be relevant to a majority of projects.

Acknowledgement: I am grateful to Aldo Bongiorno for help with the photography in this series.

Figure 9. Quick Start Guide for Double Bevel Marquetry

Double Bevel Marquetry

Quick Start Guide for the Book Method (Follow Steps 1 to 5)

BACKGROUND ON TOP	PROFILE
1 Prepare the pages of the book of materials	P1 Design glued to cardboard (0.6mm) P2 Background veneer, face side up. (The inserts go into this) P3 Spacer, cardboard (1mm) ***Insert(s) here, face side up, taped to page 4 before sawing*** P4 Backing cardboard with design (same as 1)
2 Obtain the sawing angle….. E.G If b=0.26mm and v =1.5mm, b/v =0.17333 and the sawing angle is 10.0 degrees.	First, lookup or measure the blade thickness (b) and the thickness of the spacer and the lower (**insert**) veneer (v). Then, lookup the sawing angle in the **Angle Finder** below. Alternatively, on a scientific calculator get (b/v) and press the inverse sine key to obtain the angle in degrees. See the E.G.

	Scroll Saw	**Fretsaw**[1]
3 Set the sawing angle	Tilt the table to the left or the saw frame to the right	Tilt the table to the left
4 Position the piece to be cut	On the right of the blade	On the right of the blade
5 Check the sawing direction	Counterclockwise	Clockwise

Figure 9. Quick Start Guide for Double Bevel Marquetry

Figure 9. Quick Start Guide for Double Bevel Marquetry

INSERT ON TOP

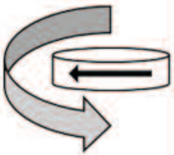
PROFILE

1 Prepare the pages of the book of materials	P1 Design glued to cardboard (0.6mm) ***Insert(s) here, face side up, taped to page 2 before sawing*** P2 Spacer, cardboard (1mm) P3 Background veneer, face side up. (The inserts go into this) P4 Backing cardboard with design (same as 1)	
2 Obtain the sawing angle.	This is the same as for Background on Top except that the lower veneer (v) is the **background** veneer.	
	Scroll Saw	**Fretsaw**[1]
3 Set the sawing angle	Tilt the table to the left or the saw frame to the right	Tilt the table to the left
4 Position the piece to be cut	On the left of the blade	On the left of the blade
5 Check the sawing direction	Clockwise	Counterclockwise

Angle Finder for 2/0 Blades (0.26mm thick)

Spacer and lower veneer (mm thick)	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
Sawing angle (degrees)	**15.1**	**13.7**	**12.5**	**11.5**	**10.7**	**10.0**	**9.4**	**8.8**	**8.3**	**7.9**	**7.5**

1. For right-handed sawing. For left-handed sawing use opposite settings, e.g.right instead of left.



Background on Top

When using a scroll saw the blade cuts counterclockwise; the insert turns in the opposite direction, toward the blade.

Insert on Top

When using a scroll saw the blade cuts clockwise; the insert turns in the opposite direction, toward the blade.

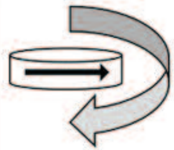


Figure 9. Quick Start Guide for Double Bevel Marquetry