

### What is "Veneer Pattern Matching"?

The Art of Veneer Pattern Matching has been practiced by cabinet and furniture makers for centuries. The concept of slicing lumber into thin leaves and rearranging them to accentuate the grain character and create unique patterns has been practiced by craftsmen since the time of the great Egyptian civilizations, 3500 years ago. The traditional way of laminating lumber boards together to create the flat surfaces of casework can be embellished with the application of carefully sliced and arranged veneer leaves.

The illustrations on these pages demonstrate the various means of capitalizing on the intrinsic beauty of wood grain and turning these into fine examples of craftsmanship.



#### **Slicing Techniques**

Before we can investigate the various means of joining veneer leaves into decorative patterned surfaces, we need to understand the techniques of processing (slicing) graded veneer logs into usable thin sheets of wood.

Veneer logs are selected for color and grain character by debarking and slicing the fallen tree trunk, lengthwise. This half log section is graded and identified as an **Architectural** or **Furniture** grade veneer log, and assigned a **Flitch** (identifier) number. Because the heart of the wood is now exposed, the spacing of the **Annular Growth Rings**, and the presence of exposed **Medullary Rays** (perpendicular grain structures running from the center of the log to the surface – see example to the left) will reveal the potential figure & character of the tree's contrasting layers. The quality of the surface can be examined to determine soundness, color, and texture.



Many times, depending on the species or the particular characteristics of a unique tree, the veneer grader may determine what type of slicing method will bring out the most attractive grain character & figure, and therefore the most value for the finished product.



The most prevalent form of slicing is the **Plain Sliced**, also known as **Flat Cut** or **Flat Sliced**. (see slicing geometry illustration below)



The **Plain Sliced** method is a simple matter of mounting a half-log section to a carrier. The carrier then moves the half-log section across the edge of a sharp blade, slicing off layers (much like a cheese slicer or carrot peeler). These layers are then stacked and bundled (generally 24 or 32 leaves per bundle) with identifying numbers. The maintenance of the order of leaves is a very important part of the process. These **Sequences** are very carefully labeled because as the slicer moves through the alternating layers, the appearance of the grain will make subtle changes in the spacing and appearance of the grain.

Since the tree is a living organism, the various environmental impacts on the growth of the tree, though several years of climate changes due to periods of extreme weather; or due to the quality of the nutrients in the soil; or due to the impacts of pests and disease, will determine the rate of growth or the negative impact on the structures of growth within the tree. These rate changes or structure impacts will create anomalies in the appearance of the grain.



These anomalies may show up the form of a **Flakey** figure; a **Crossfire** or **Fiddleback** figure; a **Curly** figure; a **Block Mottle** figure; a **Quilted** figure; a **Pommele** or **Blister** figure; a **Birdseye** figure; a **Crotch** figure; or a **Burl** (all of these figure types are discussed below).

However, conventional **Plain Sliced Veneers** typically have a **Cathedral** or **Heart** figure. These names refer to the "V" shaped center bands of grain. As the slicer cuts through the alternating growth rings, the location of the blade, relative to the position within the log, will determine the shape and scale of the **Heart** figure. As the blade slices deeper into the half-log, the **Cathedral** will get narrower. Woods such as the Walnut (shown previous page left) and Oak will demonstrate a stronger **Cathedral** grain than woods like Mahogany. This is due to a vastly different environment and climate where these woods grow. Woods in more Northern and Southern latitudes have more extreme climate variations, from winter to summer. The grains of these woods show more distinctive variation, due to the seasonal differences in climate.

**Plain Sliced Veneers** are not symmetrical across the face. The example on the left demonstrates a significantly different appearance, grain spacing, secondary figure, and many times, a color variation from Left to Right. Because of this asymmetry, the veneer matching technique becomes a very important consideration when building a piece of fine cabinetry or furniture, or any other decorative veneer construction.

**Plain Sliced Veneers** generally provide the widest face dimension (with the exception of **Half-Round** veneers discussed below). From a cost perspective, these veneers tend to be less expensive than other types of slices. From a **layup** point of view, the wider the faces, the fewer the segments across the face, the lower the cost. From an aesthetic point of view, the **Plain Sliced Veneer** is the most prevalent type used – it can also be the most complex visual statement because of the textural patterns created.

**Quarter Sliced Veneers** are quite distinct from **Plain Sliced Veneers**. Also known as Quartered or Quarter Sawn, these veneer faces demonstrate linearity of grain. Many times, due to the influence of **Medullary Rays**, the quartered veneer will exhibit





secondary figuring (see discussion below). This figuring can be very subtle or quite dramatic depending on the wood species. The structure of the wood, the porosity of the

wood, and the hardness of the wood will determine the degree of figure impact. When finished with an appropriate lacquer or topcoat, the secondary figures many times exhibit an iridescence or shimmer. These secondary figures may not show up so distinctly when logs are sliced with other means.



**Quarter Sliced Veneers** are sliced quite differently from **Plain Sliced Veneers** (see slicing geometry illustration above).

Once it has been determined, by veneer grading specialists, that a particular log will exhibit a more dramatic look when quartered, the log is sliced lengthwise in half. The half logs are sliced again in half, lengthwise, into quarter sections. Each quarter section is then mounted to a carrier. This time, the blade is oriented perpendicular to the outside face of the log. Slices are made, cutting through the **Annular Growth Rings**, from outside face to the center of the log. Because the cuts run perpendicular to the rings, the spacing remains fairly uniform and consistent from slice to slice. (Quartered Honduran Mahogany shown above left, Quartered synthetic Ebony shown left)





**Quartered** veneers tend to be more expensive because of the lower yield factor. The leaf segments tend to be fairly narrow and the waste factor prevents significant yield.

Some wood species such as Oak, when **Quartered**, will exhibit a secondary figure called **Flake**. This figure can be subtle and quite dramatic. Many times, designers desire a more linear solution without the complex secondary figure. Quartered Oak tends to have the secondary **Flake** figure, more often than not (see example left).

Traditional furniture makers have always coveted **Quartered Flaky** veneers because of their complex patterns and the sense of graceful age they bring to fine casework and millwork pieces. White and English Brown Oak & Australian Lacewood are examples.

The **Flake** figure itself is a harder and more closed pore surface than the surrounding grain. Many times finishing stains will not affect the **Flake** as much as the field grain, creating an even stronger contrast.

As in any veneer with complex primary and secondary patterns, veneer matching becomes a very critical element in the process of making fine woodworking projects. When the basic linear grain is required, an adjustment is made in the slicing process – resulting in a product that has very little or no secondary figures.

If we follow a similar process to the **Quarter Sliced** log preparation, but make a slight adjustment to the angle the blade takes, relative to the quartered log slice section. A few degree change of the blade, (see geometry illustration next page) altering the orientation through the **Medullary Rays**, will result in a very clean linear slice. This process is called a **Rift Cut**. Also knows as **Rift Cut** or **Rift Sawn**, this type of cut yields narrow, yet very linear grain (see example of Rift Oak to the left).

From a cost point of view, this type of veneer cut is the most expensive of the three cuts discussed to this point. This is due to the low yield of choice usable product generated by this process.

There are many woods which will have a radically different appearance when cut with different methods. The two examples of Oak, shown left, exhibit the extremes of the non-figured **Rift** cut (below) versus the **Flakey** figured **Quartered** cut (above).





As in the **Plain Sliced** versions, the **Quartered** and **Rift** cut veneers are carefully stacked in bundles of 24 – 32 leaves and numbered with consecutive labels. One could reconstruct the tree by assembling the layers, bundle by bundle. Each section of the log is given a distinct tracking number so that veneers can be sold in consecutive sections.

The **Half-Round** cut can exhibit an even wider variation from the methods described above.

The **Half-Round** cut is the result of taking half log sections (as in the **Plain Sliced**) and securing them to a special carrier. The Carrier is mounted to an armature, which can swing on a radius. A stationary knife blade, the length of the log section, can be adjusted in and out, to slice layers of the log as the armature swings – the result is a peeling of the log – starting from the outermost layers. Peeling through each layer of annual growth creates the appearance of wavy contoured lines of grain (see top example to the left).

The interesting examples to the left are all the same species. When sliced in the **Plain Sliced** or **Quartered** cuts, the veneer is called Bubinga. When sliced as a **Half-Round** the wood is named Kevazingo (top and middle examples, to the left). The example on the bottom is a Quartered Bubinga.

Many **Burls, Crotches,** and **Pommeles** are sliced **Half-Round.** Veneer sheet sizes are usually quite wide and long, sometimes requiring flattening when laminated.







There is an inherent tension within wood fibers. When lumber or logs are sliced, this internal tension is released (bonds are broken). The result can be exhibited in the surfaces becoming wavy, twisted, or split. The **Half-Round** cut releases bonds within the internal structure of the grain and is more subject to becoming unstable. Veneer purveyors and laminators must take extra caution in handling these veneers. Many times, a flattening agent (glycerin) must be used to release surface tensions and allow the material to "relax".

The **Half-Round** cut can be fairly expensive for several reasons. From a marketing perspective, the appearance can be more desirable and more dramatic, therefore more valuable as a uniquely saleable asset (see Elm Burl shown top left, Tamo Ash shown bottom left).

The **Half-Round** cut yields some very interesting opportunities for the making of decorative veneer faces. Because the patterns and textures are much more complex - when matched - veneer **Faces** can also be more dramatic and expressive (see figure discussion below).

(Illustration, below, shows the half-round cut geometry)



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The last type of veneer cut is the **Rotary Slice**. This cut is the same geometry as the **Half-Round** except the full log is peeled, layer by layer. This type of slice is not typically used for fine woodworking, except for the fact that most **Veneer Plywood** is manufactured with this method.

**Veneer Plywood** is a process of taking large sheets of peeled veneers and re-laminating them into panel materials. By alternating the **Grain Direction**, the plywood laminator manufactures a very strong composite. Each layer reinforces the next, creating a structurally sound panel, many times stronger than the original veneer. However, because it is constructed with unstable material, the **Veneer Plywood** panel can also be unstable when subjected to extremes in temperature and humidity. Surface tensions within the various layers can become unstable, when exposed to extreme influences, and therefore allow the panels to warp, twist, bow, or even de-laminate.

There are varying grades of **Veneer Plywood** depending on the number of laminations (**plys**) and surface finishes. (further discussions about **Veneer Plywood** will appear in separate articles)

Since the appearance of the **Rotary Slice** is much the same as the **Half-Round**, most decorative veneers are not sliced with this method. However, many plywood products are manufactured for the decorative market. Many times, the use of a **Veneer Core** is preferable to the use of a **Composite Wood Core** for the making of wood panel products.

Veneer Plywood manufacturers will combine decorative Plain Sliced, Quartered, Rift, or Half-Round veneer faces to complement the light weight, yet very strong Veneer Cores.



#### **Secondary Figure**

Many times, Veneers exhibits secondary figure. There are several examples of these types of figure.

The first type is the **Crossfire** or **Fiddleback**. Many woods will exhibit a perpendicular, to the grain, figure that can display a heavy or light luminescence and alternating dark and

light cross bands. These are not actual color changes, rather the influence of light as it hits the surface of alternating layers of **Medullary Rays**. You can view this phenomena from one direction and the bands with appear dark – light – dark. Flip the veneer 180 degrees and the same bands will appear light – dark – light. In the first view the rays are alternating coming toward you, then perpendicular, then coming towards you again. This characteristic is called **Chatoyancy** – the same term that is used to describe the effect visible in a Cat's-Eye or Tiger's Eye jewel.

The image on the previous page is a **Quartered** English Sycamore with a **Fiddleback** Figure.

The second type of secondary figure is the **Curly** figure (see image of Curly Maple to left). This is a variation of the Fiddleback. It is created by the same phenomena, except the figure is not as linear and can take on more interesting patterns. Both of these type of figures will show up in **Plain Sliced Veneers** as well.

While matching veneers, one has to pay particular attention to the alignment of these complex ray patterns.

A third type of secondary figure is the **Block Mottled**. This figure is similar to **Fiddleback** except the cross fire is more block like. This mottle figure is very distinct in wood species such as Anigre (shown left), Cherry, Makore, Mozambique, and other exotic species.

The **Chatoyancy** effect can be quite challenging when matching the larger figure types. The effect of the light vs. dark "blocks" forces the veneer face maker to pay careful attention to the intersection of the veneer edges and the alignment of the "blocks". As one sorts through the consecutive leaves in the **Flitch**, the size and shape of the "blocks" will change significantly. A misalignment of the figures will be quite noticeable and



distracting, leading to a devaluation of the quality of the project. These types of figures challenge even the most experienced face makers.

A fourth type of secondary figure is the **Quilted** figure (see Makore sample left). This type is associated with wood figures which exhibit a very dimensional rolling effect. This quilting can easily be mistaken from the **Pommele**. The difference is the **Quilted** figure meanders over the entire surface, whereas the **Pommele** exhibits more clearly defined blisters (see Sapele Pommele, middle left) of self-contained figure, like bubbles across the surface (see example below).

Both of these figure types are generally developed from **Half-Round** slicing. The veneer leaves are generally very wide and very long. Many of these trees tend to be quite large and generate quite a bit of material – it is not unusual for a **Flitch** to contain many thousands of square feet.

Another figure developed from **Half-Round** slicing is the **Birdseye**. Most people are familiar with Birdseye Maples. Maple trees exhibit these types of figure quite frequently. The degree of concentration or density of the **Birdseye** will vary significantly from tree to tree. The "eyes" can be very close together and densely populate the surface or very sporadic.

Generally, there is a secondary figure or shimmer that will exhibit itself – which adds additional depth and texture to the finished product.

**Birdseye** figure is a result of tiny distortions in the **Annular Growth Rings**. They are like small conical intrusions coming from the perimeter inward towards the heart of the tree, across several layers of yearly growth. As one slices (peels) the layers, the slice through the **Birdseye** intrusions shows up as small knot or burl like structures, many times picking up the color of the darker annual growth surrounded by the lighter grain.

Woods like Birch, Ash, and Walnut can have similar figures.

Since Maple is a very dense hardwood, finishing **Birdseye** Maples can be very revealing and lustrous.





The **Crotch** figure is the most traditional type of figured wood used in the making of fine furniture and casework. Its distinctive and dramatically contrasting figure is bold and evocative of fine quality and workmanship.

The **Crotch** veneer figure is a result of the slicing of the portion of a mature tree, at the point which the first primary branches evolve from the main trunk. As the branches grow out and up, the rings of the tree split to create this unique figure.

When you slice through this splitting of the grown rings, you reveal the complex "feather and muscle" of the wood fibers. Matching this type of wood is very challenging. Subjective decisions how to seam the veneer leaves will create very dramatic patterns.





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to the roots as a type of malignancy that is generally not discovered until the tree dies or falls over. Such burls sometimes appear as groups of bulbous protrusions connected by a system of rope-like roots. Insect infestation and certain types of mold infestation are the most common causes of this condition. (Left Image – Birch with **Burl** growth)

**Burls** yield a very peculiar and highly figured wood, one prized for its beauty by many; its rarity also adds to its expense. It is sought after by people such as furniture makers, artists, and wood sculptors. There are a number of well-known types of burls (each from a particular species); these are highly valued and used as veneers in furniture, inlay in doors, picture frames, household objects, automobile interior paneling and trim, and woodturning. Birdseye Maple superficially resembles the wood of a burl but is something else entirely. **Burl** lumber is very hard to work in a lathe or with hand tools because its grain is misshapen and irregular.

Matching of **Burls** must be very precisely done. The tight grain character demands careful attention to the mating of common edges. Because the grain character will change quickly as the slices cut deeper into the log, one has to be very aware of the sequences of leaves and find balance and harmony in the matches.





Many wood species can have **Burls**, including White and Olive Ash, Maple, Amboyna, Thuya, Olive Ash, Elm, Birch, Claro Walnut, Harewood (see image on previous page), Mappa (Poplar), Myrtle, Redwood, Madrona, English Yew, and White and Brown Oak.

Burls give fine furniture and cabinet makers the opportunity to feature highly figured insets in projects demanding special attention to the uniquely complex patterns created by nature.

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#### **Matching Techniques**

Once we have determined the species, type of slice, and identified the type of secondary figure, we can decide on the method of joining veneer leaves together to create a **Face**. A **Face** is a assembly of sliced veneer segments joined together to make a decorative wood surface.

The furniture or cabinet maker makes a subjective decision how to **Layup** the veneer leaves to best embellish the finished product. Following is a discussion of the various means of taking veneer segments and creating aesthetic design elements, adding value to the project.

A **Slip Match** is a simple type of **Layup**. Many times, due to budget constraints or for stylistic simplicity, furniture and cabinet makers will rely on the **Slip Match**.

The process is to take a bundle (24-32 consecutive leaf segments) of veneer and starting with the first leaf, lay down each consecutive leaf as it comes off the bundle. By "slipping" the leaves (like dealing a deck of cards) side by side, without turning or flipping, the resulting **Layup** will appear as shown above left.

The result is a simple asymmetrical pattern of like repeats. The left and right edges always appear on the same side. The Quartered Mahogany example, above left, and the Quartered Fiddleback Mozambique each exhibit an asymmetric lack of balance. In the case of figured woods, the result can be very unsatisfactory or acceptable depending on the point of view – there is no right or wrong decision – it is up to the eye of the beholder.

The bottom example is perhaps the extreme – **Slip Matched** Crotch Mahogany doesn't lend itself to this type of expression. The pronounced asymmetric pattern repeat can be very unique or very distracting. One would have to make careful consideration before relying on this type of **Layup** with this species and type of figure.



A **Book Match** is a more complex type of **Layup** than the **Slip Match**. Many times, to take advantage of the availability of consecutive veneer leaves, furniture and cabinet makers will rely on the **Book Match**.

By flipping every other leaf, much like the act of turning pages in a book (hence the origin of the term "book" match), one gains a symmetry or balance in the appearance of the finished product. This process is much easier to accomplish with thin slices of wood than with **Lumber**.

Generally, **Lumber** is very rarely cut and bundled in sequences, as the slices come off the tree. Therefore, there are very limited opportunities to take advantage of the effects of **Book Matching**. Veneers are routinely bundled to take allow the face maker to make a choice of the type of **Layup** that would be most advantageous for the project.

**Book Matching** requires careful attention to the secondary figuring, grain character of the wood, and the varying color within each leaf. Secondary figures can create interesting patterns and textures. One has to slice veneers to cutout unattractive edges that may detract from the final product.

**Face** balance becomes a very important factor in the appearance of the finished product. The examples to the left demonstrate this important consideration. The eye will see asymmetry if patterns of grain are not matched evenly. **Book** 

**Matching** works most effectively when an even number of veneer leaves is used to make a particular **Face**. A **Face** is a single panel surface, which can be made of any number of veneer leaves.

A **Sequenced Face** is a series of panels, that when lined up edge to edge, exhibit consecutive veneer leaves in a symmetrical array. When one looks from end to end the **Sequenced** panels appear to have one repeating pattern, much like printed fabric repeats.

You can have **Sequenced** panels with **Slip Matched Faces**, however the effect is less appealing than a **Book Matched Sequence**.



There are occasions when one can play with pattern repeats in **Sequenced** panels. The example to the left is a Quartered Mozambique **Face**.

The first two leaves on the left are **Slip Matched** to each other. The right hand pair of leaves have also been **Slip Matched** to each other. However, each pair is reversed to one another. When the two pairs are brought together in the middle of the panel, the result is a **Book Match**. The overall panel retains its balance and the grain symmetry creates a very attractive matching **Face**. Many times, the veneering art is in the eye of the panel layup manufacturer. Designers and fine furniture / cabinet makers should consult with the flipping of leaves until a consensus is reached, maximizing the design of the finished product.

**Balance** in a veneer **Face** is a very important factor in making a successful product. When equal numbers of veneer leaves are used to make a **Face**, the panel layup manufacturer is cutting the leaves in equal segments, maximizing the yield and character of the material. After squaring and truing (cropping the leaf to maximize the figure and grain character) the edges of the leaves, he carefully tapes or **Splices** the veneer faces together. When there are equal numbers of leaves to the right and left of the centerline of the **Face**, this activity is called **Center Matching**. The example above is a **Center Matched**,

Slip & Book Matched Face.

There are several occasions when a highly figured wood will benefit from a different kind match. The example to the right is a Tamo Ash **Face** assembled with a **Butt Match**.



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These type of matches are generally used with dramatic figures or when a veneer leaf length is not sufficient to cover a given panel length. Many times, when paneling high walls, the veneer will be **Butt Matched** or **End Matched**. The downside of the **End Match** is a natural misalignment appearing at the seam. Often, designers will add a reveal (break) between segments, disguising the asymmetric match. **End Matching** can be very successful such as the example of Quartered Mahogany shown above.



Highly figured veneers, such as Crotch Mahogany, can be manipulated into beautiful **Faces** utilizing several matching processes. The example to the left is the result of what is called the **Book & Butt**. Across the **Face**, the veneers are **Book Matched & Center Matched**. The upper and lower halves are then **Butt Matched** to achieve the finished look. The complex mirroring of the wood grain creates secondary patterns that would not be visible while looking at single leaves of veneer. Crotch Mahogany leaves and Burl leaves are generally very small and must be matched using these techniques of **Face** making.

The example to the right is a Carpathian Elm Burl with a **Book & Butt Matched Face**. Complex figures, like **Burls** will reveal normally hidden images, like a Rorschach test. The aesthetic test is in the hands of subjective decisions about which to turn the leaves and which veneer match looks best. Everyone will have a different opinion – the Artisan will know what is right.







#### **More Complex Matching Techniques**

Now we shall explore veneer matching techniques that capitalize on patterns created when veneer leaves are very carefully trimmed and joined together in complex assemblies.

The example shown above left is a Quartered Mahogany arranged in a **Diamond Matched** pattern. Generally, the veneer segments are clipped at a 45 degree angle to maintain a square or rectangular **Face**. The angles used are up to the discretion of the designer or fabricator. Sometimes, complex shapes require the veneer segments be clipped at different angles to accommodate the overall proportion or shape of the finished piece.

The example shown bottom left is a Quartered Mahogany arranged in a **Reverse Diamond Matched** pattern. Here the veneer segments are arranged angled towards the center of the field.



When combined together, these two matching techniques create a dynamic pattern of repeats.



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The example shown top left is a Quartered Mahogany arranged in a **Box Match** pattern. One has to be very careful to make precise angle cuts – if the angled cuts of the veneer are not uniform, the resulting pattern can have a distorted look – which can be very distracting. The example to the left starts to show this characteristic – very much like a fun house mirror will take a simple pattern and turn it into a disturbing view.

Here the art of veneer matching is tested to its limits. Balance and symmetry can be thrown on its heels if the face maker doesn't pay strict attention to the meeting of edges and the appearance of the created patterns.

The last of our complex patterns is the **Sunburst**. The example below left is a Quartered Mahogany.

Here the artisan face maker precisely cuts angled segments, and assembles them into a pie-shaped arrangement. Imprecision is very apparent when the segments are not equally cut and the veneer grain does not come to sharp points of intersection.

Veneer face making is a very old and very specialized art. Fine furniture makers and cabinet craftsmen have used these same techniques to embellish great pieces of woodwork art. Modern technology has only made the techniques easier to achieve – yet the patterns remain virtually the same.

The Art of Marquetry and Inlay are further refinements of these same techniques and do further add complexity to the finished product.

Designers add complexity to commissioned pieces by adding these embellishments – thereby adding value, both aesthetic & financial, to their creations.

The artisan derives great pleasure from the challenges of precision and of the aesthetic judgments he or she makes while building these fine pieces of art.

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