FRAGMENTATION

by Jim MacKeracher

CONTENTS

"*BURGESS DUNNE*" - CANADA'S FIRST MILITARY AIRCRAFT

Figure 1

I created a picture showing Canada's first military aircraft, the *Burgess Dunne*, 1914, flying over a small lake in Ontario during the fall (***Figure 1)***.Many different techniques were used in the making of this picture. This article describes some of these techniques.

1) FRET SAW

1-1) WORKING PATTERN.

The working pattern was drawn on translucent Mylar. To produce non-smudge, thin, distinct lines, an Indian ink drafting pen was used.

The top and front of the design was marked on the working pattern to prevent future confusion. Target-style reference marks were added to help orient the working pattern with the base veneer.

1-2) CUTTING SEQUENCE.

The first pieces cut were the ones furthest away in perspective. The cutting started from the background and moved to the foreground. Any piece, which was completely within or crossed other parts of the design, was cut in only when the surrounding parts of the design were glued in place.

1-3) CUTTING TECHNIQUE

The base veneer (American red gum) was marked, both on its front and back, with reference marks corresponding to the working pattern. Low-adhesive cellophane tape (Scotch 810) was placed on both sides of the background veneer in the vicinity of the piece(s) to be cut. Also both sides of the replacement veneer were taped. The tape helped strengthen the veneers and minimize glue staining when edge gluing.

The working pattern was positioned over the front of the veneer picture using the reference marks. Transfer paper was placed between the working pattern and the base veneer's front. The selected piece(s) were traced out in two fashions, depending upon whether the surrounding veneer in the base veneer was permanent or to be removed later. It was often the case that both types of tracings were used for the same piece, giving a modified shape from the working patterns design. If the surrounding veneer was permanent, the tracing followed the pattern lines exactly (finished cut line). If the surrounding veneer was to be removed later, the tracing of the piece was made larger and smoother (over cut line).

The modified shape was traced on the base veneer's front with a fine-tip empty pen. The inverse shape was traced on the back of the base veneer to help orient the placement of the veneer. The replacement veneer was oriented over the traced shape on the back of picture. The replacement veneer was attached temporarily with masking tape.

A hole was pierced through both layers of veneer using a needle embedded in a short dowel. The hole was placed in an inconspicuous place, for example, on a non-permanent line of the modified shape. With the good side of the picture facing upwards (replacement veneer on the bottom), the modified shape was cut out using the double bevel cutting method. The saw blade was held at an angle (usually 10 to 12 degrees from vertical), and the two veneers which were taped together were cut at the same time. Correctly rotating the work resulted in the replacement veneer's piece being cut slightly larger than the piece cut out of the base veneer. This method eliminated the saw blade kerf.

I used a 6/0 fret saw blade for the large maple leaves, tree reflections, shoreline, wing panels, struts, floats, men and engine. I used an 8/0 fret saw blade for the geese and my signature.

After cutting out the piece(s), the veneers were separated. The replacement veneer was edge-glued into the picture with white PVA carpenters glue. I used a syringe to spread the glue on the edge of the hole. The replacement veneer was often not the same thickness as its surroundings. The underside of the picture was kept flush. This allows for better adhesion of the picture when glued to the substrate. The cellophane tape was removed. Masking tape was temporarily used to hold the piece in place until the glue dried. A cabinet scraper was used to level the pieces as they were put in.

2) FRAGMENTATION

Figure 2

The far shore line of trees in their fall colours is a dominant feature in the picture. It is made up of approximately 100 trees an inch high. I decided to experiment with fragmentation. Fragmentation is a special technique in which veneer is cut up into small pieces (less than 1mm cubes) and glued together to act collectively as a piece of veneer.

I used a method of fragmentation, which involves filling in a window with fragments and glue and then inserting individual fragments to simulate branches, shading and other highlights. This gave a natural, three-dimensional effect (***Figure 2***).

The first step was making the pattern. A forest of overlapping trees was drawn. Each tree was distinguished by an outer outline only.

The next step was in veneer selection. The easiest veneers to fragment were straight and coarse grained. Through experimentation I determined each tree would consist of five types of fragments:

A) dominant leaf colour

B) darker shade of leaves

C) shadows and branches Ebony

D) sky behind tree Maple

E) adjacent trees behind tree

The forest was made of five tree colours:

1) yellow	- birches	A) Nigerian Satinwood
		B) Walnut
2) light green	- unchanged trees	A) Dyed green Maple
3)dark green	- conifers	B) Quilted Popular
		A) Quilted Popular
4)orange	- maples	A) Peroba Rosa
		B) Mahogany
5) red	- maples	A) African Padauk
		B) Satine

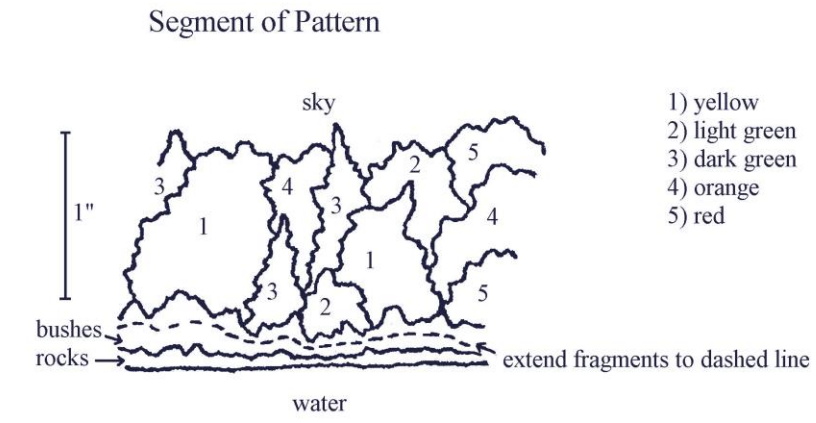


Figure 3

Each tree was numbered on the pattern according to the five colours. I tried to avoid putting clusters of trees of the same colour together to maximize the contrast (***Figure 3***).

The fragments were easy to make. I cut thin, ½ to 1 millimetre wide strips at right angles to the grain of the veneer. A quantity of strips were cut and then dumped into a food blender where they were chopped up into small fragments. These fragments were stored in labelled bottles. I made sure to clean the cutting board and blender before working on a different veneers to prevent unwanted mixing.

I then selected an oversize sky background veneer (red gum) in which the fragments were to be placed. The exact pattern of the top of the forest, where it touched the sky, was traced on the background veneer. The bases of the trees were extended 1/8 of a inch past the pattern and traced on the background veneer. This extra length was sawn off when the bushes, rocks and water were added. The individual tree outlines were not traced. The shoreline was 18 inches long so I did the fragmentation in several segments. Cellophane tape was placed covering the first segment front and back. A saw held perpendicular to the veneer was used to cut out this segment. Cellophane tape was placed covering the back of the window. This kept the glue and fragments in the window. The pattern of the forest was taped on the back of the background veneer so the pattern of the trees could be seen through the cellophane tape and window (***Figure 4***).

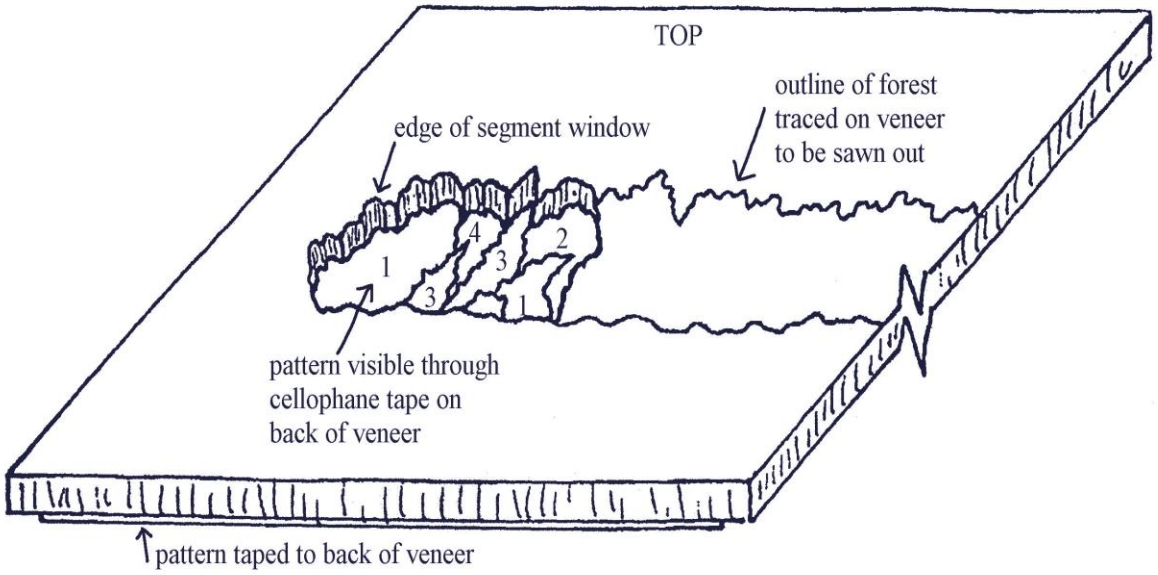

TOP
edge of segment window
outline of forest
traced on veneer
to be sawn out
4
2
1
3
3
1
pattern visible through
cellophane tape on
back of veneer
pattern taped to back of veneer

Figure 4

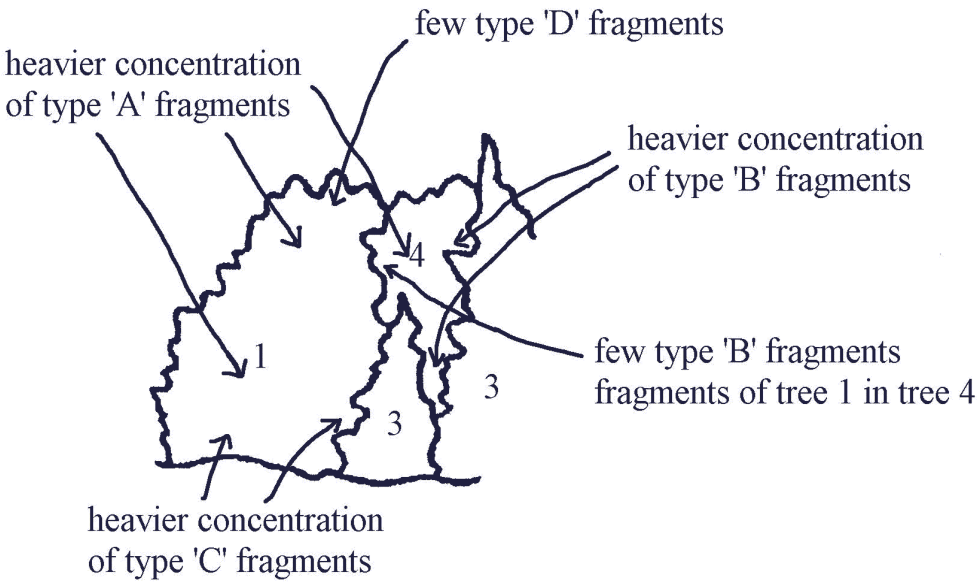


Figure 5

The fragments were placed in the window in two stages. In the first stage, I spread white glue on the cellophane tape in the window over the visible outline of one tree. Fragments of the dominant leaf colour were sprinkled over the glue with heavier concentrations near the top and middle of the tree (***Figure 5***). I then spread clusters of the dark shade and branch colour throughout the tree with heavier concentrations at the base of the tree and where the tree was overlapped by another tree.

The darker leaf colour was placed more sparingly to define branches and overlapping. A few sky fragments were placed in the extreme top of the tree. This simulated thinning of the upper branches. The tree was filled with fragments to just above the thickness of the background veneer. Once the glue got tacky the fragments were pressed into the glue with a finger. This took about five minutes so during this period the adjacent tree was worked on. Where two trees overlapped each other, heavier concentrations of darker colours were placed on the overlapped tree. The occasional fragment of the overlapped tree was placed in the tree in front to simulate gaps in the branches. The glue was allowed to dry over night for a section.

In the second stage another layer of glue was applied over the tree. Using the different colours for a tree, selected fragments were individually jammed into holes and gaps to further improve the look of the tree. Two knives with sharp tips were used to place the fragments. Usually a group of trees could be done before the glue in the first tree was dry. A piece of plastic was placed over the top of these trees and the area pressed between a board and the work top with a clamp. This flattened the fragments to the thickness of the background veneer and squeezed material into any gaps. This completed the process for that one segment.

I repeated this process on the next (adjacent) segment. Once all the segments were filled and fully dry, the pattern and cellophane tape were removed. A light gauge cabinet scraper was carefully used to smooth the front and back of the fragmentation. The rest of the picture was cut using conventional methods. I made sure that there were objects in the picture overlapping the fragmented shoreline, to have it tie in better with the rest of the picture.

3) Fine Lines

I used several different methods to make thin lines. The use of a specific method was determined by the shapes and the quantity of the line(s) required.

Part 3-1 describes the methods I used to make slots for fine lines. Part 3-2 shows how I made strips of veneer to fill a slot. Part 3-3 describes the insertion of material into the slot.

Making the slot.

I covered both sides of the veneer with cellophane tape to give the veneer extra support. I cut on a hard surface of hardwood plywood. I found cutting mats and softwood plywood too soft for the crisp clean cuts required.

Figure 6

3-1-1) KNIFE AND STRAIGHT EDGE

I used a knife and ruler to cut the slot for the spars (leading edge of the wings) (***Figure 6***). A knife and straight edge was ideal for creating long, wide straight slots. I used a metal ruler with sandpaper glued on the back to prevent it from slipping. The knife held a standard #11 'xacto' blade. The ruler was placed along one side of the slot, and a cut was made through the veneer with a knife. I did not try to cut through the veneer in one pass or the blade may have follow the grain and deviated from the ruler. Once one side of the slot was cut, I moved the ruler over the width of the slot, and made the cut for the other side. The ends of the slot were trimmed with a stab cut. I cut from the back of the picture because it produced a cleaner cut on the face (due to the bevel of the knife).

Double bladed knife

I used a double blade knife to make the ripples in the reflections of the trees in the water (***Figure 2***). I also used it to inset the wire rigging and starter crank rod (***Figure 6***). A double bladed knife cuts both sides of the slot at the same time. It produced a slot with a consistent width and was used against a straight edge. One problem with the system was setting up the knife blades. This required special sharpening of the blades to set the width (***Figure 7***). The blades were glued together with metal adhesive. I was careful to clean between the blades regularly or veneer would jam up between them and change the width of the slot.

Figure 7

3-1-3) CHISEL.

I used a chisel to make the slot for the hemlock needles (***Figure 8***). A chisel was used for very short straight cuts. I made custom chisels by grinding down #11 'xacto' knife blades (***Figure 9***). I would press the chisel into the veneer as straight up and down as possible. I made sure to keep the bevel of the chisel facing into the slot. The chisel was then reversed to cut the other side of the slot. The waste was poked out and the ends of the cut cleaned.

3-1-4) FRET SAW BLADE.

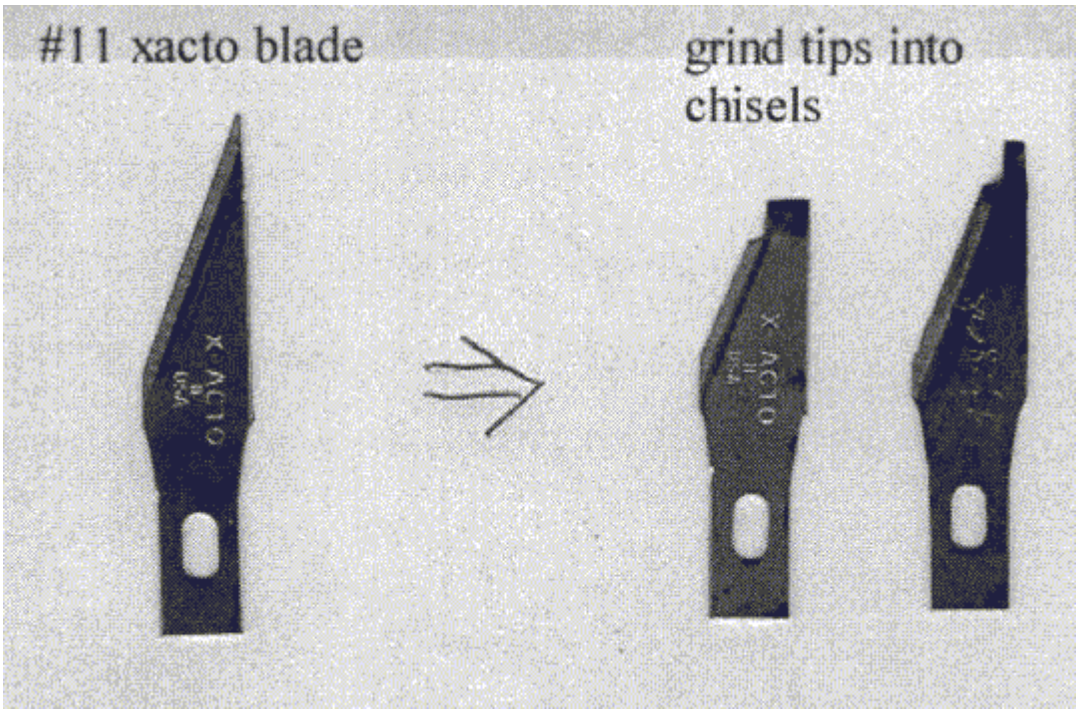


Figure 8

I used the fret saw to make slots for hemlock branches (***Figure 8***). The method was also used to make the ribs on the wings and the front of the struts (vertical members separating the wings) (***Figure 6***). The fret saw produced irregular shaped slots quickly and with a consistent width. I selected the appropriate fret saw blade for the width of the slot and put it in the fret saw. With the front side up, I sawed along the line with blade perpendicular to the table. A piece of waste cardboard was taped to the back to reduce fraying of the background veneer (***Figure 10***). The cut was started at the end of the line where the starting hole was least visible. I started the cut at the crotch of the limb, making sure to do the outer branches first. The saw dust was cleaned out of the cut. I slid the blade back and forth along the cut to clean it out.

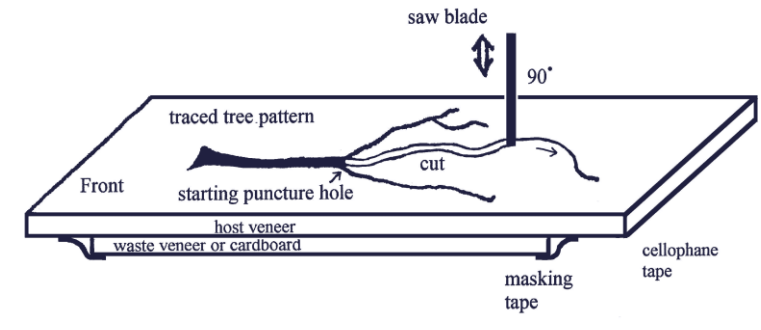


Figure 10

3-2) STRIP MANUFACTURING.

3-2-1) ONE STRIP AT A TIME.

It was safest to use veneer with straight, fine, even grain. The veneer was placed on a flat cutting surface. The edge of the veneer was trimmed parallel to the grain with a knife and ruler. Thin strips were cut off with a knife and ruler so that the strips were about 1½ times wider than the depth of the slot in the veneer. The strips were cut to the length of the slot or slightly longer, taking into account any curvature. Each strip was placed between two pieces of sandpaper on a flat surface and sanded until the strip reached the desired thickness (***Figure 11***).

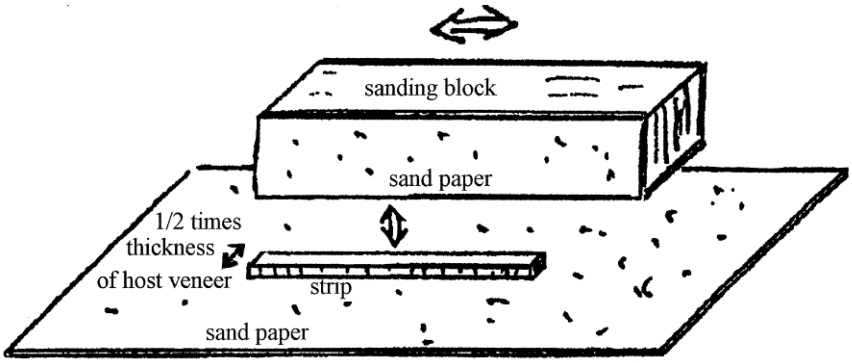


Figure 11

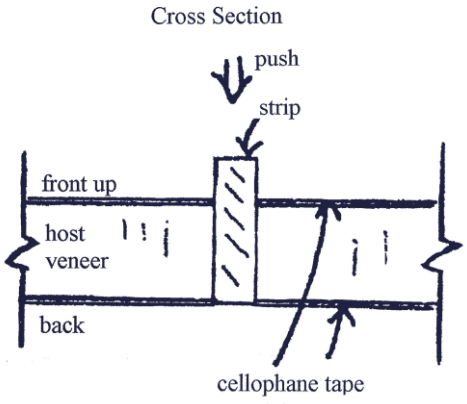
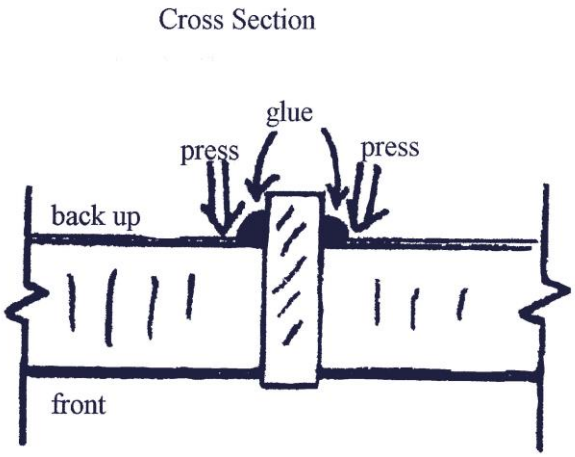


Figure 12



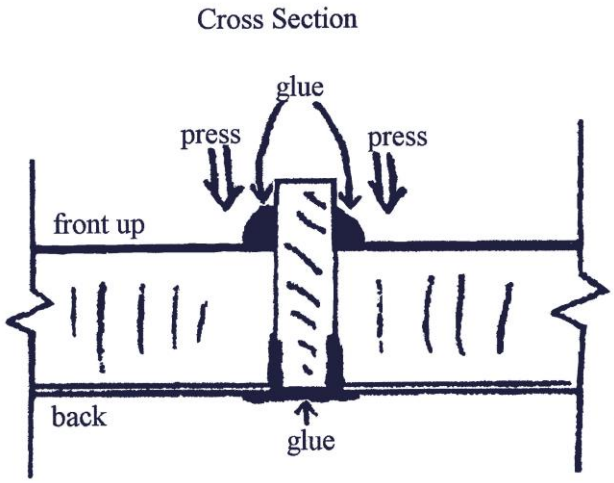


Figure 13 **Figure 14**

3-2-2) MANY STRIPS.

I use a portable planer to produce sheets of veneer in any thickness. Strips were cut off the sheets as required and the remainder stored for another time. The planer had sharp blades and was carefully set up. The back of a sheet of veneer was covered with low stick double face tape. It was stuck down onto a piece of melamine. The board and veneer were run through the planer. I removed very little material with each pass I used a fish filleting knife to separate the veneer from the board. The tape and residue were removed by rolling it up with a finger.

I glued a piece of dyed black veneer to a piece of maple. I then used the planer to remove most of the thickness of black. I flipped over the veneers and removed most

of the maple. Cutting off strips and inserting them on edge gave me the black and white strips simulating the light hitting tubular wire rigging (***Figure 6***).

3-3) FILLING THE SLOT.

The strip was pushed edgewise into the slot face side up (***Figure 12***). Any excess was trimmed off the end of the strip. The host veneer was turned over (back facing up) and the strip pressed down around the slot. Glue was spread around the strip protruding from the back (***Figure 13***). The host veneer was turned over (front facing up) and the strip pressed down around the slot. This action squeezed the glue on the back up into the slot. The excess glue was wiped from the back. Glue was spread around the strip protruding from the front and the excess wiped off (***Figure 14***). The glue was allowed to dry. The protruding portion of the strip was trimmed off with a knife. The cellophane tape was removed from the front and back of the host veneer. The surface was scraped flat with a cabinet scraper (***Figure 15***).

4) BORDER, INLAY BANDING AND EDGES.

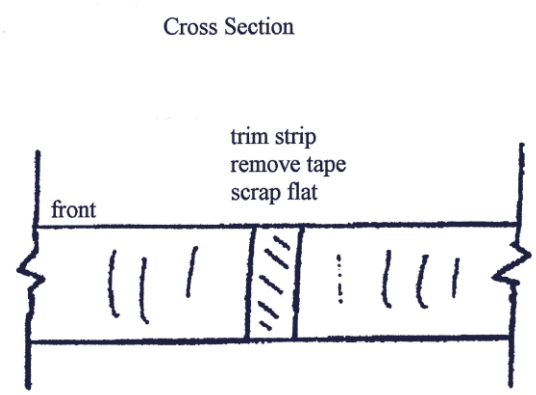


Figure 15

I decided to add walnut burl borders, $^{1}/_{8}$" black/white/black inlay and $^{3}/_{8}$" solid yellow birch edges. The first part of this section outlines how I selectively glued a picture without the border attached, trimmed it to size, and added a border. The second part shows how I inserted inlay banding between the picture and border. The third part deals with how I glued solid edges on the panel. The methods used required some special equipment including a press, pipe or 'F' clamps, veneer saw, and laminate trim router. The substrate for the panel was cut and worked in its finished size. The substrate was $^{11}/_{16}$" particle board.

4-1) GLUING THE PICTURE.

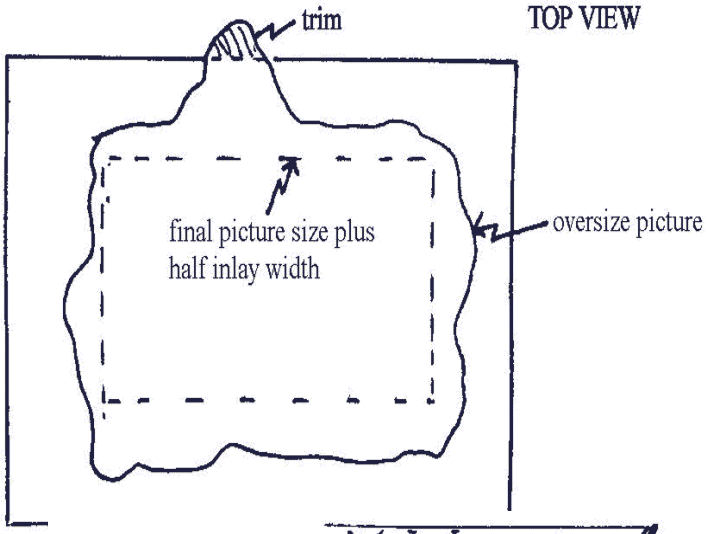


Figure 16

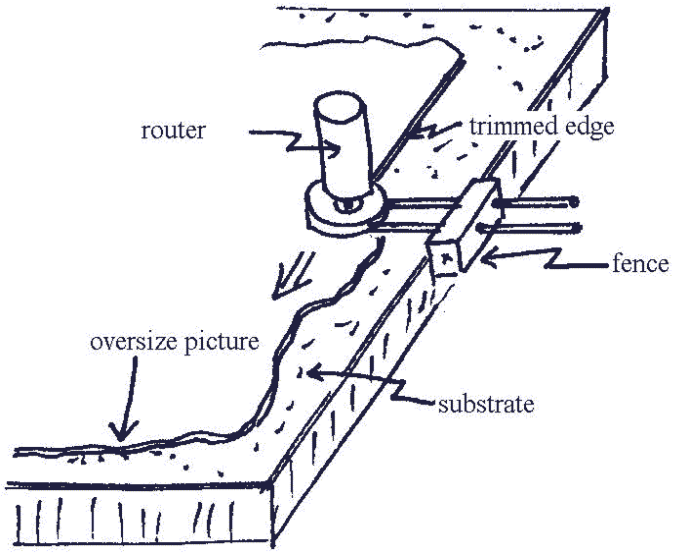


Figure 17

I used a pencil and set square to draw guidelines for gluing on the face surface of the substrate. The pencil lines were be drawn where the centre of the inlay was situated. Masking tape was placed along the outside of the pencil lines. White glue was spread over the masked off area. The masking tape was removed. I then taped the picture in place and pressed it with a thick pad to overcome any discrepancies in the thickness of the veneer (***Figure 16***).

4-2) TRIM.

I trimmed the picture veneer to final size with a router. The distance from the router's fence to the outside of the router bit was set to be the distance from the edge of the substrate to the centre of the inlay. The depth of the bit had to be set a hair shallower than the thickness of the picture veneer. I routed around the panel keeping

the fence tight against its edge (***Figure 17***). Most of the excess picture veneer broke away. I used a sharp chisel paint scraper to clean off the remainder.

4-3) BORDER.

The border veneer strips were prepared by making them $^1/_4$" wider than the distance from the trimmed picture edge to the edge of the panel. The strips were butted up against the trimmed pictures edge and taped in place with veneer tape making sure the strip ends overlapped (***Figure 18***).

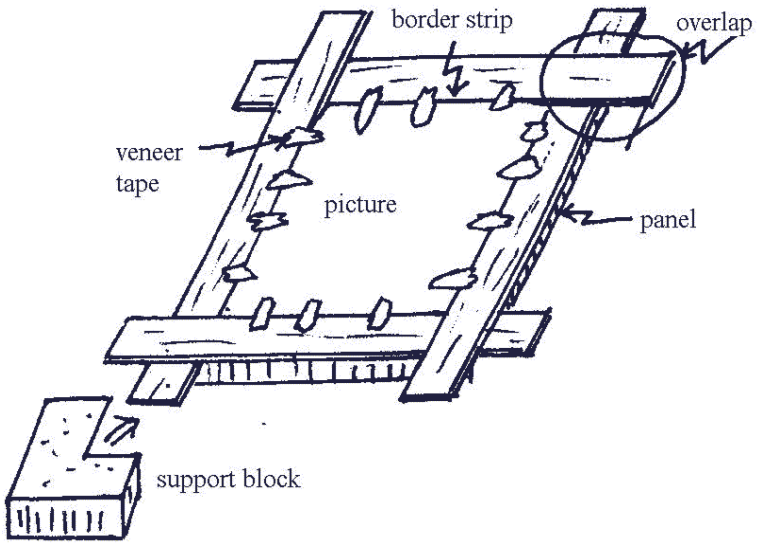
The next step was to cut the borders 45^o corner mitres (***Figure 19***). I used a ruler to measure length 'A1', which is the shortest side. Beginning at corner 'B', I marked 'C' with a pencil on the joint between the picture and border so that length 'A2' equalled length 'A1'. I laid a straight edge along a line joining 'C' and 'D'. This gave me a perfect 45^o mitre to the outside corner of the panel.

A notched support block of the same thickness as the panel was placed at the corner to be mitred. The overlapping border strips were cut through with a knife. I cut from the centre to the outside. The remaining mitre were cut in a similar fashion.

The border was now ready to be glued. Gluing had to be done quickly to prevent the water in the glue from swelling the veneer and opening the corners. The corners were taped tightly together with masking tape.

Once the glue was dry, the masking tape was removed. The overhanging border veneer was trimmed off by a router with a flush cutting bit and the edge sanded smooth with a rigid sanding block.

4-4) <u>Inlay.</u>



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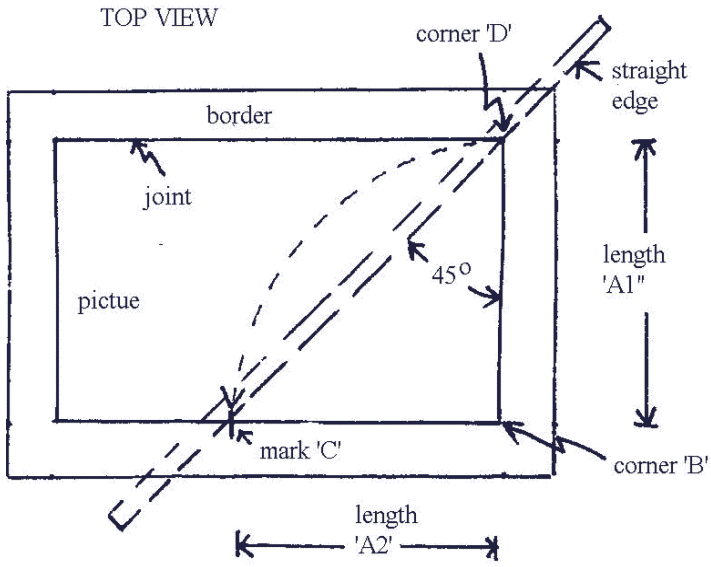


Figure 19

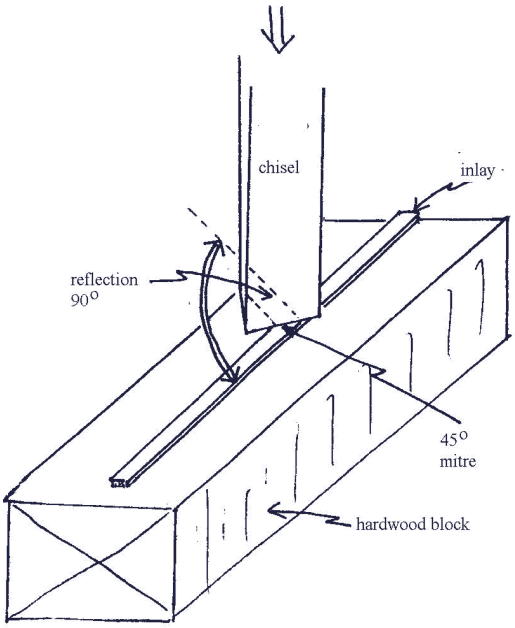


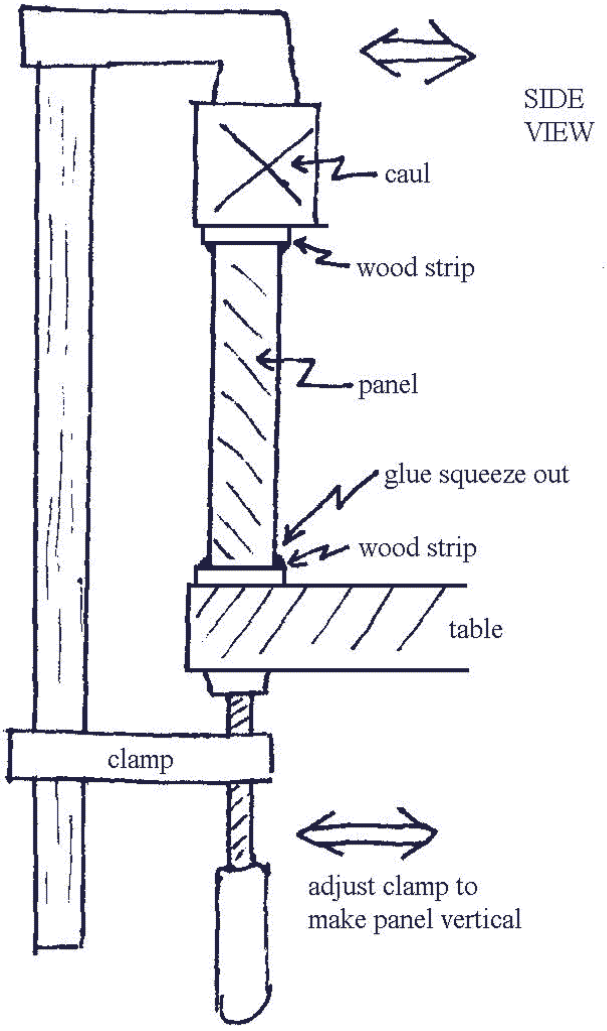
Figure 20

Inserting a strip of inlay banding involved removing an exact width of veneer at the joint between the border and picture veneer. A straight bit was placed in the router slightly smaller but as close as I had to the width of the inlay. The router fence was set so that the outside edge of the bit ran along the inside of the inlay. The depth of the bit was set to be slightly less than the thickness of the inlay. I used a piece of scrap to test the set-up. The router bit was plunged down into the panel with the fence tight against the panel's edge. The inlay was too tight for the groove so a second router pass was required to widen the groove. The fence was adjusted by adding pieces of masking tape to it. The corners were cleared out with a chisel.

I cut an end at a 45° angle on a piece of inlay (***Figure 20***). The inlay was placed on a hardwood block. A sharp polished chisel was set vertically on the inlay and positioned at a 45° angle. The reflection of the inlay in the back of the chisel produced a reflection of 90°. The inlay was cut by giving the chisel a sharp blow. The mitred end was inserted in one corner of the groove. The length was marked with a pencil and the other end cut off at a 45° angle. I proceeded around the picture in the same manner.

The inlays were removed from their grooves. A tiny amount of white glue was spread in the grooves and inlays inserted. Several pieces of masking tape were used to keep them in place. The pane was pressed.

4-5) EDGES



Solid wood edges (yellow birch) were cut and dressed to width. The wood was left $^1/_4$" thicker then the thickness of the picture. The extra thickness allowed for slippage and bends during clamping. The two longest sides are cut to length with 45^o angled ends.

One piece of wood was placed outside down along the edge of the table. White glue was spread on the corresponding edge of the substrate. The glued edge of the substrate was placed on top of the wood strip. Glue was spread on the opposite edge of the substrate. The other strip of wood was placed inside down on the second glued edge (***Figure 21***). A caul (a straight board at least 1" thick and wider and longer than the strip) was put on top.

The caul prevented the clamps from denting the veneer and evenly distributed the clamping pressure. The whole unit was clamped to the table with pipe clamps. The clamps had to be adjusted in or out to keep the panel vertical to the table surface and eliminate gaps between the wood strips and the edge of the substrate. I had to make sure the mitred corners did not slip out of alignment.

I left the panel in the clamps for a hour and trimmed off the excess wood with a block plane. The same procedure was repeated for the other two edges.

5) FINISH

First, I removed all veneer tape by soaking it with water and then scraping it off with a paint scraper. I then used a 8' bed stoke sander to level the picture. I drew light pencil lines on the surface and sanded until all the lines were just removed. A hand held orbital sander with 150 grit paper was used to finish sand the surface. I used compressed air to blow the dust from the surface of the picture. A stiff toothbrush swept out any remaining dust from the pores and the tip of a knife scrapes out any stubborn particles. The solid wood edges were sanded with a sanding block with 120 grit paper. The sharp corners were slightly rounded. The surface was now ready for the finish. The finish used was "Flecto Varathane Elite, Diamond Finish, 2000 Clear Gloss".

The finish was stirred gently, not shaken, in its container so as to minimize the quantity of bubbles formed. A quantity was then poured through an old nylon stocking, which acted as a strainer, into a small glass jar. I continually stirred the contents in the jar and slowly added 2 oz. per quart of "Hydrocote Ultraviolet Light Absorber and Stabilizer". The best room conditions were a temperature of 70^{o}F and relative humidity below 50%. (A warm room temperature helps the finish to flow better and thereby fill in cracks and make bubbles easier to break. Low humidity allows the finish to dry quickly and harden properly.)

The first full coat of finish was applied with a 2-inch wide foam brush. I did not scrape the brush over the jar's rim to remove excess; scraping promotes bubble formation. Instead, I merely touched the brush to the inside wall of the jar. The finish was spread parallel to the dominant grain direction. I made sure to spread the finish very thinly and to use as few strokes as possible to reduce the amount of bubbles that form. Bubbles did occur but most broke. Any stubborn bubbles were burst by blowing on them before the finish filmed over. The surface dried in 1 hour. Afterwards, I sanded the picture lightly with 150 paper. This removed the fuzz and any irregularities in the finish. The surface was blown clear and a toothbrush removed any other debris.

Another thicker coat was applied and left to dry for an hour. The surface was lightly sanded with 600 grit wet/dry sandpaper and a sprinkle of water to remove most of the bumps and scuff up the surface for the next coat. The residue was wiped away with a cotton cloth, and the surface was washed with clean water and dried with another clean cloth. A third coat was applied in the same manner as the second coat. The picture was then left to dry for a day; during this period, the finish hardened and shrunk in the pores.

Over the next couple of weeks, I added more coats of finish, always applying three coats in a short period of time and letting it sit for at least a day. Gradually the pores were almost filled. The three coats in quick succession are necessary because the product has layer binding problems if left too long between coats. The thin layers are easy to sand through and produce what looks like a water mark if you sand through improperly bonded layers. The three quick coats bond (remelt) together

because they have not fully cured and make a thick enough layer that it is hard to sand through.

Once I was satisfied with the finished surface I sanded it flat to remove the brush marks with 600 and then 1200 grit wet/dry paper with a water lubricant. The residue was wiped away with a cotton cloth and the surface washed with clean water and dried with another clean cloth

The next step was to coat the surface of the picture 3 more times with the same finish, only sprayed from a “Wagner FineCoat HVLP” paint sprayer. A extremely light sanding was given between coats with 1200 grit wet/dry sandpaper. This process left a slightly pebbly gloss finish, which is less reflective than a smooth mirror-like finish and reveals fewer faults. The veneers' texture can also be seen and felt, which to me was very important for a wood picture.