

## SECTION 2: THE WORK OF THE PALACE MAKER (*kuudenshi*)

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### INTRODUCTION:

Anyone gazing up at a temple, clearly understands the magnificence of Japanese carpentry. It encapsulates the mastery of woodworking skills like nothing else. Then again, when we look inside a Japanese family altar (*butsudan*), at the small but intricate canopy or palace (*kuuden*) which surrounds the Buddha statue, we see a mini version of the temple. As society modernizes and cheap products are imported from other parts of Asia, these traditional craft techniques are being lost. Temple building and repair is one of the few ways that such joinery skills are being maintained. *Butsudan* making is another. In this website, through the study of how a Hikone *butsudan* is made we are documenting what we can of these traditional skills.

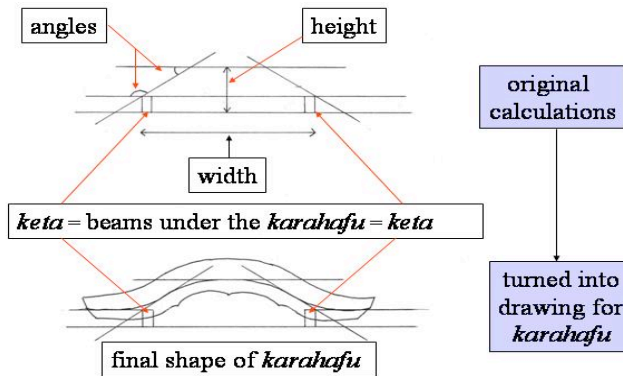
To understand clearly the expertise involved in *kuuden* making, we must look first at the different styles that are part of the repertoire of the traditionally skilled (DKS) artisan.

#### 2.1 STYLE

Whereas the shape and style of the *butsudan kiji* (see previous sections) are fairly standard regardless of Buddhist sect, those of the *kuuden* are quite distinctive. In general there are two types of *kuuden* (see intro photo 01 & *kuuden* photos 02 & 03). The one called *touriyane* tends to be used in cheaper ready-made *butsudan*. It is fixed permanently into the *butsudan*, hence is worked only on the front side. Stylistically, there are three gables at the front and no *kashiranuki* because the pillars go directly into the *hiraketa* and then into the *daimasu*. (for terms see *kuuden* fig. 04)

On the other hand, a *douzukuri kuuden* is removable and must be as carefully crafted on the back as the front. It is this type, found in the highest quality *butsudan* and requiring the utmost skill, which will be discussed below. *Kuudenshi* (*yaneshi*)

Tanaka Kazuo says, “It is the most challenging and most interesting. I put the most energy into the curve of the roof, to make a smooth and beautiful curve. It is hard to explain. My *kuudens*’ characteristics are concerned with the relationship between the width and the height of the curve as well as the angle of curvature of the roof.

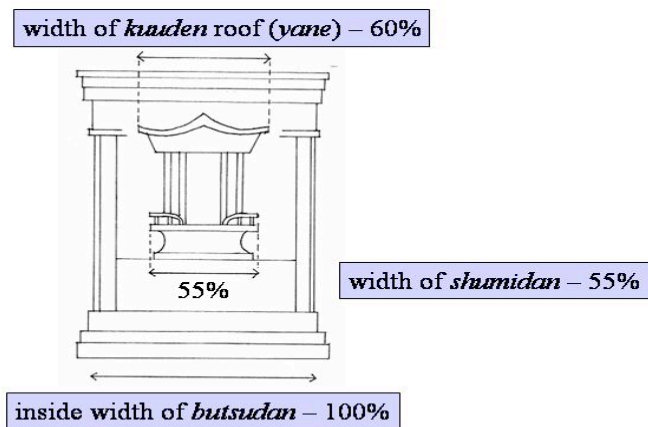


***Kuuden* figure 01: the shape of the *karahafu* is determined by the proportions of height, width and angles**

I always record in my notebook the shape of each *kuuden* roof that I make.” This distinctive and highly recognizable relationship is often a characteristic of the family business, as it is with the Tanaka family’s workshop, Tsubochuu, where Kazuo and his son Masashi and sometimes their wives, work together amongst the typically organized chaos. (see *kuuden* photo 04)

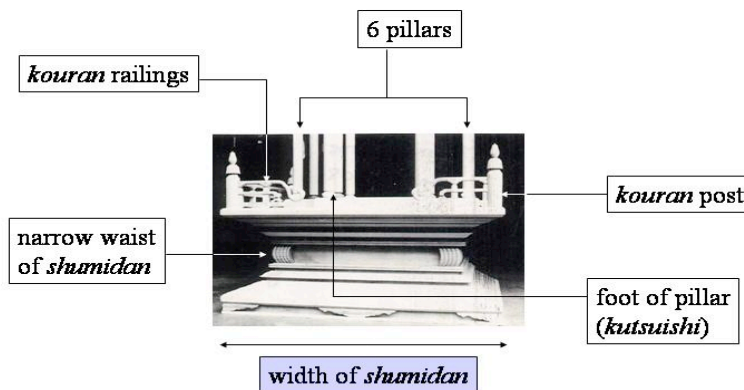
Although the *kuudenshi* is never present when the *butsudan* is finally conveyed to the customer, and sadly his identity will probably never be known, putting the *kuuden* in place is very special. “When the *butsudan* is delivered to the customers’ house the shop president will put the *kuuden* separately into the *butsudan* so that every side of it can be seen first. Sometimes the new owner gives a bottle of sake or something to the merchant (*toiya*) for taking special care of it before delivery,” says Kazuo.

The all-over size of the *kuuden* will be determined by the size of the *butsudan*, which is in turn determined by the size of the *butsuma* or alcove into which it will fit. The *butsuma* height is more or less fixed (by the height of the room) but the width can vary. Thus a bigger sized *butsudan* only becomes wider, and following on from this the width of the *kuuden* increases, thereby changing the relative proportions of the *butsudan* and the *kuuden*. Kazuo says, “The size of the *kuuden* is decided according to the inside size of the *butsudan*.”



***Kuuden* figure 02: relationship of the *kuuden* to the inside size of the *butsudan***

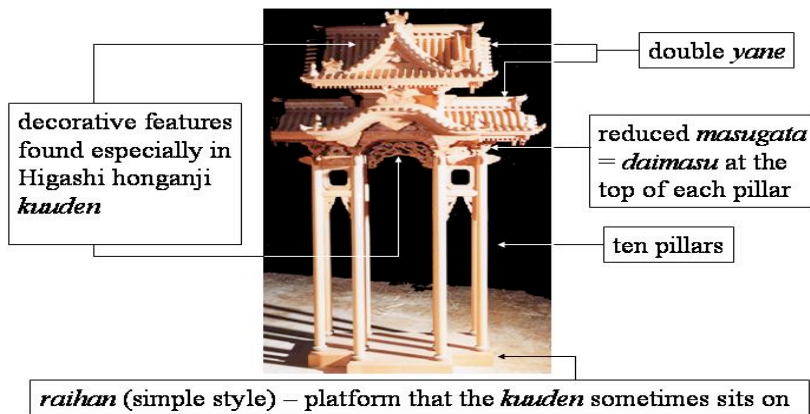
The width of widest part of the *kuuden* roof is 60% of the inside size of the *butsudan*. The width of the *shumidan*



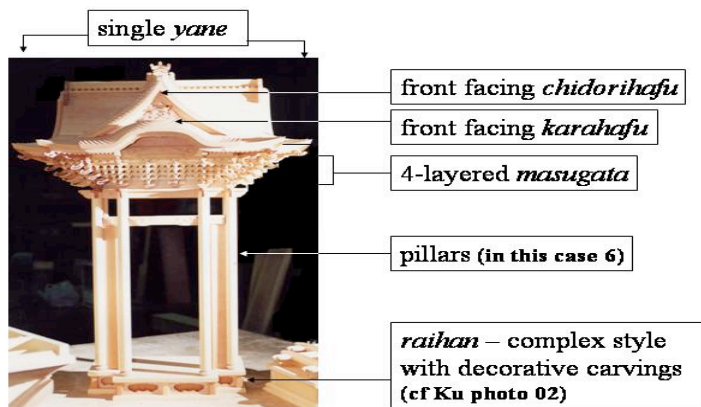
***Kuuden* photo 01: *shumidan* (photo courtesy of Tanaka Kazuo)**

is 55 % of the inside size. (also see *kijishi* photo 01) The *kuuden* height is roughly fixed so one for a smaller sized *butsudan* becomes narrower but not much shorter. Also, since all *butsuma* are a standard depth, that of the *kuuden* doesn't vary."

As mentioned before, for each sect (*shuu*) or subsect (*ha*) of Buddhism, the shape of the *butsudan kuuden* will mirror either the shape of the head temple main hall (*hondou*) or the altar within the *hondou*. Thus, including the two subsects of Joudoushinshuu and the single sect of Joudoshuu, there are three unique styles of Hikone *butsudan kuuden* and most people buy the *kuuden* to match the sect to which they belong. Within these styles, variations and similarities occur in the form and detail of the roof (*yane*), the beams (*masugata*), and the pillar (*kobashira*) complex. (see *kuuden* fig. 04)

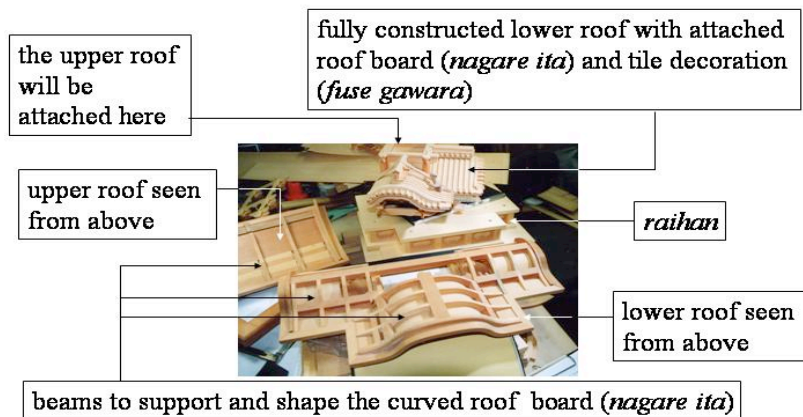


**Kuuden photo 02: Joudoshinshuu - Higashi honganji style**



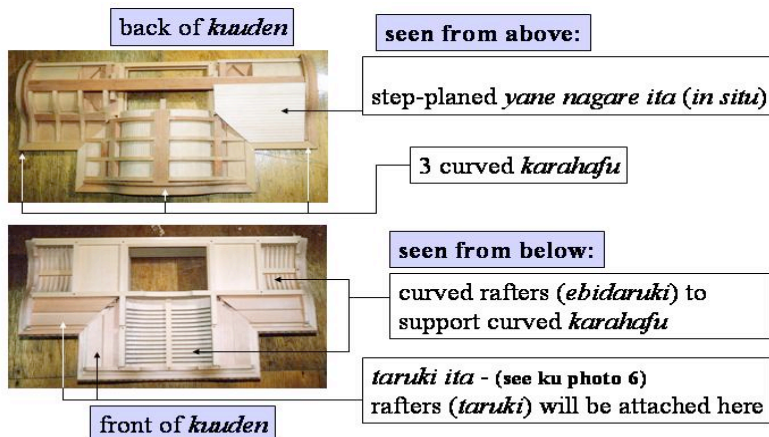
**Kuuden photo 03: Joudoshinshuu - Nishi honganji style (compare with ku fig. 04)**

Perhaps the most distinctive *kuuden* and the one requiring the most consummate skill is that for Joudoshinshuu, Higashi honganjiha (named for its main temple in Kyoto). (see *kuuden* photo 02) The complicated construction takes an artisan 1 month and is done only by special order.



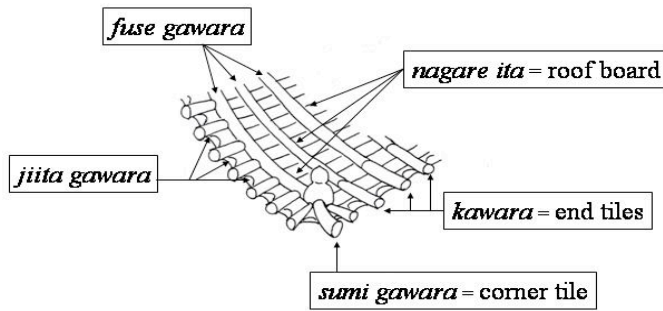
**Kuuden photo 04: showing the complicated construction necessary in making a Higashi honganji *kuuden***

Typically it has a double-layered *yane* with 3 curved ‘Chinese’ gables (*karahafu*) on the lower roof



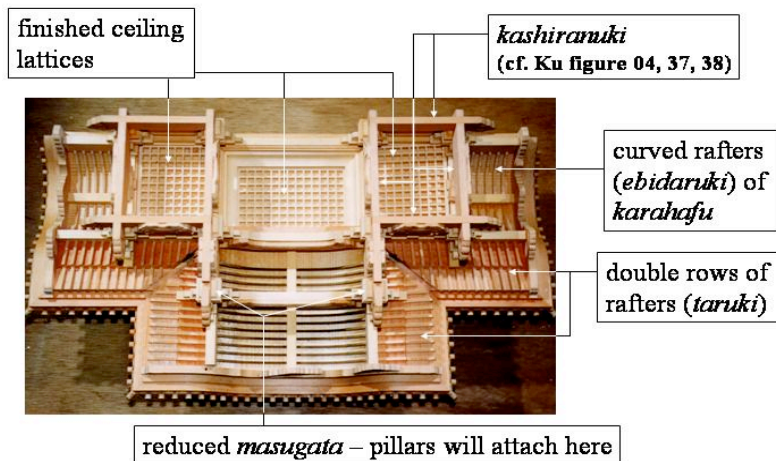
**Kuuden photo 05: - lower roof of Higashi honganji *kuuden***

and three pointed gables (*chidorihafu*) on the upper one. (see *kuuden* photo 09) The sloping roof board (*yane nagare ita*) is planed into a step design and a tile (*kawara*) design, in imitation of the real temple (Azby Brown 1989: 146-8), is added. For this, strips of wood, looking like half round roof tiles (*fusegawara*), run downward ending with a slight upturn at the eaves. These *fusegawara*, the eave pieces between them (*jiitagawara*) and the upward jutting corner pieces (*sumigawara*) are glued onto the *nagare ita*.



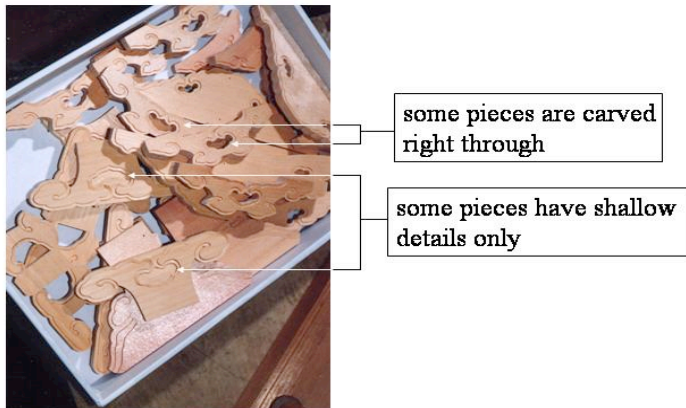
*Kuuden* figure 03: *kawara* on roof of Higashi honganji style *kuuden*

The rafters (*taruki*), under the *yane*, form two parallel rows at the sides and side fronts.



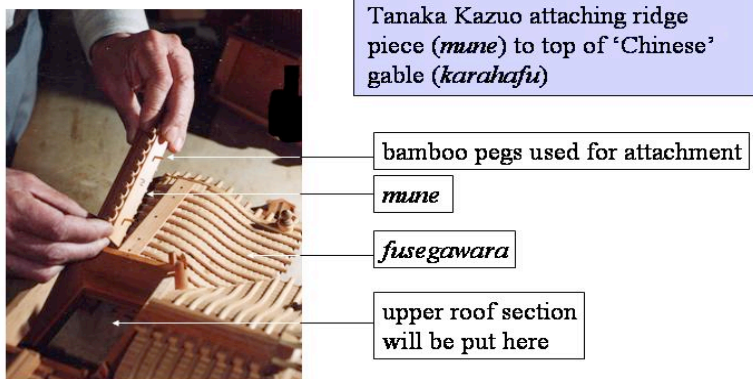
*Kuuden* photo 06: lower layer of the roof seen from below – showing 2 parallel rows of rafters (*taruki*)

The *masugata* is simple and found only as blocks on top of the ten pillars. (see *kuuden* photo 02) Some small carvings will be fixed onto the roof and between the pillars.

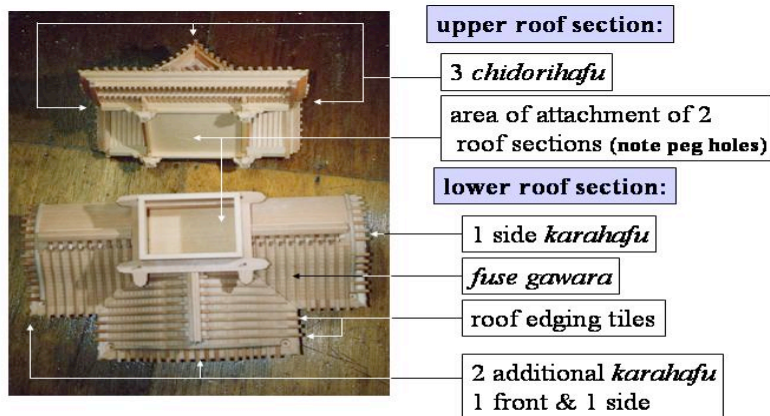


*Kuuden* photo 07: carved pieces for attachment between the pillars and on the roof

After the final details are added to the roof sections they will be ready to join together.

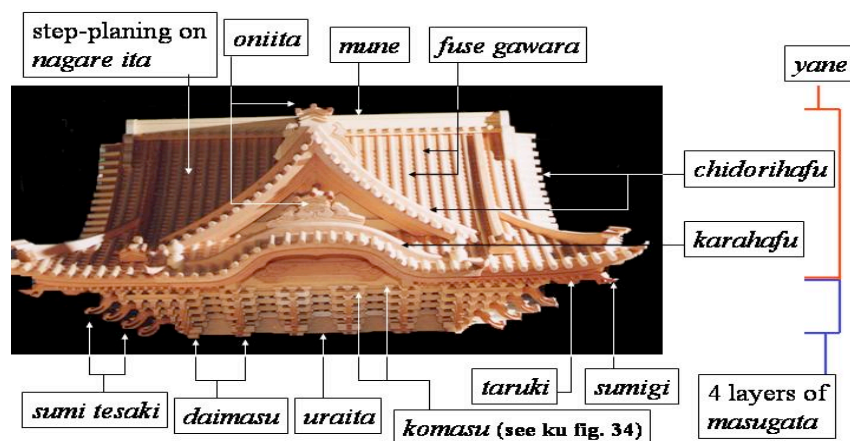


*Kuuden* photo 08: finishing touches



*Kuuden* photo 09: showing both layers of the completed roof

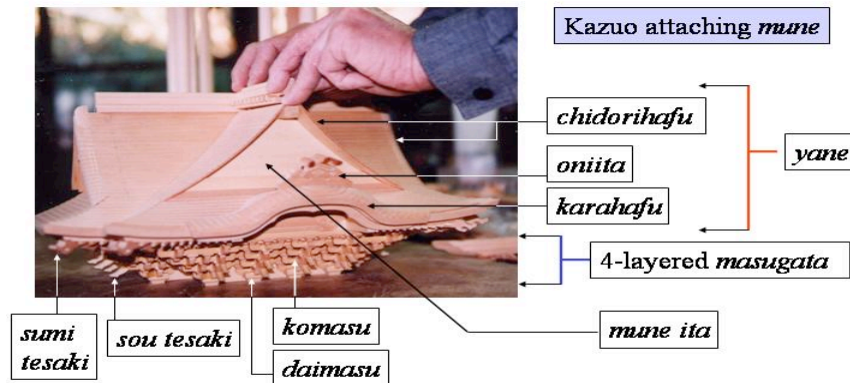
In contrast to the rather extravagant design described above, a simpler style can be found for Joudoshuu, whose main temple is Chionin in Kyoto and for the other subset of Joudoshinshuu, Nishi honganji ha (also named for its main temple in Kyoto). Because of their many similarities these two will be considered together and because of its relative simplicity the construction of a Nishi honganji *kuuden* will be detailed below. In both cases the stepped *yane* is a single storied structure with one central, curving *karahafu* and three *chidorihafu*, two at the sides and another above and behind the *karahafu*. The main feature, which distinguishes these two styles from one another, is that the Joudoshuu style has a *kawara* design similar to the Higashi honganji style.



*Kuuden* photo 10: *yane* and *masugata* – Joudoshuu style

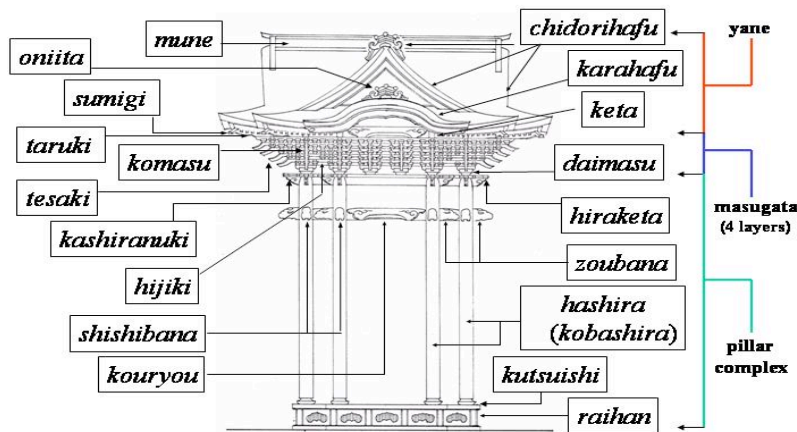
However the Nishi honganji style, in line with the main temple *kuuden*, has none.





*Kuuden* photo 11: *yane* and *masugata* – Joudoshinshuu Nishi honganji style

In both cases the *masugata*, under the *yane*, may be three, four or even more layers. It runs across the front and along the sides of the *yane* and extends outwards beyond the pillars.



*Kuuden* figure 04: Nishi honganji style *kuuden* [drawing courtesy of Tanaka Kazuo]

The basic number of pillars is six but can be reduced to four in the case of Nishi honganji, if the customer prefers. A ‘rainbow’ girder (*kouyrou*) (see section on pillars) may be placed lower down on the pillars and the protruding ends (*kibana*) point front ways (*shishibana*) and sideways (*zoubana*). Finally, the *kuuden* sometimes sits directly on the *shumidan* or is placed on an additional platform (*raihan*), which may or may not have decorative carvings.

## 2.2 TOOLS:

Since a craftsman’s tools are his most precious asset and something even a fellow artisan would never handle without permission, it seems worth making a few comments about them generally before embarking on the description of the *kuuden* manufacturing process. The information below applies equally to all three wood working artisans, Tsuji Ryoza (*kijishi*), Tanaka Kazuo (*kuudenshi*) and lastly, Mori Tesso (*choukokushi*) whose work will be described next. However for Kazuo the

subject sparked a special kind of animation. Reminiscing about the old days he said, “until about 10 years ago artisans used to take pride in sharpening their newly purchased carving chisels and knives. The blades had not been sharpened when they were first delivered. Now, I guess the artisans want to skip the first and rather lengthy process of this initial sharpening.

“Still, it seems that the occasional blade will never be satisfactory,” continues Kazuo. “Even among the tools from first ranked makers, the blades of some are easily chipped or notched or can become bent and blunted, meaning the quality of the metal is not so good. Such as those are called ‘*namakura*’ which also means someone who is lazy or good for nothing. Also tools from the same shop are different, depending on the artisan who made them. Once, I received items which were made by an apprentice artisan because his skilful master had quit working and I was very disappointed that the blades didn’t sharpen enough to cut. Some knives (*kurikogatana*), which I bought 20 or 30 years ago and which I’m still using, cut well.



Kazuo in his workshop

*kurikogatana*

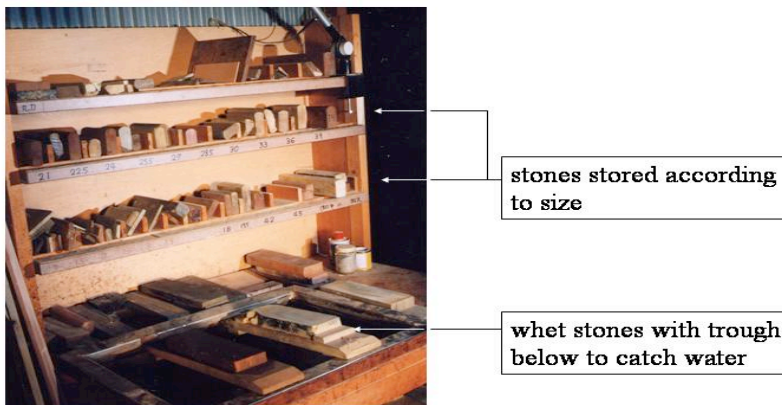
***Kuuden* photo 12: Tanaka Kazuo sorting through the knives, showing his favourites**

The artisan who made these was very skilled but has already died. I think around 25% of gouges (*gantou*) do not cut to my ideal standard but I’m using them anyway. The blade itself costs about 3 to 5,000 yen and the handle costs about 1,000 yen. Before I set to work I sharpen it, changing the method according to the use. The blade becomes shorter by 3 cm in 10 years. A beginner could break the tip of the blade many times when carving a small part. Every time it breaks it must be sharpened again and it is very time consuming. In the past I was asked to use the tools where hardness had been measured by a machine, as an experiment, but they did not cut well. Hard blades don’t necessarily turn out to be good blades because they need flexibility as well as hardness,” he adds.

“Good materials, good tools and good skills are essential for good finished products. If even one of them is missing you cannot expect good products. There is a saying that ‘Priest Koubou Daishi does not choose his brush’ in other words, whatever brush he happened to pick up, his work would still be excellent. But I do not agree. I feel that a person who does good work has a good assortment of tools available. They say that when you hire a carpenter you should look at the tool box of the person first and

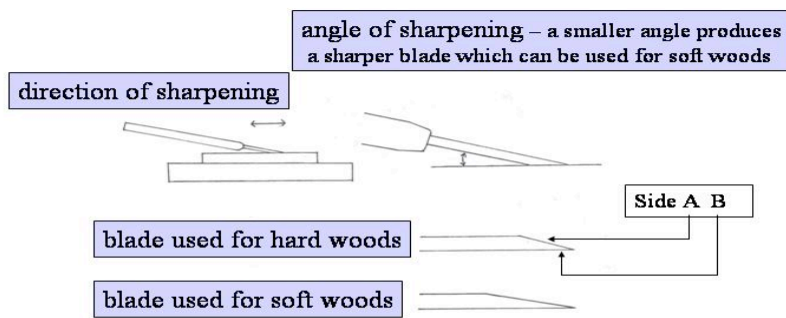
then hire him. I heard that in the past the wages were decided by looking in the toolbox. All the tools which are still in my tool box are easy to sharpen, cut well and keep sharp for a long time. You cannot easily collect tools which have these three characteristics.”

As mentioned before, sharpening is a lengthy and exacting process. Kazuo bends over a bench with a box below to collect the water dripping off the whetstones as they are being used. There are two grades of stones: *naka toishi* for intermediate grade sharpening and *shiage toishi* for the finishing touches. In his workshop the stones were stored on shelves in rows according to the shape and size of blade they sharpen. The size is written on the shelf below each stone.



*Kuuden* photo 13 : grinding stones

He wets the stone (*toishi*) then he fixes the angle of his hands and rubs back and forth evenly in both directions pressing the chisel to the grinding stone. The end product depends on the hardness of wood to be carved. Kazuo says, “there are many degrees of hardness. Quercus (*kashi*) is amongst the hardest and Paulonia (*kiri*) is the opposite extreme, but even here the difference in the angle of sharpening, between the blade and the stone, would be less than 1 degree.” It is very delicate and wouldn’t be detected by an outside observer.



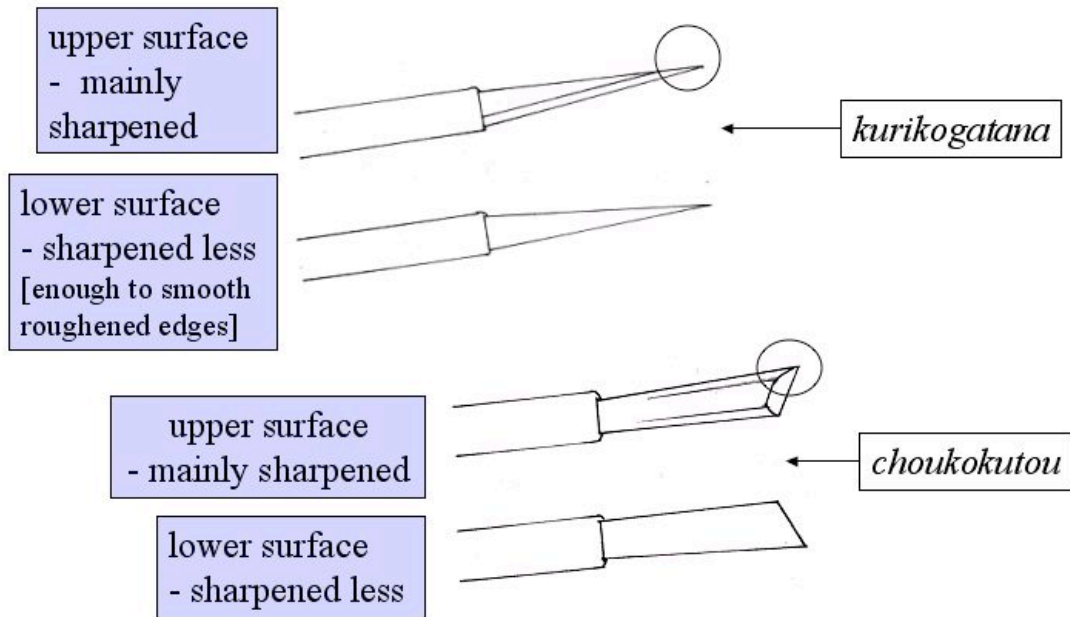
*Kuuden* figure 05: sharpening blades of carving tools (differences in sharpness exaggerated for clarity)

“I sharpen the chisels according to the type of wood, to get the right balance between ability to penetrate the wood and the risk of breaking. Thinner, sharper edges penetrate the wood more easily but they are brittle and break easily. On the other hand thick blades are not brittle and not easily broken but they are heavy and not easy to control and penetrate the wood with difficulty. When the wood is hard the resultant blade must be thicker.” Naturally all artisans differ, however for Kazuo the sharpening process consists of a repeated sequence of 80% working on side A then, just to maintain the blade’s original shape and grind off the rough edges, that is followed by 20% on side B. Finally, when finished he dries and oils the blade.

Favoured tools can pass from father to son and all artisans find their own way to use them safely and efficiently. Kazuo explains, “When I use chiseling or gouging knives I push with my right hand and use the left index finger to adjust the pressure. When I was young and not experienced, I often got injured.” Not surprisingly, certain particular tools will suit the occasion and the artisans’ skills and will be used over and over again.

**Carving knives:** For instance, as with *kijishi* Tsuji Ryoza (see previous section), Kazuo uses the small pointed carving knife (*kurikogatana*) where the carving goes right through the wood (pierced). (see *kuuden* photo 07) Ranging over 7 sizes from small to large, this tool is used to make the inside surface smooth.

**Flat chisels:** On the other hand the flat carving knife or chisel (*choukokutou*) (also see *kiji* section) has a thin, sharp, slanted blade and comes in 8 sizes with widths ranging from 8mm to 1.5cm.

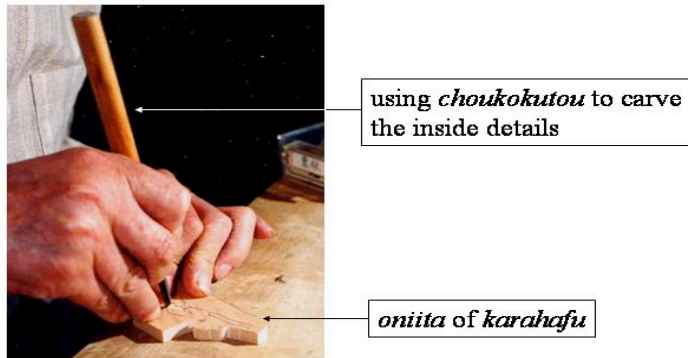


*Kuuden figure 06: kurikogatana and choukokutou showing sharpened points*



*Kuuden photo 14: kurikogatana and choukokutou*

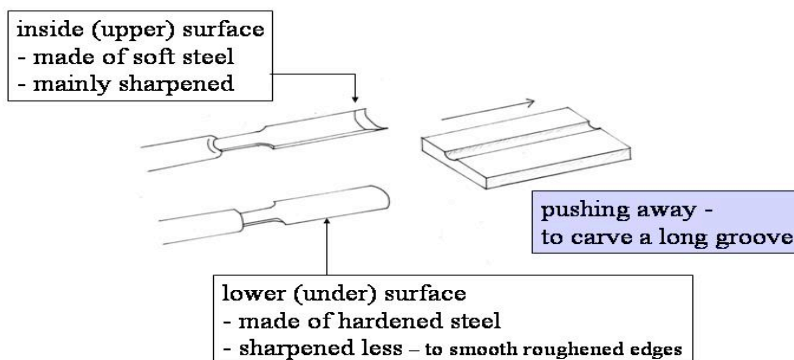
It is used for delicate carving. As with all small pieces the shape is roughly cut by jigsaw (*itonoko ban*) then the delicate grooves are made and the shape is perfected.



***Kuuden* photo 15: Kazuo doing the delicate carving on the *yane* decorations (*oniita*)**

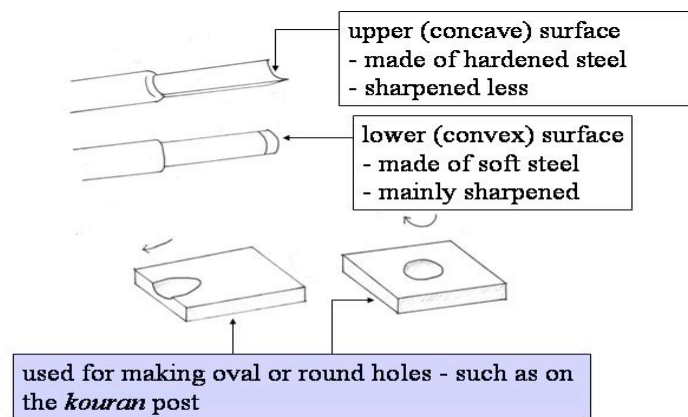
(also see *yane* section) When he uses the chisel he has to move and change direction slowly or else the blade breaks. With smaller pieces he has to make sharp turns so the blade tip snaps frequently and has to be resharpened. That is why these carvings can increase the price of a *kuuden* (see *kuuden* photo 07).

**Shaped chisels:** Of the curved chisels it is the position of the bevelled surface, inside or outside, which will determine its use. For example on the simple peeling chisel (*marusuki nomi*) the outside, convex surface is hardened steel and the softer, inner, concave surface is sharpened. The bevelled chiselling surface on the inside suits this tool for making simple, one-step, long grooves.



***Kuuden* figure 07: *marusuki nomi***

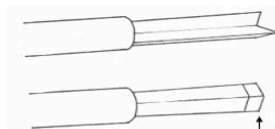
Conversely on the gouge (*gantou*) the inside of the curve, the concave surface, is made of hardened steel and the outside is a softer metal. The outside is sharpened so the bevelled edge is on the underneath, convex surface. There are 26 sizes ranging from 0.6 bu to 15 bu (1 bu = 3.03mm). This *gantou* is suitable for making round or oval shaped holes.



*Kuuden figure 08: gantou*

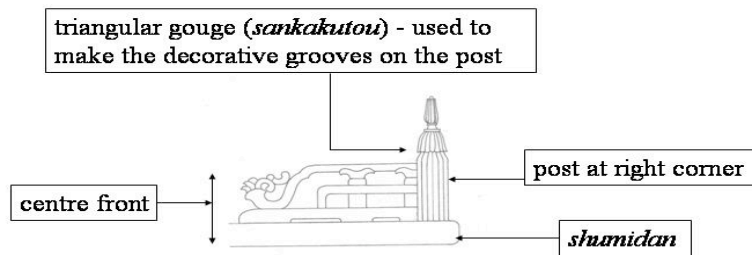
It can be used for shaping parts of the *kouran* post. (see *kuuden* photo 01 and figure 09.c) Kazuo has only one triangular gouge (*sankakutou*). The bevelled surface is underneath so he uses it to make v-shaped grooves to different depths such as on the *kouran* post

triangular chisel – used to make triangular grooves



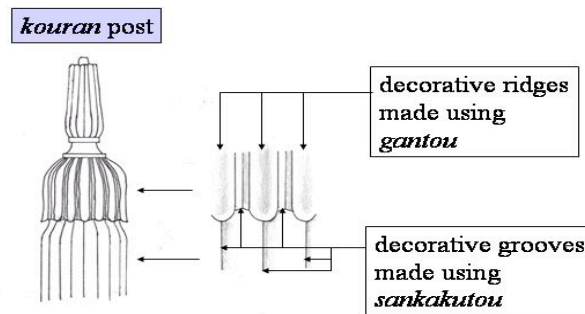
lower surface of the blade is mainly sharpened

*Kuuden figure 09.a: sankakutou*



*kouran* runs across the front and along the sides of the *shumidan*  
(see *kiji* photo 21)

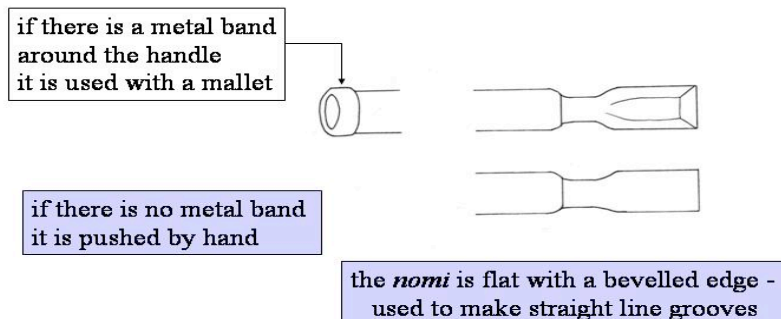
*Kuuden* figure 09.b: details of *kouran*  
(railings)



*Kuuden* figure 09.c: details of carving on  
*kouran* post

(see *kuuden* photo 01)

**Banded chisels:** However he has eight block chisels (*nomi*). Flat with the bevelled edge on top, they are used to make straight line grooves.



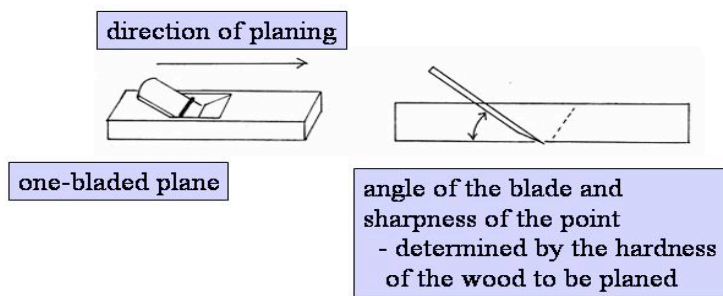
*Kuuden* figure 10: *nomi*



They can either be pushed by hand or if a mallet is needed they will have a metal band around the end of the handle (*tataki nomi*).

**Planes:** Planes (*kanna*) are another essential tool in the woodcrafters collection. Interestingly they are used pulling towards the person, which is opposite to western style. Kazuo says, "I learned the way to use the planes from my father. I had thought that in the case of *butsudan* I wouldn't need to worry so much about the smoothness because the lacquerer would put *urushi* over it. But in reality if the surface is not really smooth the unevenness of the urushi surface becomes apparent after a few years. The wood of the *kuuden* is the base so I have to do perfect work."

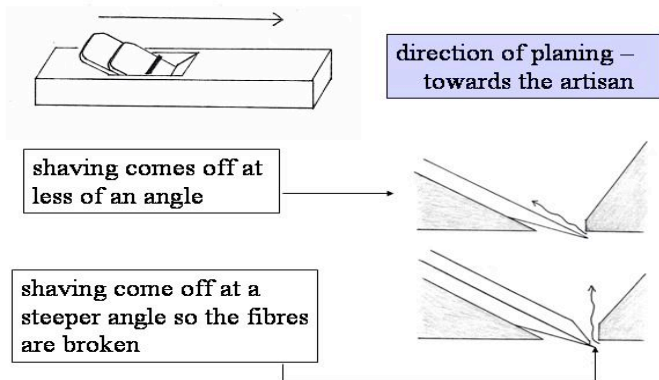
Basically there are two styles of planes: single and doubled bladed. The one-bladed plane (*hira ganna*) is used for planing horizontally to the tree trunk, in other words in cross section. In that case it does not matter which kind of plane he uses so he uses the single bladed one because it is lighter.



*Kuuden figure 11: hira ganna*

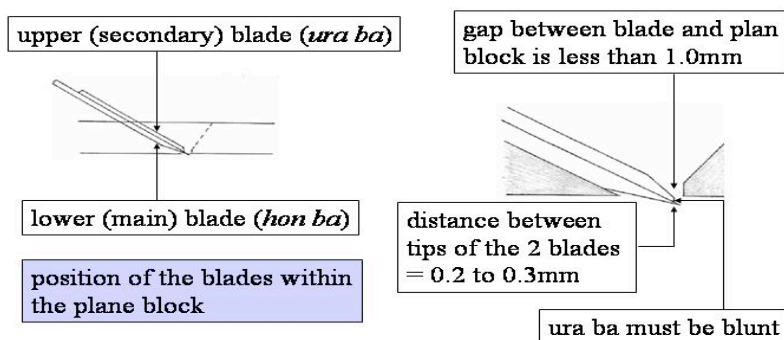
As with chisels the angle of the blade is very slightly different (less than 1 degree) for soft wood (smaller angle) and for hardwood (steeper angle) where the blade is also not so sharp.

However if he goes against or across the grain with the single blade it cuts too deeply and unevenly and the resultant surface would be rough. Therefore the two-bladed plane, which was invented towards the end of the Meiji period, is very helpful in making the surface smooth even such cases.



*Kuuden* figure 12.a: double-bladed plane

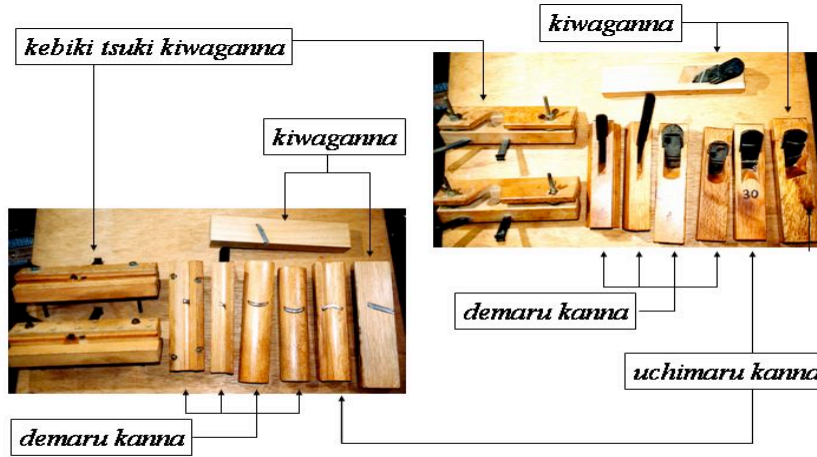
(also see *kiji* section) (see *kuuden* figs. 25, 26). The slightly blunt upper or secondary blade (*ura ba*) determines the depth of wood which is sliced and the angle at which it comes off, while the sharp, lower blade (*hon ba*) does the cutting. The shaving comes off more at right angles to the main board and the fibre is broken as a result. This means that the double bladed is good for cutting large surface areas where the grain frequently changes such as in *keyaki* or *sen* (also see *kiji* section). Kazuo says, “I have to control the gap between the blade and the plane block and the relationship between the two blades and the sharpening of the secondary blade. These are techniques which require much skill.” The blade must be positioned so the gap is less than 1 mm or else it will slice too deeply. He uses a hammer to knock the blades into position. The distance between the tip of the main blade (*hon ba*) and the tip of the secondary blade (*ura ba*) must be 0.2 to 0.3 mm. Finally, the tip of the secondary blade must be a little blunt.



*Kuuden* figure 12.b: setting up a double-bladed plane

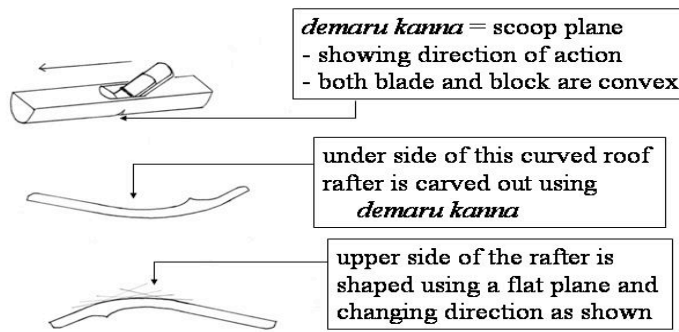
“Once, when I was around 30, I was asked to make about 1000 rulers each 50 to 60 cm long. At that time my finishing ability was not good and the ruler-making specialist told me the important points to consider when using the 2-bladed plane. The surface of the ruler must be very smooth because tiny markings will be put there and that would be difficult if the surface was not absolutely flat.”

Other than the above differentiation, planes are classified according to the shapes of the blades, either flat or curved and their functions, such as the sizes of poles or the depths and shapes of grooves to be cut.

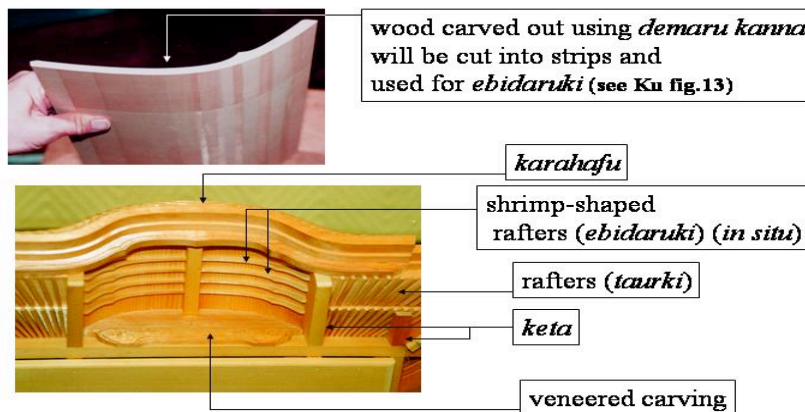


*Kuuden* photo 16: selection of planes

Kazuo uses curved bladed planes to make concave surfaces and poles. The *demaru kanna* (scoop plane) is used for the curved under-part of the roof because the underneath of the plane block and the blade are convex



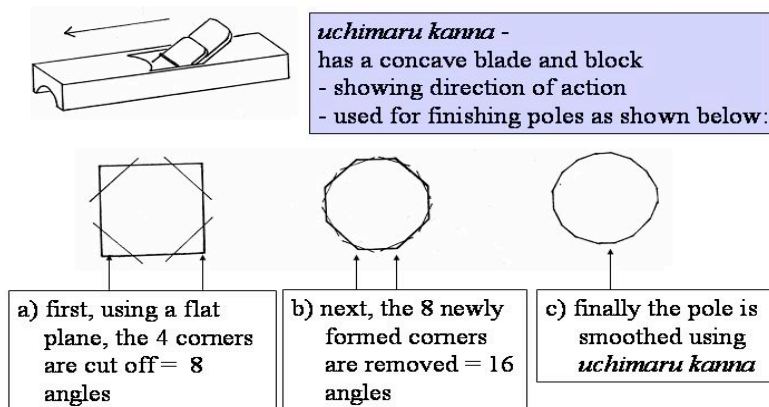
*Kuuden* figure 13: *demaru kanna*



**Kuuden photo 17: function of *demaru kanna* and *ebidaruki* in position under *karahafu***

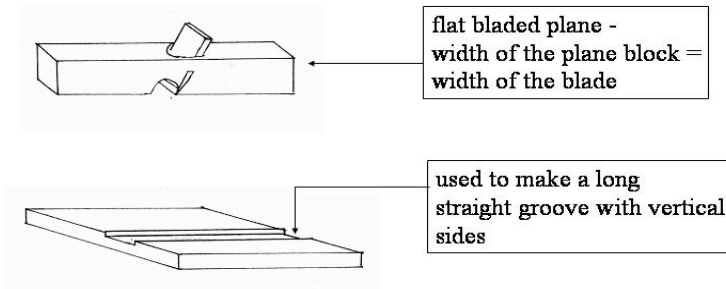
(see *yane* section)]. For the upper curve he uses a flat plane and changes the angle of the blade (see *kuuden* fig. 13). In the case of the *uchimaru kanna* the underneath of both the plane and the blade are concave so it is for finishing the poles. The pole is made by:

- a) cutting the corners off a square piece to give a 8 angled shape;
- b) cutting each angle again to get 16 angles;
- c) make it round with *uchimaru kanna*.



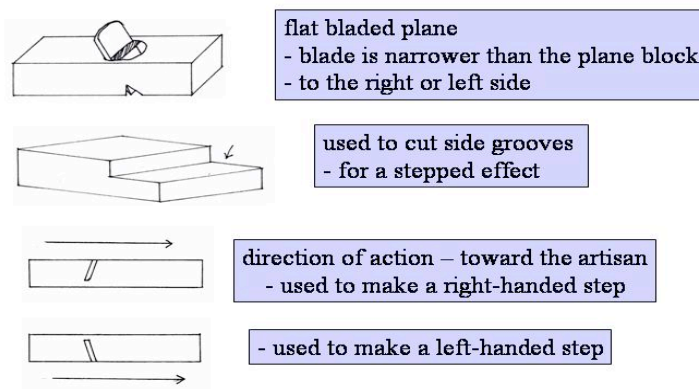
**Kuuden figure 14: *uchimaru kanna* – making a pillar**

Three frequently used flat planes are as follows. The *shakkuri ganna* is a plane where both the block and the blade are flat and the same width. It is used to make a long straight groove with vertical sides such as to allow the *daimasu* or *komasu* to slot onto the *hijiki*.



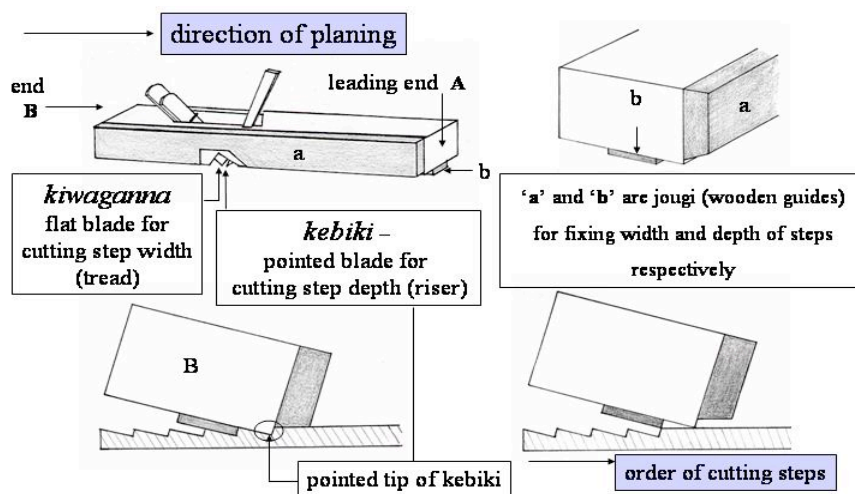
*Kuuden figure 15: shakkuri ganna*

(see kuuden fig. 33) The *kiwa ganna* is used to plane the edge of a piece of wood. It makes a shallow one-sided step.



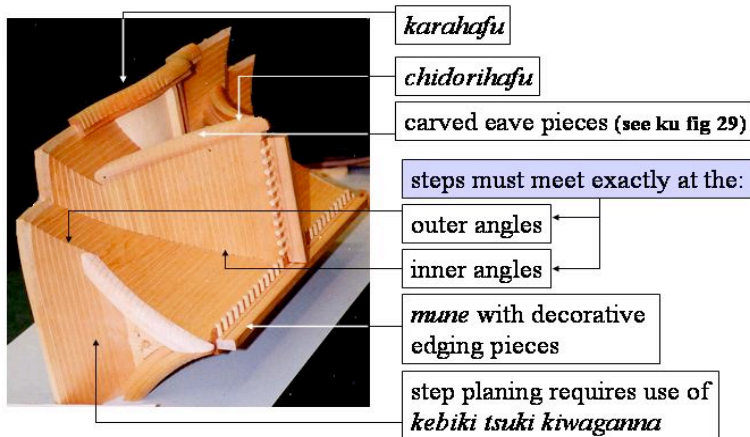
*Kuuden figure 16: kiwa ganna*

The blade is to the left or right of the plane and not as wide as the block. Kazuo uses both hands; the right hand to cut right side grooves and the left hand to cut grooves on the left. He does not use his left hand for anything else. Finally the *kebiki tsuki kiwa ganna*, a 2-bladed plane, is used to make a shallow step at the edge by cutting and planing at the same time. The *kiwa ganna* blade cuts the horizontal (tread) to between 5.0 and 8.0mm and the other more pointed *kebiki* cuts the sharp vertical side (riser) of the step to between 0.7 and 1mm.



*Kuuden* figure 17: *kebiki tsuki kiwaganna* used for step planing on the *kuuden* roof

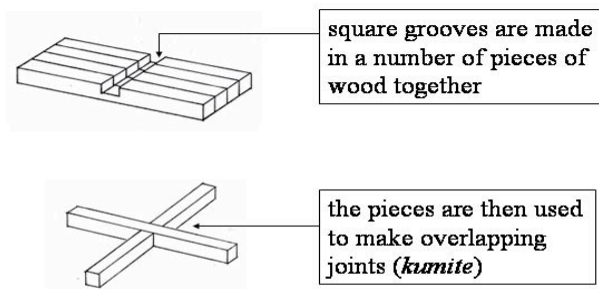
[see *kuuden* photo 16) It is used for the stepped slope on the upper surface of the roof (*nagare ita*) and the exact measurements depend on the size of the *yane*.



*Kuuden* photo 18: step-planing of Nishi honganji style *yane*

(see *kuuden* photo 20 )

Making joints is worth a special mention here, particularly as parts of the *kuuden*, such as the *masugata*, are a composite of tiny jointed pieces. A special saw (*douzuki noko*), with a very thin blade and fine serrations, which can cut across the grain, is used to make flush joints. A radial machine saw (*rajiaru*) is used to make square groove joints (*kumite*) to overlap pieces.



*Kuuden* figure 18: making overlapping joints

*Kumite* is the ditch which is carved to make the joints. *Kumite* is also the joint itself. Kazuo puts up to 4 pieces of wood together and makes the same sized ditch in all of them at once. When combined, the jointed piece (*kumiko*) makes a cross shape. For example this can be used on the *hijiki* between *daimasu* and *komasu* (see *masugata* construction below).

**Machines:** Of course more and more machines are creeping into use for all but the highest quality of *but sudan*. Even then, Kazuo finds a few reduce his labours considerably. For preparation of the wood he uses electric saws and planes. The circular saw (*marunoko ban*) has a lever at one end of the table to tip the blade and control the angle at which it cuts. In the old style machine the whole table tipped while the blade stayed vertical to get an angular cut. Warps or bends in the wood are removed by pushing it through a hand push plane (*teoshi kanna*) to trim the irregularities and make them straight. As the work progresses Kazuo could use the following machines. The electric jig saw (*itonoko ban*), where the whole table is tilted, is used to cut out the irregularly shaped pieces (see *kuuden* photo 07). Then the curved surfaces thus produced can be smoothed with an electric sander. Here a spindle made of abrasive material spins in the centre of a table. He also sometimes uses a chamfering machine (*mentori ban*) to round off the corners to make the roughly curved shapes of such parts as the Chinese gable (*karahafu*). (see *kuuden* fig. 29)

### 2.3 MATERIALS:

With regards to the making of a *but sudan*, choosing the correct materials is an important consideration both for the ease of working and for the quality of the finished product. More options are open to the woodworkers than to the artisans of the lacquer and gilding skills, and since it is considered an integral part of the techniques, it is dealt with in the processes section which follows.

Later, construction of the *kuuden*, focusing especially on Nishi honganji style, will be described from the top down - the roof (*yane*) including small, carved pieces, then the beams (*masugata*) and lastly the pillar complex including the *raihan*. However, first the details of preparation, which are quite similar to those of *kiji*, will be explained.

### 2.4 TECHNICAL PROCESSES:

## 1. Ruler (*tsue*) making

As with the *kijishi* the first job of the *kuudenshi* is to make the rulers (*tsue* sometimes called *jougi* by *kuudenshi*), which will establish the final dimensions, depth, height and width, of the palace. Based on the overall proportions of the *butsudan*, the palace (*kuuden*), including base (*raihan*), pillars (*hashira*), beams (*masugata*) and roof (*yane*) will be designed to match. Although the style of the *kuuden* varies according to the Buddhist sect to which the customer belongs, his personal choices are also taken into account. The *kuudenshi* considers such things as the slope of the *yane* very carefully when designing the structure and again these three *tsue*, 1.3 cm sq in size and marked with Chinese ink (*sumi*), determine the final dimensions of the *kuuden* and are thus a kind of ‘blueprint’.

## 2. Selection of materials

Even as he measures up, designs and makes the *tsue* for the *kuuden*, Kazuo will have his preferred materials in mind. According to Nomura (1977: 50-51) attention must be paid to the strengths and flaws, such as grain and cracks, of each piece of wood. However making sure the wood is completely seasoned is not a big issue. As Kazuo’s son, Masashi, says, “We do not need to be as careful about drying the wood as the *kijishi*; especially for small parts.” Although sometimes *hinoki* is used on the *kuuden*, generally other woods such as *hiba* (see below) and various pines are preferred. Flexibility and ease of carving are the special features they look for, especially when considering the decorative or curved areas. For these, both *himekomatsu*, a Japanese white pine from Gifu and Aichi, and *benimatsu*, a Russian red pine, are resinous, thus flexible and easy to carve.

Tanaka Kazuo is meticulous about the slope of the roof (*yane*). Besides differences in the curvature dictated by the Buddhist sect, even minute alteration in the angle can effect the sophisticated appearance of the *kuuden* and to this end he has dozens of templates hanging on the walls in his workshop.

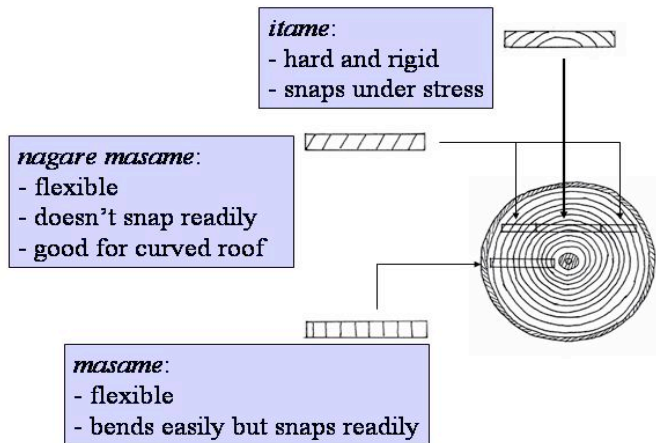


each template is slightly different according to the required height and curvature

*Kuuden* photo 19: *karakafu* templates hanging on the wall

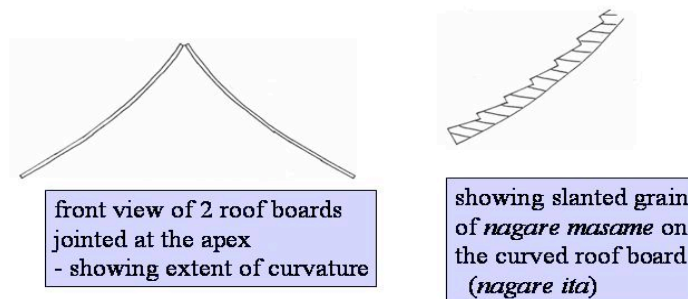


To achieve the exact effect, besides his choice of wood, the particular cut is very important. Kazuo says, “The wood cut where the grain is circular (*itame*) is very hard and cannot bend, it snaps if you try. The wood, cut where the grain is straight and parallel (*masame*) is flexible and bends but snaps easily. The wood in the middle where the grain is curved but parallel (*nagare masame*) is flexible and does not snap easily.”

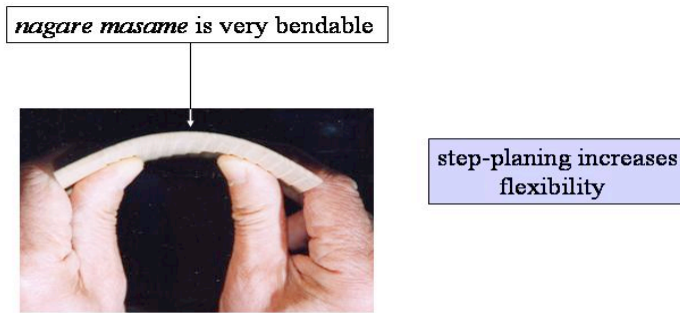


*Kuuden* figure 19: cuts of wood

(also see diagrams in *kiji* section)



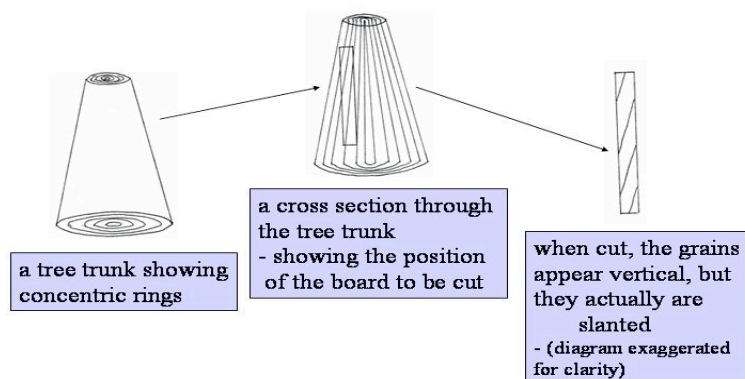
*Kuuden* figure 20: showing grain on *nagare ita*



*Kuuden* photo 20: showing the bend ability of *nagare masame*

There are several characteristics that make the wood suitable for carving. Mainly it must be soft and easy to fashion tiny details without any risk of the tools slipping and making a mistake and without the constant need for re-sharpening. Secondly, there should not be any tendency to warp. Generally early wood, which grows in spring to summer, is soft, less dense and paler than that which grows from summer to autumn (late wood). Therefore it warps more easily. Tanaka Kazuo explains, “When wood is seasoned the grains (darker wood) are raised because the inter-grain wood (early, paler wood) is formed in the spring and summer and is softer. It loses more water with seasoning and therefore shrinks more, leaving the grain, the darker autumn wood, raised. This is so on both the inside (core side) and outside (bark side) of cut timber. However with warping it changes. In that case, the grains on the core side are raised (pushed up) and the inter-grains are depressed; and the grains on the bark side are depressed and the inter-grains are raised (pushed up). (also see *kiji* diagrams)

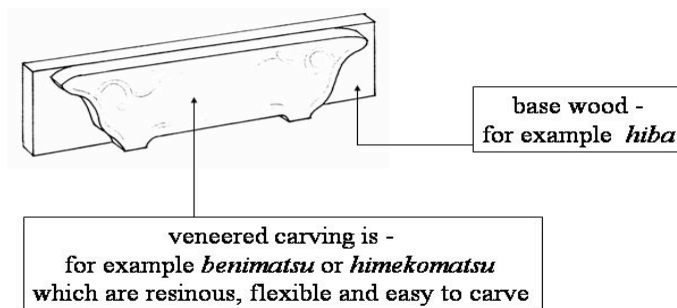
Also although the grains may look straight from the side of the board, they are, in fact, slightly slanted.



*Kuuden* figure 21: showing slanting grains

This is because the trunk is narrower at the top so the grains are packed closer together. Finally, the wood should not shrink after lacquering, which also means it would not shrink after drying. Lacquer hardens by absorbing moisture so necessarily the wood would become drier during that process. If the *kuudenshi* selects the boards carefully, making sure they are well seasoned they will not shrink and leave gaps in the finished product. This tends only to be important in the case of the base stand or *raihan* because only here thicker, larger boards are used. (see *kuuden* photos 21, 42)

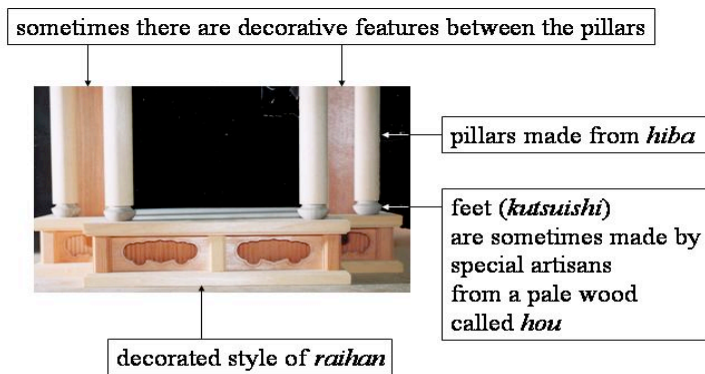
Another wood, *hiba* (bot: *hiba arborvitae*), a fine textured, yellowish wood from North America, is often used. Although it is rather hard to carve, it is strong and easy to shape into pillars. (see *kuuden* photo 21) Also it forms a good foundation for veneering.



*Kuuden* figure 22: veneered carving

For example, in the case of the cross girder at the top of the pillars (*kashiranuki*) and the lower decorative beams (*kouryou*) the surfaces may be veneered with carved pieces of *benimatsu* which have been attached with adhesive, 'bondo'. (see Tanaka's fig. 04)

The rounded feet (*kutsuishi*) at the base of the pillars are made from a pale coloured wood called *hou* or *hounoki* (bot: *magnolia hypoleuca* or *obovata*), which comes from Hokkaido.



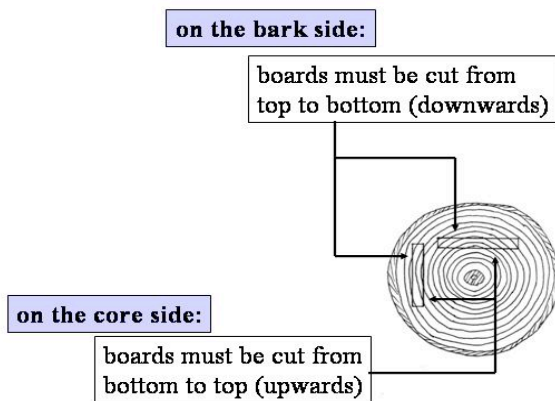
*Kuuden* photo 21: feet of pillars sitting on the *raihan*

It is suitable for making round shapes because it is easy to lathe and carve and it does not shrink. Kazuo explains, “This part is made by machine and is bought ready made from a shop in Hikone that specializes in making lathed pieces. This shop, Kawatake, originally produced spools for thread but since these are now made of plastic, it has shifted to *butsudan* parts, such as *kutsuishi*, and sometimes the posts on the *shumidan* railings (*kouran*), which traditionally are made by either the *kuudenshi* or a special *kouran* artisan (*kouranshi*). (see *kuuden* fig. 09 and *kuuden* photo 01)

### 3. Rough cutting (*arakidori*)

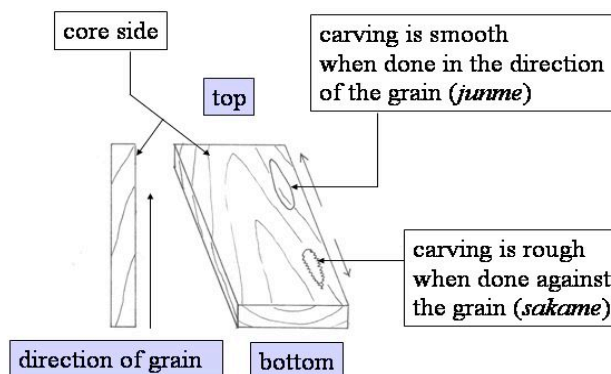
After selection and marking, the wood is cut roughly to shape using machine and hand saws. It is then smoothed. The hand push plane (*teoshi kanna*) can be used to trim away irregularities. Using an automatic plane (*jidou kanna*), a lever at the front of the mechanism can be turned to adjust the thickness of the wood shaving being removed. Thus it is possible to get the wood planed to an even thickness all over. Finally, the super finishing plane (*chou shiage kanna*) makes the surface totally smooth. A lever adjusts the thickness of the board which can go into the machine and by turning a dial one notch a layer as thin as 0.3mm can be removed.

When cutting the boards, care must be taken to cut the outside (barkside) surface from top to bottom and the inside (core side) surface from bottom to top.



*Kuuden* figure 23: showing position and direction of cut

This applies to both *masame* boards and *itame* boards. Following this, carving can be done on either surface. If the wood is carved against the grain (*sakame*) the carved surface will be rough.



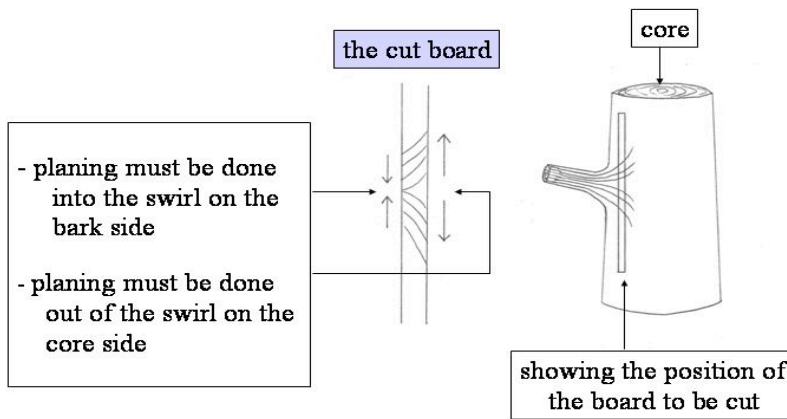
*Kuuden* figure 24: showing effect of carving with or against the grain

If the work is done with the grain (*junme*), the surface will be smooth.

#### 4. Planing and Marking (*yoritori*)

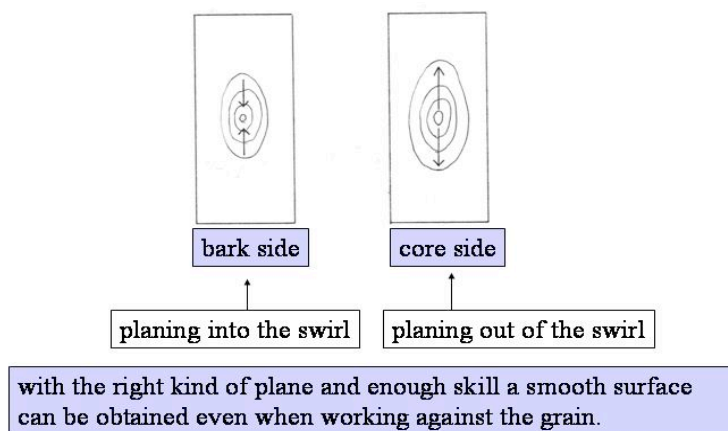
Following the rough cutting, the boards are studied and twists are removed using hand planes, chisels (*nomi*) and knives and finally finished off and marked according to the *tsue*. (Nomura)

When Tanaka Kazuo planes, he can tell whether or not the work will be smooth. If the piece comes off curled it means some parts are not even and it will leave a rough surface. He uses a double bladed plane because he can remove a translucent layer, thin enough to tie in a knot without breaking. Most boards have a complex grain pattern, the swirls occurring where the board was cut across a branch.



**Kuuden figure 25: showing the position of a board cut across where a branch has grown**

On the outside it is best to plane into the swirl and on the inside, out of it. However, of course this is difficult. Therefore it has to be done as described in the section on tools (see *kuuden* figs. 12.a and b) (also see *kiji* section).



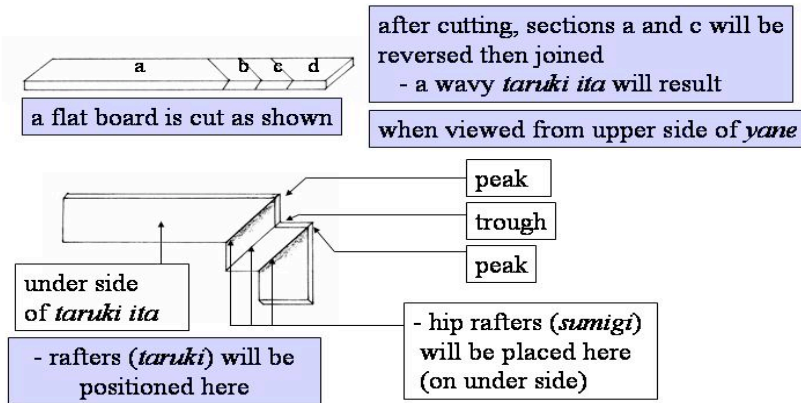
**Kuuden figure 26: ideal planing technique**

He sharpens the blades, adjusts the angles and takes off a very tiny amount and then he can get it smooth even if it is against the grain.

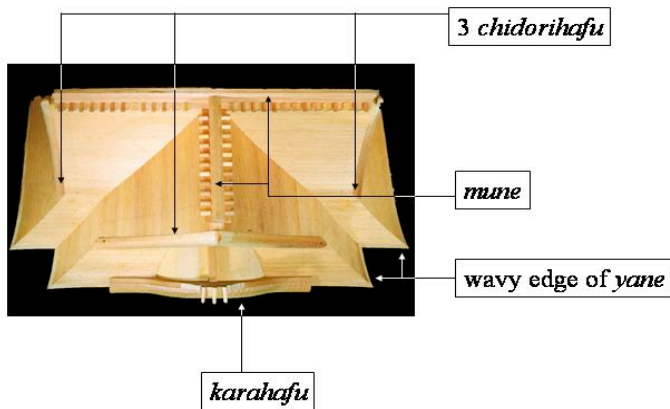
Once the designing and measuring are completed, and the materials have been chosen and prepared, the actual job of making the *kuuden* can start. For simplicity, the description will be divided into three parts. (see *kuuden* fig. 04) The roof (*yane*) including all the small decorative and supporting pieces, such as the underneath rafters, will be explained first. Working down from there, the ornamental beams (*masugata*) will be detailed. Finally the pillars with their associated girders and the base (*raihan*) will be described.

## 5. Making the roof (*yane*)

A good starting point in describing the construction of the *yane* might be the base or flange of the roof (*taruki ita*) with its underlying rafters (*taruki*). The *taruki ita* is prepared by cutting, with *marunoko ban*, a straight board into parallel pieces at a slight angle. Adjacent pieces are then turned over and joined so that a sloping edge with a wave shape is obtained.

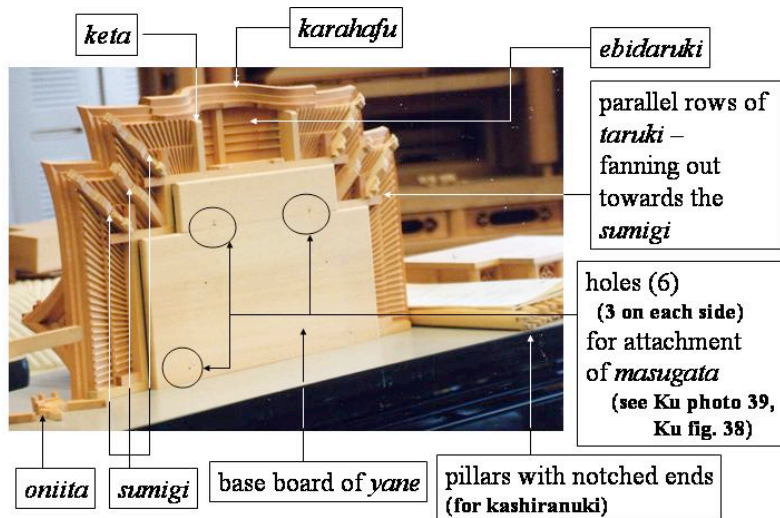


*Kuuden* figure 27: cutting to make edge of *yane* (*taruki ita*)



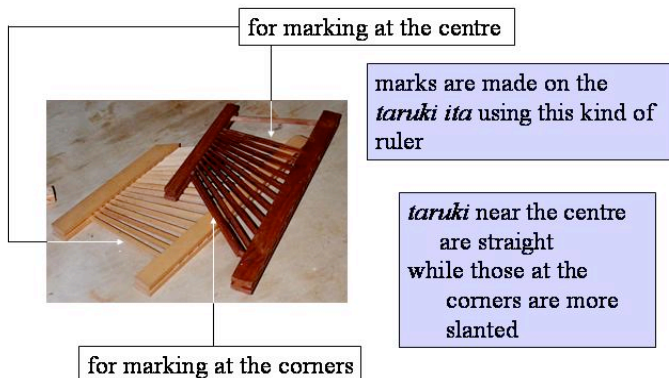
*Kuuden* photo 22: *yane* from above (showing the wavy edge of the roof)

(see *kuuden* photo 27) Underneath this, double rows of rafters (*taruki*), with thicker corner (hip or angle) rafters (*sumigi*) are attached. For Nishi honganji and Joudoshuu style *kuuden* the rafters are fixed in a kind of fan-shaped design (cf Higashi in intro).



*Kuuden photo 23: yane (from underneath)*

In order to position them accurately, marks are made using a special ‘taruki ruler’ (*jougi*),



*Kuuden photo 24: rulers (jougi)*

where one size does for all sizes of roof. The *taruki* are so close together that Kazuo’s wife, who usually does this job, has to glue every second one and then wait for it to set before she can do the in-between ones.





Kazuo's wife applying *taruki*  
- in parallel rows  
- alternate pieces at a time

*keta*

*Kuuden* photo 25: putting *taruki* in position

She says, "I can do *touriyane* (fixed style) *kuuden* rafters without marking. But I need the marking for the *douzukuri* (removable *kuuden*).” The *taruki* at the corners run into the point of the roof parallel to the *sumigi*, then the angle gradually changes until, in the middle, they end up almost parallel to the main body beam. "It is difficult without markings." Interestingly, even after years of experience, her husband still does the marking.

Before attaching the rafters, an inner system of beams (*keta*), which will support the main body of the roof with its four gables (*hafu*), is constructed.



*ebidaruki*

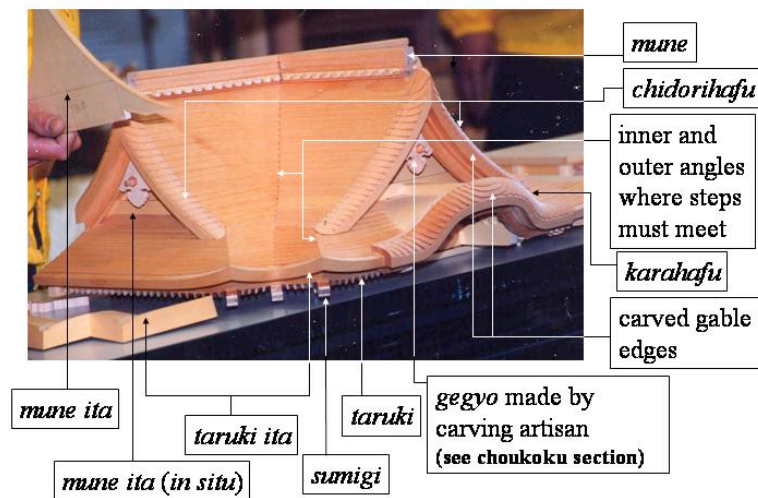
system of horizontal beams  
(*keta*)

*taruki*

*sumigi* at roof corner

*Kuuden* photo 26: beams, a few *taruki* in position

As mentioned before, the upper roof consists of a single, rounded, Chinese gable (*karahafu*) placed center front and three arched gables (*chidorihafu*) placed behind and to each side.



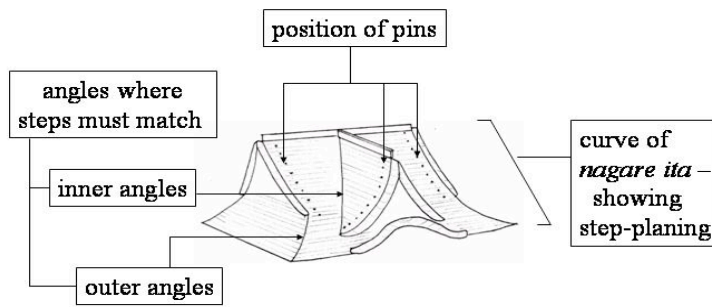
*Kuuden* photo 27: showing gables, with *mune ita*

The roof board (*yane nagare ita*) is made with thin, naturally flexible wood 1mm to 2.5mm thick, which can be bent to follow the flowing shape of each gable (see *kuuden* photo 20).

The roof of the *karahafu* is supported from underneath by a central beam with adjacent pairs of small shrimp-shaped rafters (*ebidaruki*), (see *kuuden* photos 23, 26) which are shaped with *demarukanna*. (see *kuuden* fig. 13) In this case, unlike that of the *chidorihafu*, the 1mm thick *nagare ita* is left smooth and not planed into a shingle design. (see notes on wood cuts) Once in the *butsudan*, this part, which has the initial impact, is always viewed from the front.

Thus again Kazuo stresses, “What is most important in making the roof is the shape. I especially pay attention to the angle of curvature of the Chinese gable (*karahafu*). Gables seen separately may look nice but when they are combined with other parts they do not suit each other. A good finished *kuuden* may turn out to be unsatisfactory when it is put into a *butsudan*. It is the same as in the case of clothes. Looking at one tiny piece of cloth gives a different impression from actually wearing clothes made from that cloth. I especially care about gables because they are the parts which stand out most once the *kuuden* is *in situ*. When I make something I always want to think I have delivered the best possible work. However in a few years time I occasionally feel dissatisfied with the curve.”

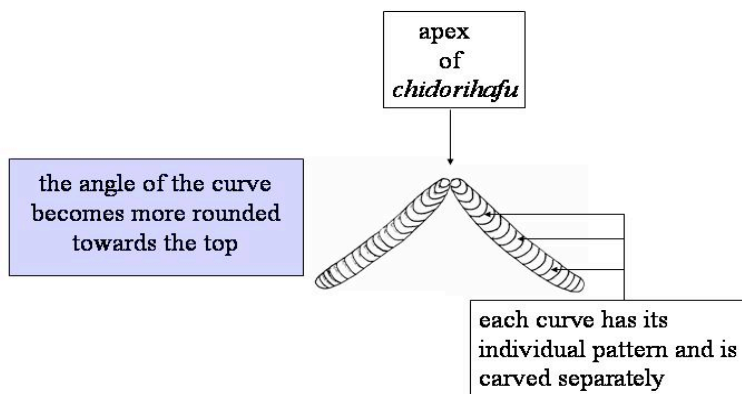
In order to make the rest of the roof, struts (*mune ita*) are put in place to support the three arched gables (*chidorihafu*). (see *kuuden* photo 27) These triangular-shaped *mune ita*, visible within the *chidorihafu*, are cut with a jig-saw, carefully shaped and finished with the *kurikogatana* and placed in position. This part is important since the roof boards (*yane nagare ita*), will exactly follow the contours, thus determining the elegant slope of the roof. The *yane nagare ita*, about 2.5-3.0 mm thick, are planed using *kebiki tsuki kiwaganna* into a step pattern to imitate a copper or wooden shingled roof. These are attached with tiny (0.8mm) steel pins to the *mune ita*.



***Kuuden* figure 28: sketch showing step-planed *nagare ita*, position of pins and matching of steps at inner and outer angles**

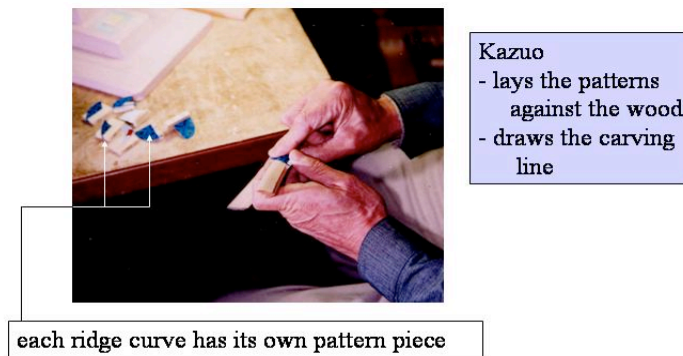
Masashi explains, “We use wood which has a nature to bend (meaning the natural warp would correspond to the imposed curvature), then we bend it more to make the curve of the roof. (see *kuuden* photo 20) We do not use *itame*. We use a cut between *itame* and *masame* called *nagare masame* (see materials). The most difficult part is to make the grooves match in the dip and at the outer angles.” (see *kuuden* photo 27 and fig. 28)

Following the construction of the roof the gable edges are prepared and attached. First the edge pieces are chamfered using *mentori ban* (see tools). The finish carving requires skill and concentration to get the angles of the curves exactly right.



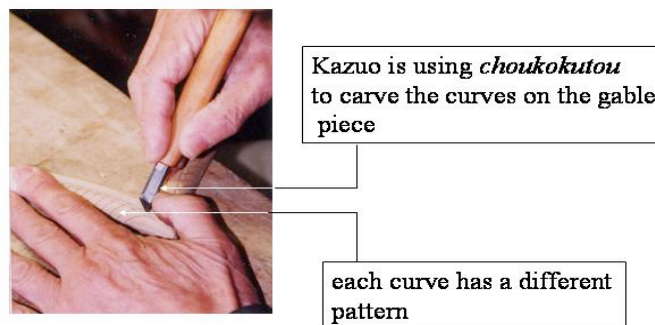
***Kuuden* figure 29: angle of carved ridges on the gable edges**

The curve changes from the top where it is more rounded to the bottom where the curve is gentler. Kazuo has prepared a series of patterns, made from plastic playing cards, individually attached to sized blocks of wood. He lays these against the edge piece and draws a series of lines with a pencil.



*Kuuden* photo 28: drawing the carving line on the gable edge piece (see Ku fig. 29)

Then carves it by hand.



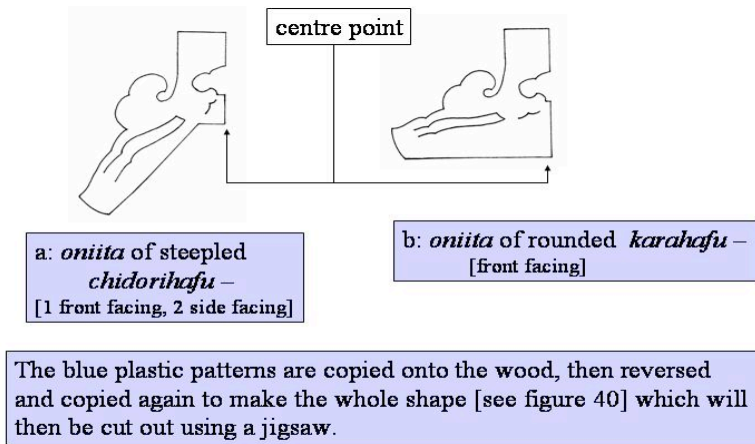
*Kuuden* photo 29: carving the edge piece

He has a different pattern for each curve. The direction of carving is decided according to the wood grain so he may have to change direction as he crosses the grain. "So carving the curved part is difficult," he says.

Finally when the whole roof is assembled the finishing touches are added. A long decorative ridge piece (*mune*) goes across the top of the roof from right to left and another central front at right angles to the first. (see *kuuden* fig. 04 and cf. *kuuden* photo 08) Then the small carvings are prepared and added to the *yane*. For example the *oniita* are slotted over the squared off *mune* on the three *chidorihafu*. (see *kuuden* photo 03 and cf. *kuuden* photo 10) (see *kuuden* fig. 04) On the *karahafu* they are pinned just behind the carved edging. (cf. *kuuden* photo 10)

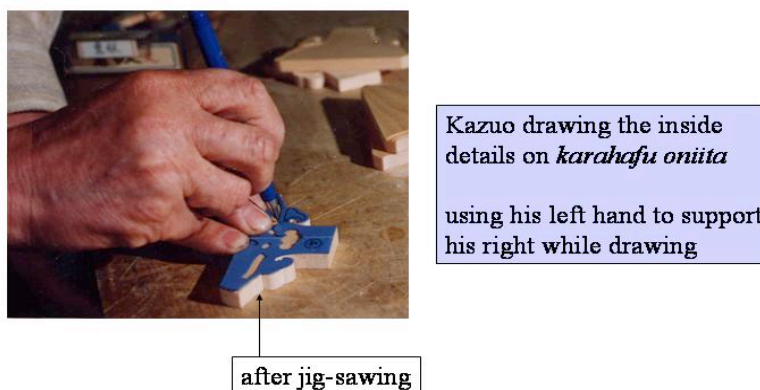
When carving these small pieces, a light source above and to the side is most convenient because it allows him to see the depth of the carving, which he cannot do

if the light is directly above. First he draws the design onto a piece of wood using a pattern made from a blue plastic playing card.



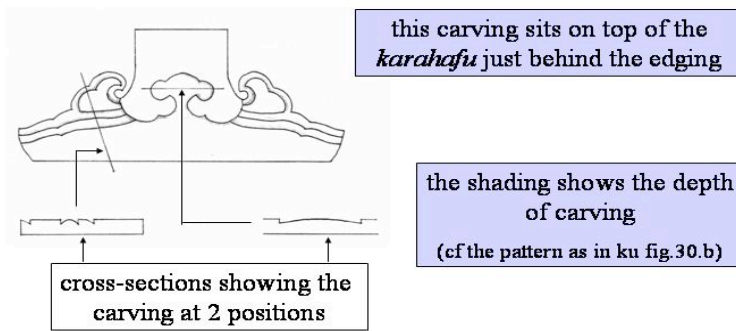
*Kuuden* figure 30: patterns of *oniita* (courtesy Tanaka Kazuo)

Then three thicknesses of wood are nailed together and jig-sawed into the required shapes. Three are used because with only one layer the wood is too thin, the jigsaw goes too fast and is difficult to control, and with more than three it goes too slowly. But with three layers it is slow and it is possible to get a sharply defined cut edge. During jig-sawing the teeth will damage the bottom piece, which would have been taken from a poor section of the timber and will be thrown away. After cutting the outside edge, any inside patterns are drawn.



*Kuuden* photo 30: Kazuo drawing the inside pattern of *oniita*

Then very carefully, using a compass, a pencil-line border is drawn next to the cut edges and inner details, being careful not to vary the gap. Finally the borders and any other features are carved in.

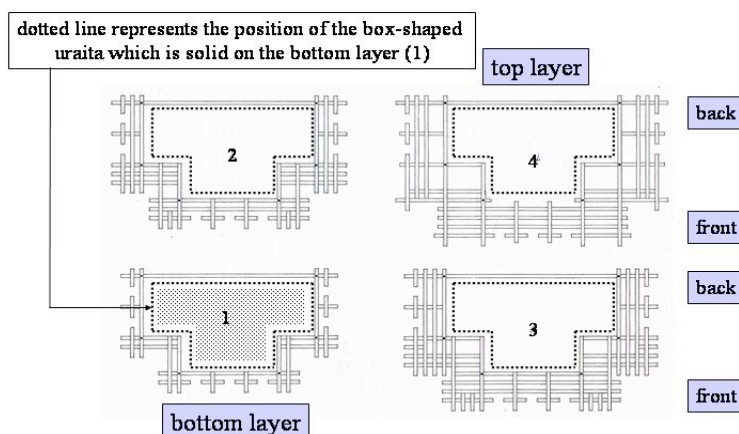


*Kuuden* figure 31: carving of *oniita* for *karahafu*  
(drawing courtesy of Tanaka Kazuo)

(see *kuuden* photo 15)

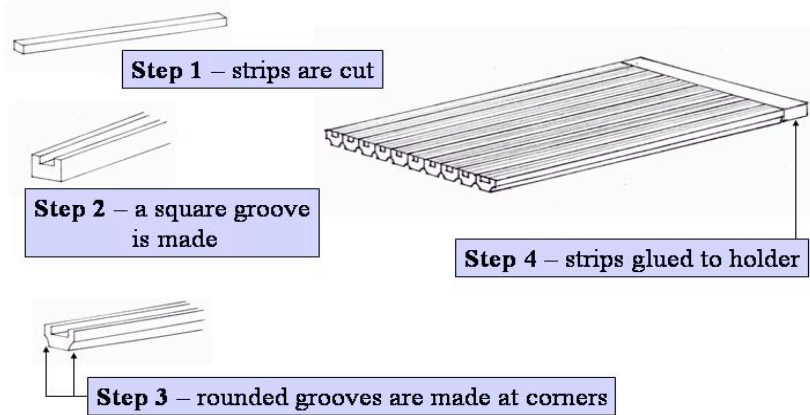
## 6. Making the decorative beam complex (*masugata*)

Basically the *masugata* (FN.1) consists of a layered series of beams (*hijiki*), which run horizontally across the front and along the sides of the *kuuden*, under the *yane*. (see *kuuden* photo 03 and 11 and cf. *kuuden* photo 10 in *kuuden* introduction) To make the beams a variety of saws, knives (*kurikogatana*), chisels (*nomi*) and planes are used to cut and smooth the thin straight segments of wood. These *hijiki* are then jointed into a 3-sided lattice.

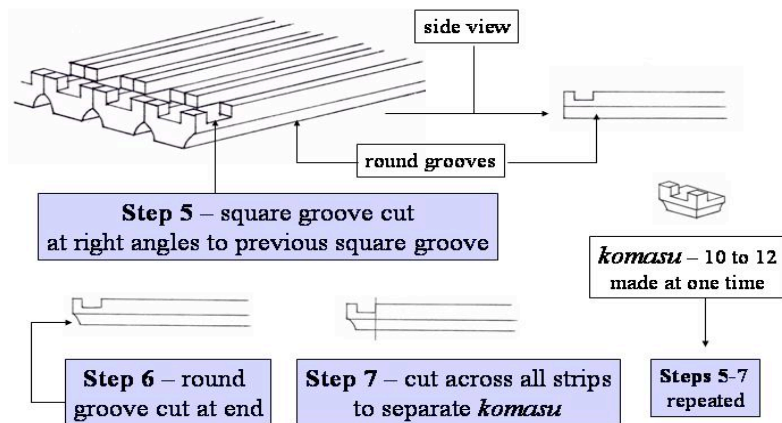


*Kuuden* figure 32: arrangement of 4 layers of *masugata* beams (*hijiki*) (courtesy Tanaka Kazuo)

Then the blocks, which will decorate and support the beams, are prepared as described below (*komasu* in this case).



*Kuuden* figure 33.1: steps for making *komasu* (decorative blocks)



*Kuuden* figure 33.2: making *komasu* (continued)

1. Kazuo cuts a board into strips measuring about 1 square cm and 25-30cm long.
2. Then, using a radial saw (*kumiko ki*), he cuts a square groove running the length of each strip.
3. Next, he makes rounded grooves lengthwise on the underneath corners using *mentori ban* which has spoon shaped blades.
4. To work as efficiently as possible, ten to twelve of these wooden strips are then glued to a straight holder and treated in the following way:
5. He makes another square groove across all strips, as in 2 above, but at right angles to the first square groove.
6. He then scoops out a groove along the end, on the underneath surface of the glued pieces as in 3 above.

7. Finally he cuts the strips at right angles to the original cuts, as in 1 above, at the edge of the square groove to make the individual *komasu*.

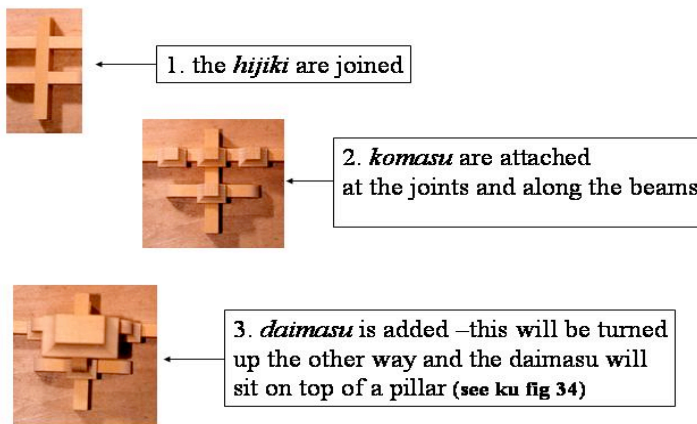
Many decorative blocks can be made at one time. Steps 5, 6 and 7 will be repeated until the holder is reached and all *komasu* are separated. The large blocks (*daimasu*) are made in much the same way.

The *komasu* are spaced evenly along the beams and attached with rice glue (*sokkui*).



Kazuo's daughter-in-law often works on many *masugata* at one time

*Kuuden* photo 31: attaching *komasu* to the beams with rice glue



*Kuuden* photo 32: building up of *masugata* components (as viewed from underneath)

With the square grooves notched onto the beams these blocks are then used to connect the beams together into layers.

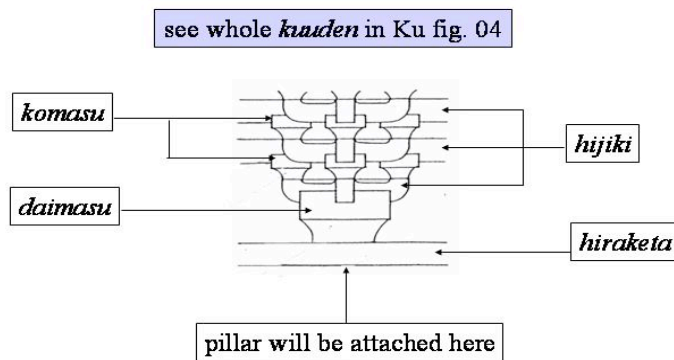




showing stacks of *hijiki* and *komasu* being attached by Kazuo's daughter-in-law

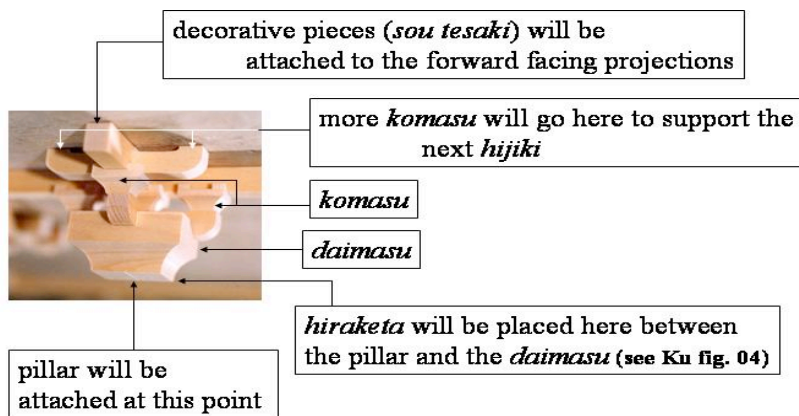
*Kuuden* photo 33: building the beams into layers

The large ones (*daimasu*) are made in more or less the same way and are connected above to the *komasu* and below to the top of each pillar via a flat beam called *hiraketa*.



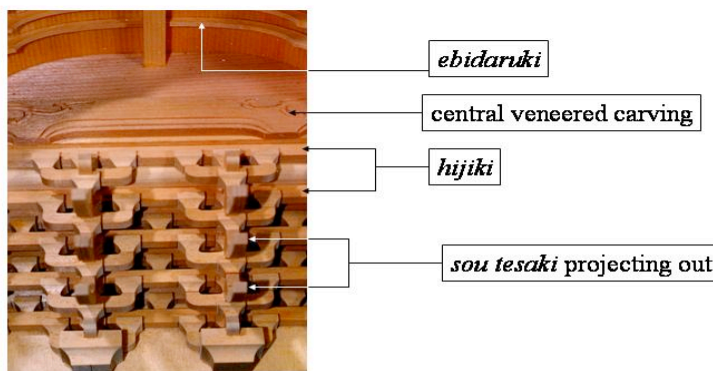
*Kuuden* figure 34: arrangement of decorative blocks on *masugata* (courtesy of Tanaka Kazuo)

They thus support the first layer of *hijiki* and in fact the whole *masugata*, from below. (Azby Brown 1989: 101)



*Kuuden* photo 34: showing *daimasu* which will sit on top of a pillar (see Ku fig. 34)

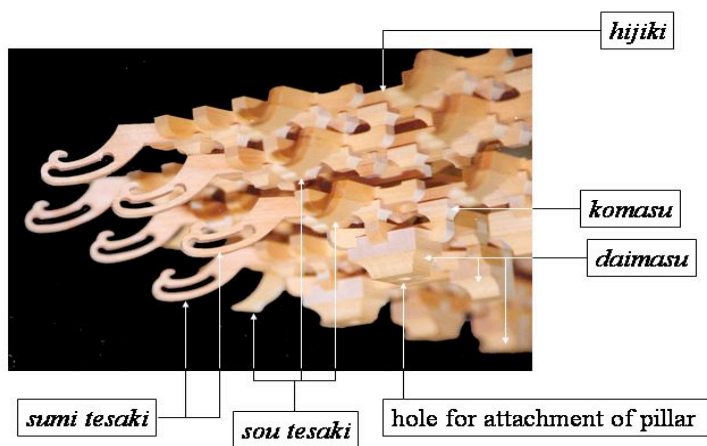
When joined by metal or bamboo pegs (*higo*) (see black dots marked on Tanaka's fig. 32) this makes a structure very similar in appearance, but rather exaggerated, to the temple structures (Asby Brown).



*Kuuden* photo 35: assembled section of *masugata* with 5 layers of *hijiki*

Each front and side facing *hijiki* has an ornamental end (*tesaki*). *Tesaki* at the corners (*sumi tesaki*) are especially elaborate, usually with a cut out design.

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*Kuuden photo 36: showing sumi tesaki*

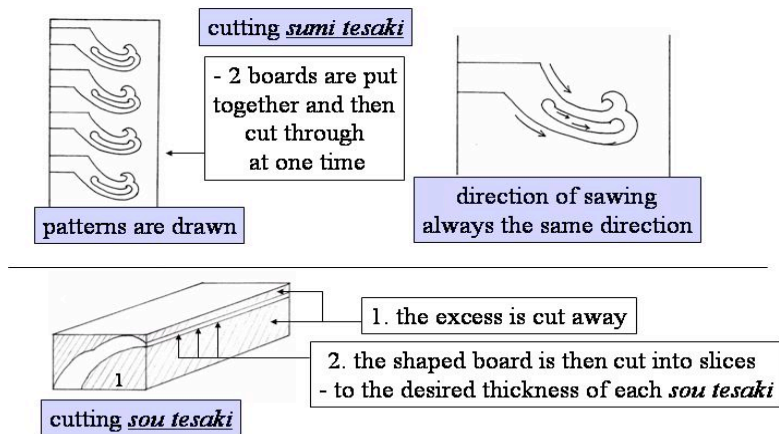
When making these pieces two boards, with a width equal to the desired length of the *sumi tesaki*, are put together. The pattern is drawn on and then both boards are cut through at the same time.



Kazuo's son, Masashi, explaining how *sumi tesaki* are made

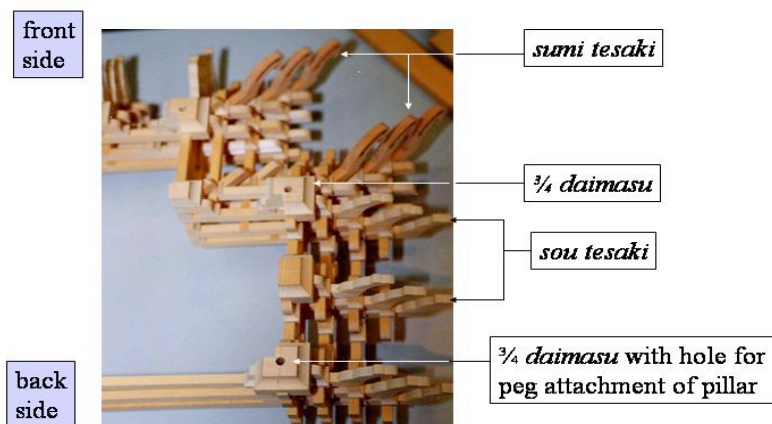
*Kuuden photo 37: explanation about the design of sumi tesaki*

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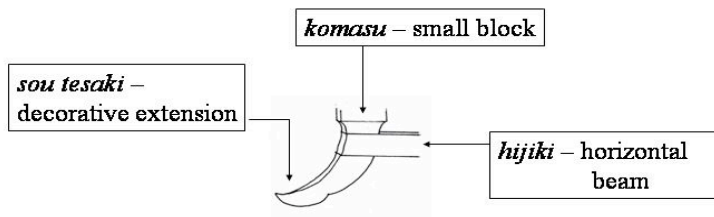


*Kuuden figure 35: cutting sumi tesaki and sou tesaki*

“If we saw against the grain,” explains Masashi, “the surface will be rough. So we jigsaw from the same direction each time (see arrows).” Simple or *sou tesaki*, are attached to and project outwards from the front and side *hijiki* and are jointed to the *komasu*.



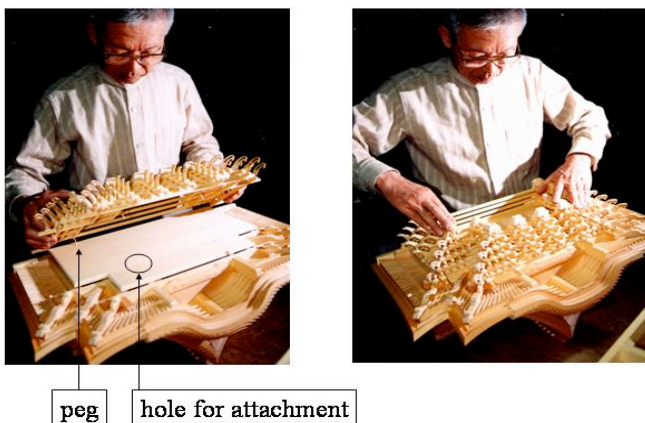
*Kuuden photo 38: sumi tesaki and sou tesaki*



*Kuuden* figure 36: attachment of *sou tesaki* to *hijiki*

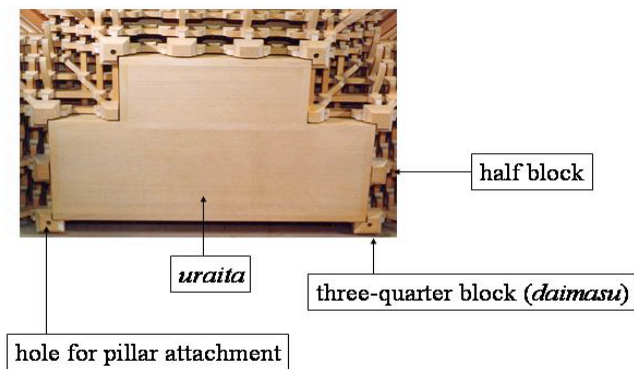
The method of making these is different from *sumi tesaki*. In this case the shape is drawn onto one end of a wood block, the excess is sawn away and then the piece is cut into slices. (see *kuuden* fig. 35) However in the case of high quality *kuuden*, even *sou tesaki* have a complex shape so they will be made the same way as *sumi tesaki*.

When all of this has been completed, holes for the pins (*higo*) are made with an electric drill and they are slotted in, to combine up to six layers making the complete *masugata*. Then this is inserted into a board on the underneath of the *yane*, using bamboo pins.



*Kuuden* photo 39: Kazuo attaching 4-layered *masugata* to base board of *yane*

Finally the backboard (*uraita*) is attached.



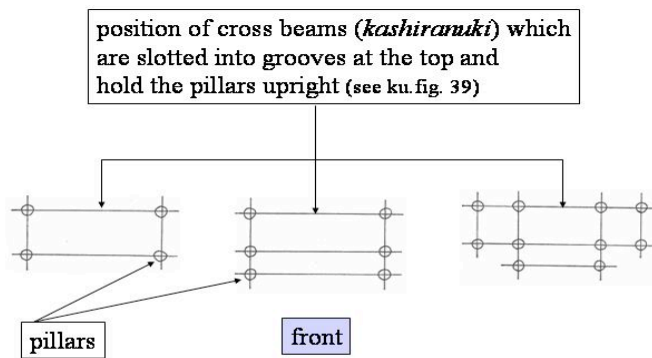
*Kuuden* photo 40: attachment of *uraita* to *masugata*

It is like a box slipped into the space formed when the *masugata* is layered together. In order to make it fit snugly the small inner extensions (see *kuuden* photos 39-41, cf *kuuden* fig. 32) on the *masugata* layers are trimmed off first. These extensions are left on for the assembly process to ensure that the pieces fit firmly and exactly at 90 degrees. This finishing touch is important because when seen from the front the *uraita* is visible at the back through the slotted pieces of the *masugata*.

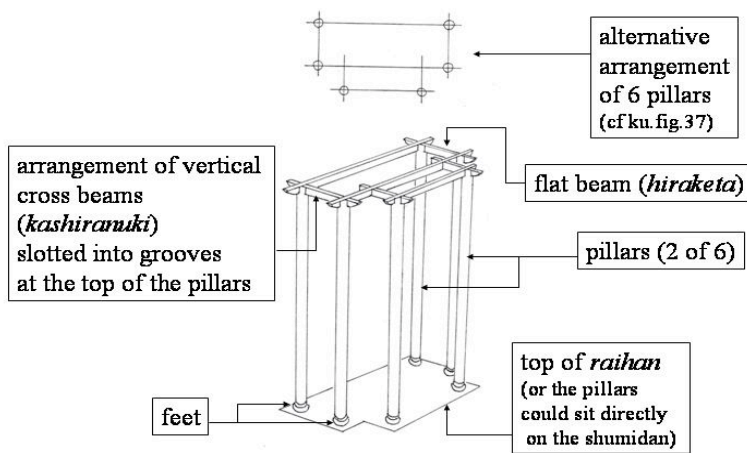
## 7. Making the pillar (*hashira*) complex and base (*raihan*)

### Pillar and beam complex

On looking at a high quality *butsudan* (*douzukuri* style) with a removable *kuuden* of the type described here, it can be seen that there are three sizes of pillars. There are two large ones at the front (*obashira*) and two smaller ones (*dobashira*) at the back covering the joins of the three back boards (*mukouita*). These, because they really belong to the *kiji*, are made by the *kijishi*. Then there are the four, six or up to ten smaller pillars (*kobashira*), which support the *masugata* and *yane*, and are thus part of the *kuuden*.

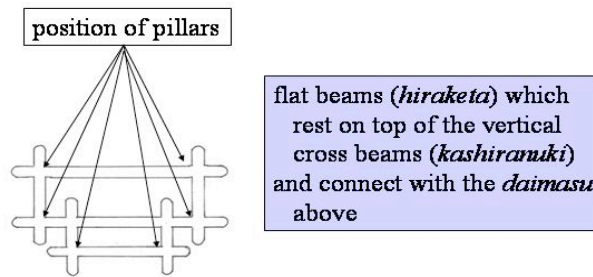


*Kuuden figure 37: configuration of 4, 6 or 10 pillars standing on the raihan (as seen from above)*



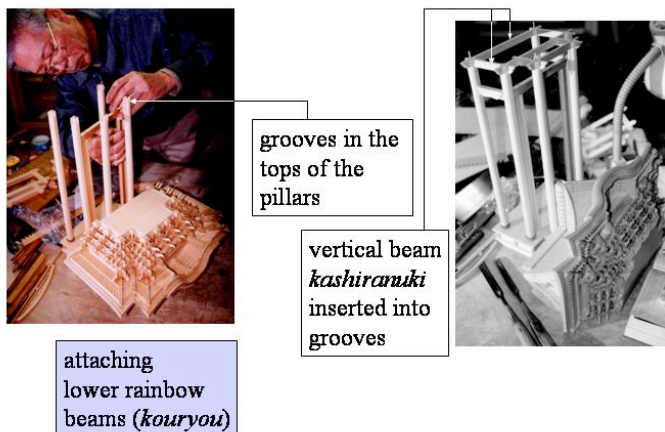
*Kuuden figure 38: six-pillar arrangement*

These *kobashira* are prepared as explained in the section on tools and they stand on feet (*kutsuishi*), which are made of *hou*. (see *kuuden* fig. 14) Considering the pillar complex as a whole, starting from the top, a configuration of flat beams (*hiraketa*) makes the junction between the *daimasu* of the *masugata*, and the *kobashira*.



*Kuuden* figure 39: configuration of flat beams at the top of a 6-pillar arrangement (as in *ku* fig.38)

(also see *kuuden* figs. 04, 34 and 38) Below these, vertical beams (*kashiranuki*) rest in grooves made in the tops of the pillars.

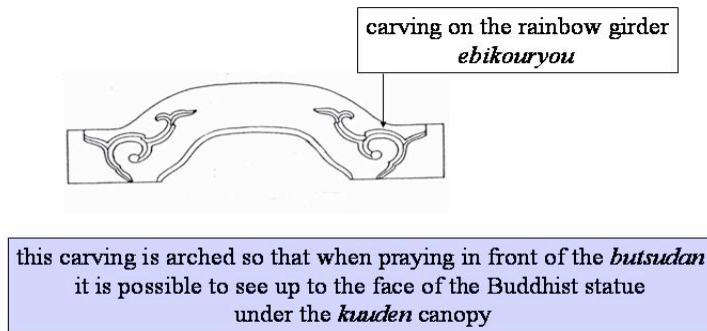


*Kuuden* photo 41: assembling the pillar complex

For the position of the pegs and the relationship, compare *kuuden* fig. 32 (black dots), *kuuden* photo 36, 38 and 40 (holes in *daimasu*) and *kuuden* photo 39 (pegs).

Additionally, further down a rainbow beam (*kouryou*) is inserted into the pillars with extensions (*kibana*) protruding outwards. The *kouryou* is sometimes given a particularly graceful arch shape to allow worshippers to look at a statue of Buddha or scroll picture inside. In this case it is called *ebikouryou* because of its shrimp shape.



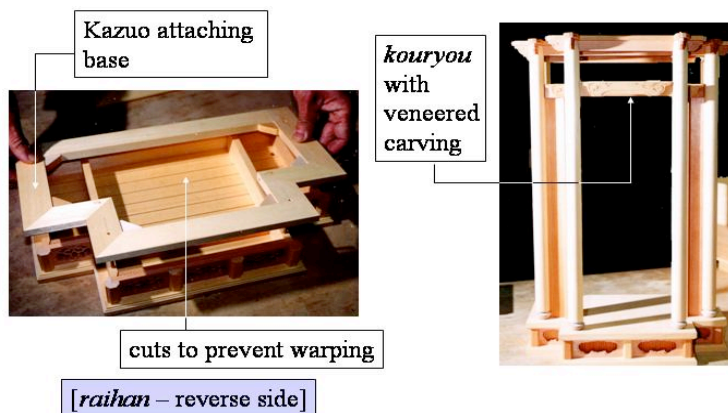


*Kuuden* figure 40: ebikouryou (drawing courtesy of Tanaka Kazuo)

These beams are conspicuous and the carvings are fashioned carefully using chisels and *kurikogatana*. (see section on materials and veneering) (see *kuuden* fig. 22) The *kibana* project out frontways and sideways. Contrary to appearance, where they look as though they go right through the pillars, they are in fact, attached by tenons or bamboo pegs. Thus, unlike the *kashiranuki*, they don't play any part in holding the pillars together. *Kibana* pointing out to the side are shaped like elephant noses (*zoubana*) and those toward the front, like lion noses (*shishibana*). (see *kuuden* fig. 04) These shapes are used because it copies the shapes used in temples. "But also," says Kazuo, "it is thought that they ward off evil spirits."

### *Raihan*

For making the base or platform (*raihan*) on which the pillars stand, *masame ita* is used because it has less tendency to warp. In order to minimize warping, several cuts, about 6mm deep and 1cm apart running parallel to the grain, are made on the lower side of a 12mm thick board using a saw.



*Kuuden* photo 42: assembling *raihan* and pillar complex from underneath showing cuts

Since the board is relatively thick and only the upper surface is lacquered and the underneath surface is left as bare wood, it has a tendency to twist because of unequal absorption of moisture from the lacquering process. A thinner board cannot be used for the *raihan* because of the carved beading around the edge. It is possible to make a design around the edge with thin board but it is too fiddly and expensive.

The conventional way to make a *raihan* is with seven small border pieces cut at angles and mitred at the corners. A narrow shelf is cut all the way around the inside to lower the upper board into, so that the upper surface is smaller and has less potential to warp. Beading and decorated panels are put around the outside. The base board is made the same way as the upper border, but is wider and has eight pieces including a back. There are wedges put into the corners on the underneath.

## 8. Assembly

This completes the construction of the *kuuden*. Most of the assembly processes have been described along with the details of production. The only thing to note is that many of the parts are combined using long thin bamboo pegs (*higo*) or, more recently, stainless steel pins because bamboo has been shown to weaken over the years. The whole *kuuden* will be taken apart for lacquering and then reassembled. In later years, when necessary, the same thing will be done for cleaning (*sentaku*).

## FOOTNOTES:

FN.1: The term *masugumi* is used more often when considering the real temple; *masugata* is conventionally used for *butsudan*]

Vocabulary: To understand the striking similarity of structure between a Japanese temple and a *butsudan kuuden* please refer to The Genius of Japanese Carpentry by S. Azby Brown. The terms used in these cases will vary slightly, so for example a temple *masugumi* is the same as a *kuuden masugata*. In fact the terms used within the *butsudan* industry vary between Production Areas and even from company to company within the same Production Area. Part of the way the company keeps its secrets is to keep its terms as obscure as possible.

## REFERENCES AND ACKNOWLEDGEMENTS:

“Hikone *butsudan* no rekishi to enkaku” (History and Changes of Hikone *Butsudan*.) In Tanaka Hisao (ed) *Nihon no dentou butsudan shuu* (Collection of Japanese Traditional *Butsudan*), 1977; Edited by Nomura Hiroaki. Shouei Shuppan Corporation: Tokyo, p 50/51.

Azby Brown; The Genius of Japanese Carpentry, 1989; Kodansha International Ltd: Tokyo, p 101, fig.103 front elevation and p 146-8

Private interviews with Tanaka Kazuo, his family and other *kuudenshi*

Diagrams, where indicated, were gratefully received from Tanaka Kazuo. Other diagrams are by Yuriko Nishiyama.