

The Problem

I want to design and make a racking system to hold these rack mount units and a Mixing Console. If I have time I may consider adding a pull-out drawer to house cables and other accessories and also a multi-power supply unit to give the units in storage mains power.



My problem is that a large portion of my desk in my Recording Studio at home is occupied by a large Mixing Console and several rack mount units.



Design Task 3

Sporting and musical activities are very popular. Many need specialised equipment. Design and make an accessory or product for a sport or musical activity of your choice.



I am using this controlled assessment task for my coursework. I am looking to create a Racking System to also accompany a Mixing Console.

350 x 384 x 42/96mm **Mixing Console**



Rack Unit 19"

What do I need to do?

Considerations I have to take into account is whether I will use wheels or handles to transport my product. Wheels may be more convenient as the product may be too heavy to carry. Also I have considered making my racking system curve towards the top so that the units would be more accessible when sitting on a chair. I have also considered fitting the unit with a multi-power supply because the units in storage will all require mains power. This would save on the amount of wires hanging around and would probably be more safe for the product in case somebody trips over the cables. I have also considered giving my product a pull out draw to hold cables and other accessories.

My product should be strong and durable and made out of an attractive material e.g Metal or Wood. It must be mobile and stand from the ground. It must be able to accommodate a mixing desk and several rack units. It must be able to accommodate multiple cables running in and out of the units in storage.

My target audience's age could vary massively. I am primarily doing this for myself but I feel I will need to get a professional's opinion as this is a very specific product targeted at a clear niche market.

Existing products

All of these pictures have been taken from www.thomann.de



This design for me is fairly good. It looks very durable and has handles instead of wheels which is now something i can consider. I would however want to make my product larger to hold more units and to stand from the ground.

I think using wheels for transportation is a practical and convenient idea

This product is a good example of something I would definitely not want to produce. It is not mobile and has an extremely run of the mill design. It does not look particularly durable and quite flimsy and does not inspire me whatsoever.

This is an example of a pull out draw that I might like to include in my design if time permits . Although I haven't thought about whether to make the draw part of the racking system or to make it separately with the ability to be fitted into a racking system

This product is close to what I would like to achieve although I find the design somewhat un-inspiring and this is where I would want my product to stand out



Handles would not be practical for my product as it would be too heavy and too big to carry.

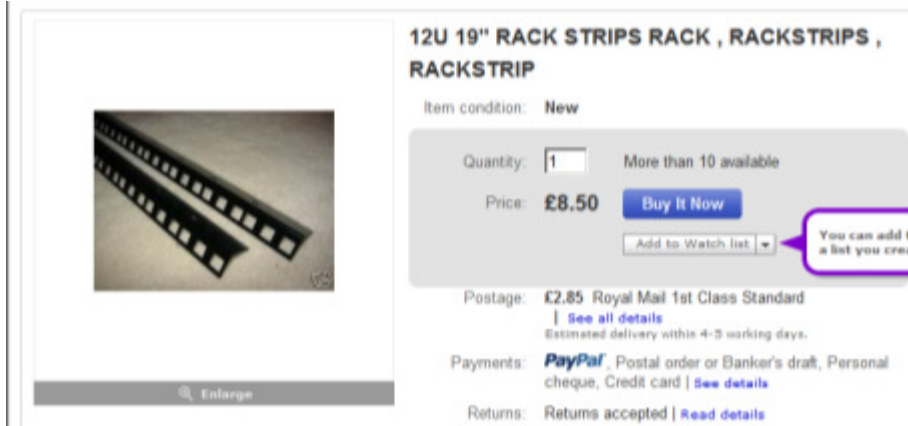


This design represented my idea of my product curving towards the top of the unit to make it more accessible from sitting on a chair.

Conclusion:

I think that wheels would be more practical than handles because the product may be too heavy to carry. I also think as my product will have to be quite tall to be accessible from a chair or standing I will not need all the space for the rack units so I could use the extra space for a draw that can hold other accessories and wires. If I have time.

Secondary Research



For my project to fulfil its purpose I needed to order in a pair of Rack Strips so that the units can actually be stored in my product. These Rack Strips fix onto parallel sides of the product and can fit 12 units in them. They are made from metal.



I also needed to order some wheels for my product to be mobile. The actual wheels are made from rubber but the axle and the base for the screws is made of heavy duty metal. It needs to be heavy duty so it can survive life on the road.

Considering the nature of my product I could not find any appropriate or relevant social or cultural issues, however I do want to ensure my product could be produced in an environmentally friendly way. If I decide to use wood in my product and if permitting I would try to use perhaps recycled school tables.

I have decided that my product will either be made out of metal or wood or a mix of the 2. I will definitely not use plastic as it would not be durable to withstand being moved into different places very often and will not be strong enough to house the Rack units.

Design Specifications

After reviewing a few existing products I have come to some conclusions:

I will use wheels to make my product mobile because it will need to be moved around a lot due to the nature of its purpose. I will do this by putting 4 wheels on the very bottom of the base of the product.

It will be able to store cables that are not in use because a lot of cables will be used in this application. For this I will use an extra pull out draw at the bottom.

I will use either Metal or Wood or both for my product because the product must be strong and durable and also have an attractive appearance.

This product **MUST** have the following qualities:

Strong and Durable to survive life on the road.

Attractive material to make it eye catching.

Mobile e.g. Wheels, Handles to give ease of mobility.

Hold at least 12 Rack Units to accommodate for enough rack units.

Be able to House a 350 x 384 x 42/96mm Mixing Console.

Be able to accommodate multiple cables running in and out of the Rack Units and Mixing Console because there will be lots of loose cables.

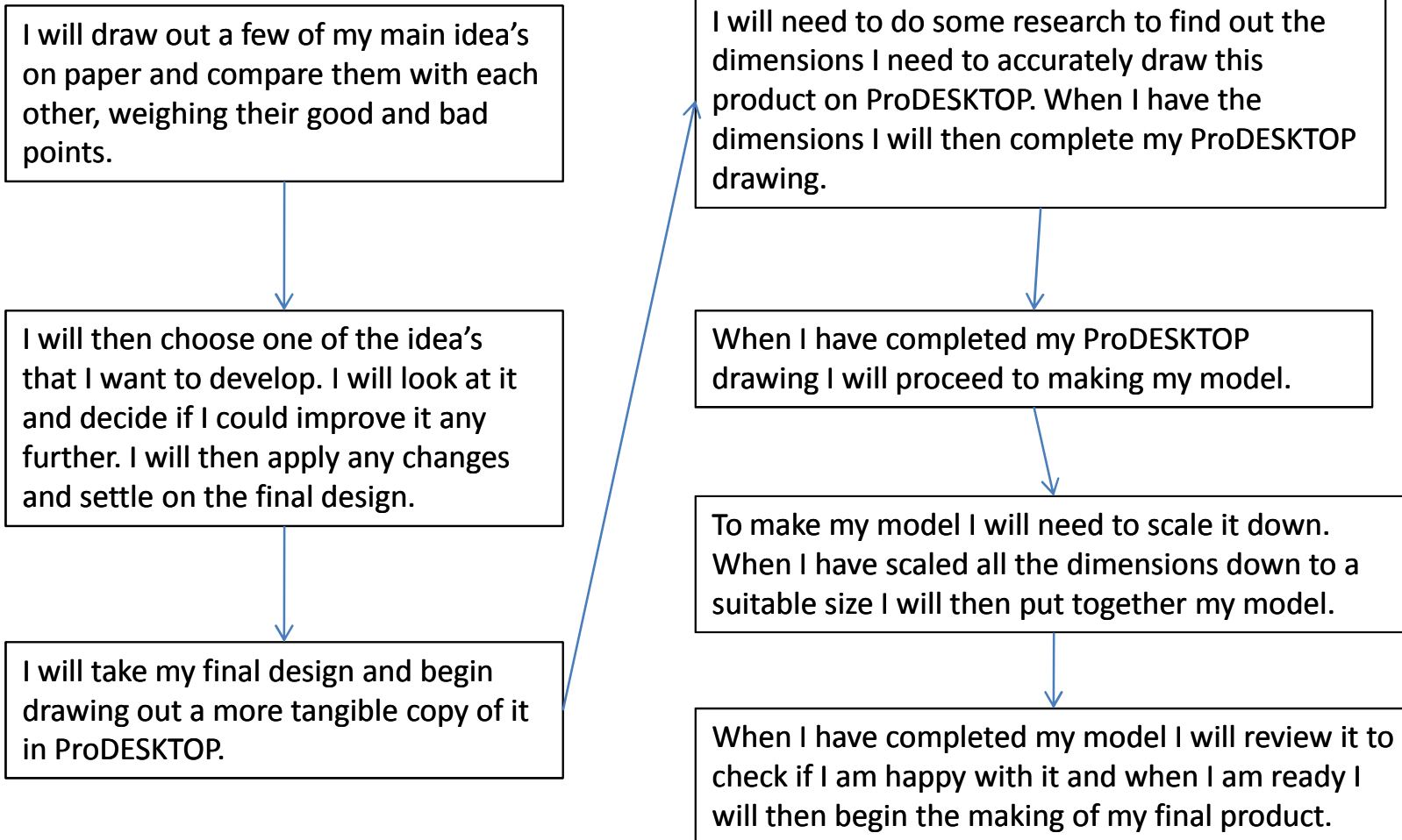
Stand from the ground but still be tall enough to easily access the units in storage.

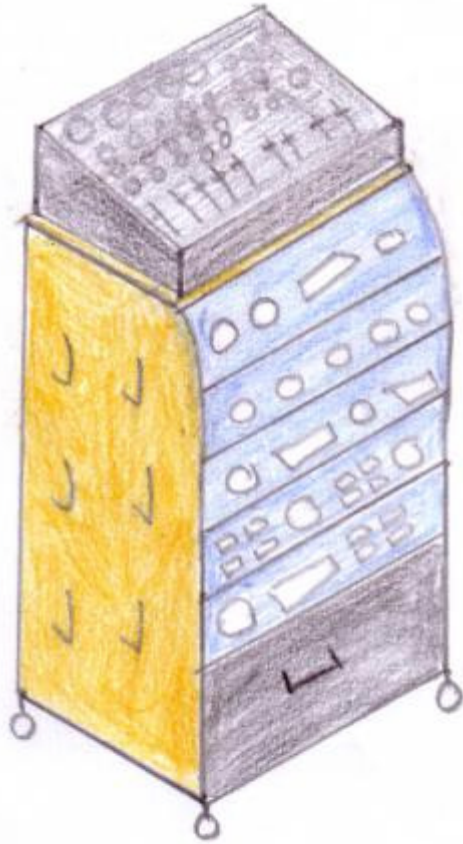
During the planning for making this product I felt I needed someone with a fair amount of knowledge in my products field of work that could give valuable advice to help me along my way.

I thought that the best person to fill this position would be my Dad. My Dad used to be a Design and Technology teacher and he uses building and repairing units of furniture and other things as a hobby.

He would also be an easy point of communication and I would be able to run ideas by him very easily. He also has a good idea of what schools expect from projects as he used to teach this very subject.

Plan for next section





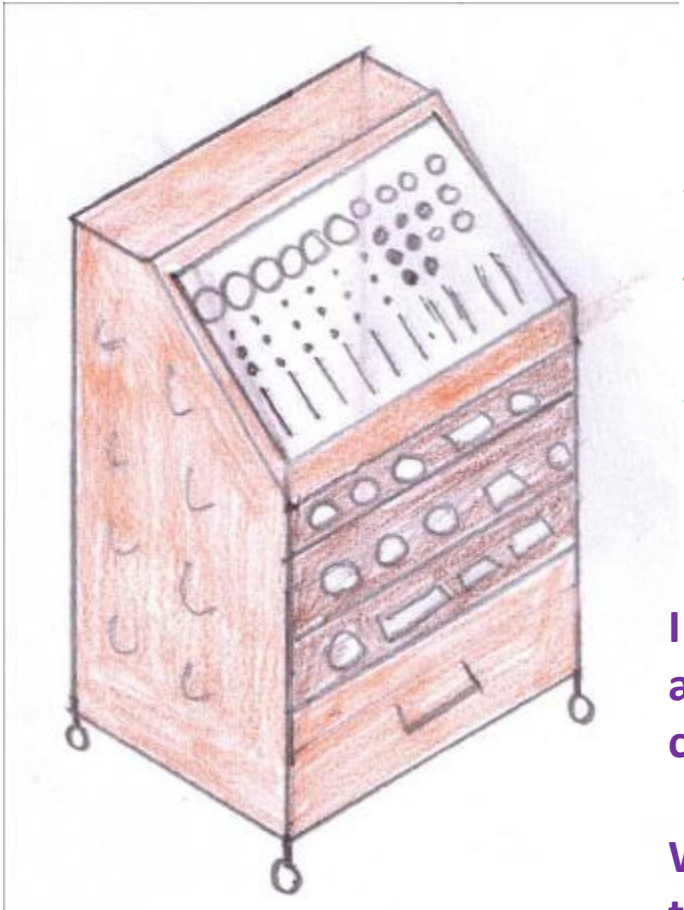
Initial Idea's

Analysis:

This design is simple but does the job perfectly. The Mixer is stored in a very accessible manner that also makes the cables running to and from the units run behind the unit so as to avoid tripping over and harming the equipment. It also houses any un-used cables via the hooks on the side of the unit and the rack units are made easily accessible through the unit curving towards the top.

The main concern for this design is the lack of innovation. It doesn't look incredible eye catching and doesn't spark much in the imagination. Also the mixer could be difficult to access if at a low height such as being seated because the mixer is facing upwards and it would be hard to monitor what the mixer is doing whilst someone is recording as it is facing upwards.

Initial Ideas



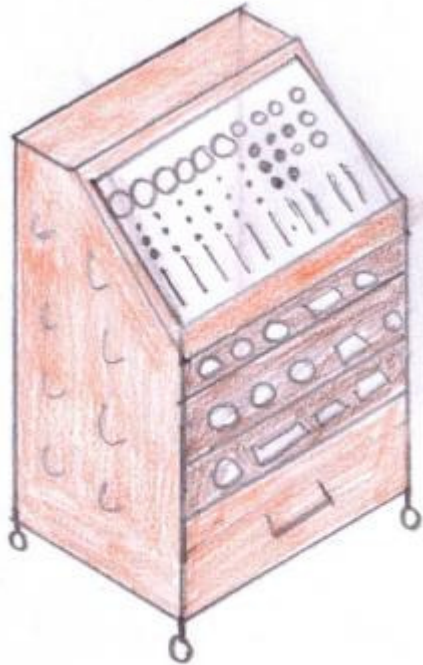
Analysis:

This design solves my problem in the previous design. It keeps the general idea of the previous one but it holds the mixer in a more accessible way. It also looks very modern and gives a more creative aura to the project.

I have chosen to develop this idea because it is practical and i think it could be an attractive product. When compared to my specifications it tick's all the boxes.

When choosing this design I had to consider the fact that due to the very practical nature of this product, although it should not be over-looked, the aesthetics of the product are not as important as the practicality and functionality of the product.

Development of Initial Idea



I am going to start the development of this idea by creating a more tangible design than drawing freehand so I will be producing a computer model on ProDESKTOP.

Measurements:

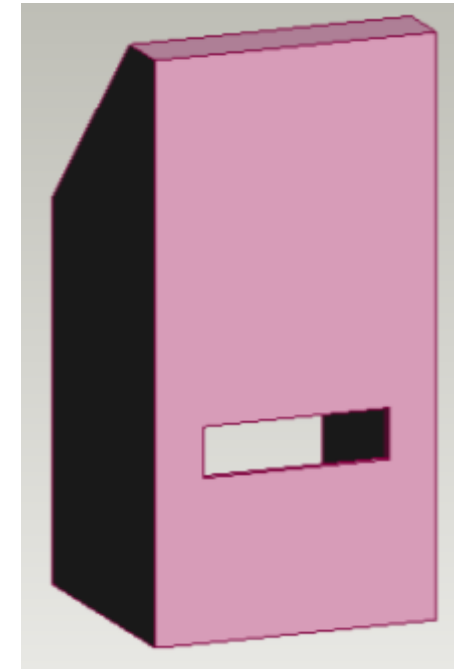
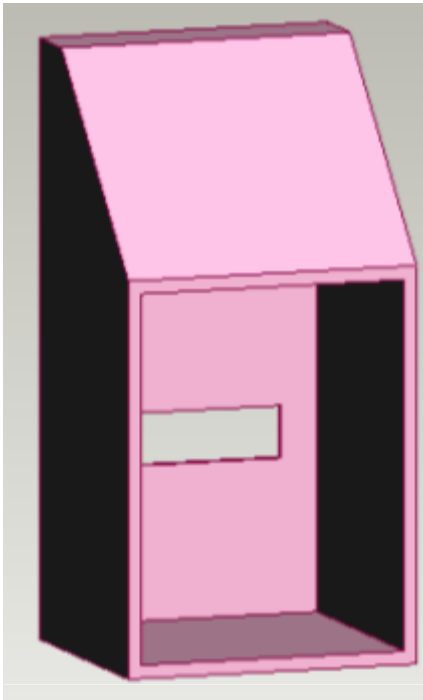
For my measurements I need to consider the anthropometrics for height and arm reach. I also have a have to consider the measurements of the units that will be required to be stored in the unit.

Mixing Console: 350 x 384 x 42/96mm

Rack units have a universal size and mounting design so my product will need to be at least 19" wide and also have a special rack mounting system.

Considerations

A consideration I had to make was where all the cables running to and from the units would exit the unit. I decided the best way was to extrude a Rectangular hole in the back for all the cables to run out of. Originally I was going to completely get rid of the back panel but I decided the product would suffer from a lack of rigidity



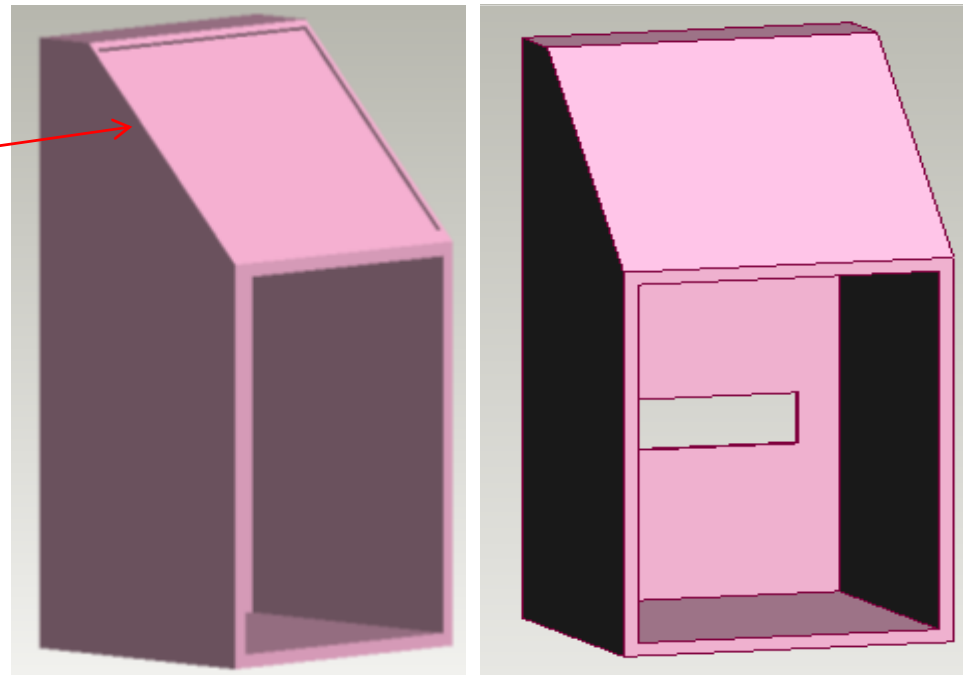
I decided to use ProDESKTOP to produce my model because it gave me something fairly tangible and it is produced in 3D. I can easily view all sides of it and view it with a full 360 degree perspective. I can also easily produce engineered drawings of it and quickly get exact measurements of all my angles.

Considerations

One consideration i had to make was that my Mixer had to somehow sit on a slant and therefore needed

Some method of keeping it from slipping off the face of the wood. I considered adding a barrier at the bottom to keep it from falling off but thought it wouldn't be aesthetically pleasing. I then realised my Mixer had several rubber feet to suspend it from the ground to allow for hot air produced to flow out to stop overheating, I thought I could then drill holes corresponding to their position on the mixer to suspend the it. I liked this idea a lot but I was worried that the rubber feet weren't large enough to suspend the mixer at a slant.

I then decided on using a “shelf” idea by extruding into the work plane to create a “tray” for the mixer to sit in. I decided on this idea because it was practical, stable and looked good.



My Model

This is my model. It was constructed on a 1:5 scale so all the measurements are 1/5 of the original measurements.

Good Points:

- The model turned out to look exactly how I imagined it to look.
- It looked very sturdy and stable .
- The pieces of wood fit together in a fairly straight forward way and it doesn't contain any complicated bits.

Bad Points:

- I Feel the design doesn't really look particularly eye catching
- I do not know how I can make it look more attractive/eye-catching.
- I am not sure how I am going to create a device which sits on the side of the unit to hold spare cables.



Parts List

PART NUMBER	PART NAME	NUMBER OF	CROSS SECTION	LENGTH IN METRES	MATERIAL	COST/METRE	TOTAL COST
1	19" Rack Strip	1		0.5334	Metal	N/A	£11.35
2	19" Rack Draw	1	Square	0.4826	Metal	N/A	£45.49
3	Sides	2	5 sided polygon	0.78	Veneered Ash	£8.58	£13.38
4	Back Panel	1	Rectangle	0.78	Veneered Ash	£8.58	£6.69
5	Bottom	1	Rectangle	0.10	Veneered Ash	£8.58	£0.86
6	Top Panel	1	Rectangle	0.0966	Veneered Ash	£8.58	£0.83
7	Mixer Panel	1	Rectangle	0.0966	Veneered Ash	£8.58	£0.83
8	Wheels 4X	1	Circle	0.1	Metal/Rubber	N/A	£22.00
						Total	£304.30

Plan of making my project.

Cut the Veneered Ash Chipboard to the correct dimensions ready for assembly



Then cut appropriate grooves for the biscuit joints i will use to fit it all together



Then cut out the "tray" for the mixer to sit on.



Join all the pieces of wood together using the biscuit joint method



Then fix in place the racking slots and extra draw.



Fix in a set of wheels on the bottom of the product and sit the Mixer on its stand and put the Rack Unit in its slot.

Making my Product

The first step i took in making my final product was to cut all the necessary pieces of ash veneer that my product needed out on the ban saw.

To do this I measured and marked out each face of wood on a massive sheet of ash veneer. I then cut each piece as marked out to give the net of the product.



As the piece of wood supporting the mixer is suspended at an angle i cut opposite sides at a 45 degree angle so as to tidily fit against the very top piece of wood.

After cutting the ash veneer I noticed that some of the sides were un-even or bumpy so i used a plane and levelled out each side and checked it's flatness using a tri-square.



My next step was to sand and varnish each face of wood which would be facing inwards. I did this because i can sand and finish the outside faces when the product is assembled whereas i wont be able to do the inside faces when assembled.

I sanded each necessary face getting rid of any pencil marks or stains. After this i applied my first coat of varnish to the sanded faces. For the first coat i needed to dilute the varnish with some white spirit. After the first coat i used just the varnish to give a strong and aesthetically pleasing finish to the wood.



The next step i took was to cut the for the back panel of plywood. I did this using the router table as shown in this picture.

I chose to fit the back panel of plywood in with a groove because i decided it would give the product much for rigidity and make it much more stable. I looked at the possibility of using a rebate to hold the panel in but It would require me to use pins or screws to stop it falling out and did not give the product the necessary rigidity and stableness it needed.

I then started to cut the biscuit joint grooves in each face of the wood. I used a biscuit joint cutter and marked 3 points along each side of the wood because I felt any less than three biscuits per side of wood would not be sufficient.

I chose to use the biscuit joint method because it was efficient for me to do and didn't require too many materials or complicated equipment. It also provides an extremely strong bond for the wood which is highly necessary as this product will have to endure "life on the road" and must be very hard wearing.

After cutting the biscuit grooves i realised some sides of the veneer will be showing and since the ash veneer finish was only on the outside the inside wood did not look very aesthetically pleasing so i decided to iron on ash veneer strips to the sides to hide the wood. I did this by placing the strip of veneer over the side and then running a hot iron over the top of the strip of veneer to activate the glue as shown in this photo.



With the inside faces varnished and all the biscuit grooves cut and the back panel of plywood cut to size and ready to fit i decided i would proceed by gluing my project together.

After applying the glue to all the necessary sides and biscuit joints i clamped it all together and left it for 2 days between lessons to set.

After gluing my project together I decided to fix the wheels to the project so as to see my project take its final shape.

Safety precautions

During my project I had to follow some health and safety rules to ensure I did not injure myself or anyone around me

- Whenever I used any equipment such as drills etc I always wear safety glasses to prevent foreign objects flying into my eyes.
- When using any equipment I would tuck my tie into my shirt to prevent it getting caught in the equipment
- When varnishing and finishing the wood I wore a overall coat to stop my clothes being stained by the varnish/
- I always ensured my hands were a safe distance from any blades or drills.

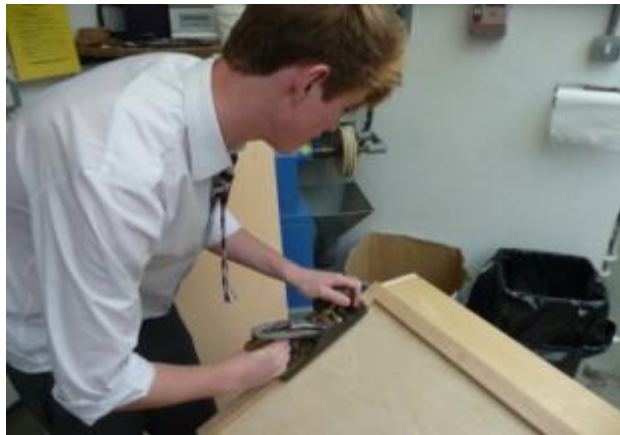


At first i wasn't sure the best way to fit my wheels to my project and as I looked at ways to attach them i came to the conclusion that the only viable way to attach the wheels was to drill four 10mm holes with the twist drill big enough to fit a nut half way into the base of my project and four 5mm holes the whole way through from the other side of the base. I then Sandblasted my nuts to clean them. I then put glue all over my nuts and stuck them in the 4 holes. I then screwed the 4 wheels into their respective nuts from the other side and let the glue set on my nuts.

I then set about making the perimeter to prevent the mixer from falling off the unit. For this i cut 4 pieces of wood to fit around the sides. I simply stuck the first piece of wood on the bottom most position on the face of wood and clamped it to let the glue set.



However when i went to clamp the other sides i found there was no way i could clamp the wood down to let the glue dry so i decided to screw these pieces of wood in using a similar method as the wheels. However, this was not ideal because although the pieces of wood were fixed in place you could see the heads of the screws from the front



. I decided to fill in the heads of the screws with a small bit of ash veneer. I fit a small bit in each hole with a screw in it and then scraped the un needed bits until completely flat. This was a very good solution to my problem and did not use up much time at all.

Quality Control

When making my project I tried to keep regular quality control checks throughout the making for example:

When Varnishing my wood I made sure that no brush hairs or foreign objects stuck to the veneer. I also made sure the coat was applied evenly with no bubbles.

I measured all right angles of the project with a tri-square to ensure all the dimensions were parallel.

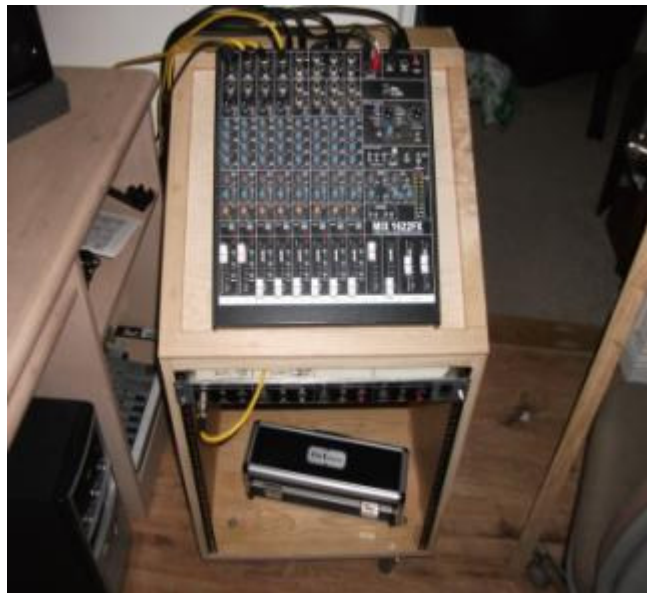
Although my product was made from commercially made Veneered Ash it still had paint marks and finger prints and pencil marks all over it so to ensure the best aesthetics of my product I made sure I sanded every single imperfection





My Finished Product





Evaluation of Final Product



My Evaluation:

Aesthetically I am very content with my product. I feel the varnish finishes and Veneer strips have done wonders for the looks of the product and I am very content with it. I feel my product is extremely sturdy and stable and I am confident it can withstand and fulfil it's purpose very well. The wheels have proven incredible practical and have made the product extremely portable.



However, I am concerned that due to the fact it is almost entirely constructed out of wood it may suffer aesthetically if knocked or dropped. I would also consider making the top panel slightly deeper because the only useful thing I can put on it is a cup of tea. I may also consider making a slightly bigger hole OR putting another hole on the mixer support piece of wood to get cables straight to the mixer.



Evaluation against Specification



This product MUST have the following qualities:

Strong and Durable to survive life on the road.

I feel my product is extremely strong and durable and as I work with a lot of similar equipment being used in similar ways I am very confident this product can withstand life on the road.

Attractive material to make it eye catching.

I was particularly happy with this field of the specification because at the beginning of making my product I was struggling to find ways of making such a practically orientated project eye catching but I think

Mobile e.g. Wheels, Handles to give ease of mobility.

Although the stable and durable nature of the product I was dubious as to how I was going to make it as easily transportable but I think using wheels was the best idea because they didn't add to the weight of the product much and being able to toe it around the studio or stage with me is extremely useful.

Hold at least 12 Rack Units to accommodate for enough rack units.

Considering it can house 12 units. I think I have hit that nail on the head.

Be able to House a 350 x 384 x 42/96mm Mixing Console.

The mixer sits perfectly in place and is very safe and stable in its position. Even when knocked I doubt

Be able to accommodate multiple cables running in and out of the Rack Units and Mixing Console because there will be lots of loose cables.

The hole I cut for my product can cater for any multitude of cables that would be running in and out of the units in the rack however one problem I have noticed is that any cables going from the rack units to the mixer have to go over the top as shown in this picture. If I were to re-produce the product I would cut another hole from the rack units to the mixer to reduce loose cables running around the back of the unit

Stand from the ground but still be tall enough to easily access the units in storage.

This product is a very convenient height when accessing it from a seat during long mixing sessions in my studio. The mixer sits at a perfect height for constant use when mixing tracks. The units in the rack do not need to be as readily available but access to them is still extremely convenient. The mixer is also very accessible from standing up when being used on stage applications however in this situation the rack units especially near the bottom become more difficult to access but considering these units vary really need to be accessed it is not a major problem.

If I Were to Develop My Design Further



If I were to make this product again there are a few things I would change or like to do better:

I would have liked to back the very top panel deeper so as to accommodate perhaps a computer screen or a studio speaker or any other useful equipment I made need readily available as the only practical use the top panel has at the moment is to store my many cups of tea I consume during long recording sessions.

It has also come to my attention that when being stationary in a studio or stage application it has a tendency to roll around as you are trying to change settings on the mixer and rack units. The slightest nudge sends it rolling away so If I were to make this again i would definitely make sure the wheels and some sort of brake mechanism.

After putting the unit to a practical test I realised it would be very convenient to have a hole coming up through the top panel from the rack space to allow cables to run straight from the rack units to the mixer because at the moment the cables come out of the back and over the top panel which puts my cups of tea in danger.

Mass production?

If my product were to be made commercially:

If my product was to be produced commercially I would have to consider whether it would be more financially viable to produce it in mass or in batch production.

Batch Production:

Advantages:

Good quality control and lots of room for differentiation. Unique designs can be aimed at specific niche markets.

Disadvantages:

Production costs more. Products will have to be sold at a higher price to make up for extra labour work.

Mass Production:

Advantages:

The product can be produced on a huge efficient scale and therefore costs less to make. The product can be made all year round 24/7 without stop.

Disadvantages:

Less quality control and the product becomes less unique. No room for differentiation.

I decided that since my intended market is not very broad and very specific it would be more viable to use the batch production method to produce my product commercially. The product could be sold at a high price because of the quality care taken in making it and the uniqueness.