Sankheda

Design | Optimisation | Production

Aswin S, 156130017

Guided by Prof. R. Sandesh

Primary Study

Situation Analysis

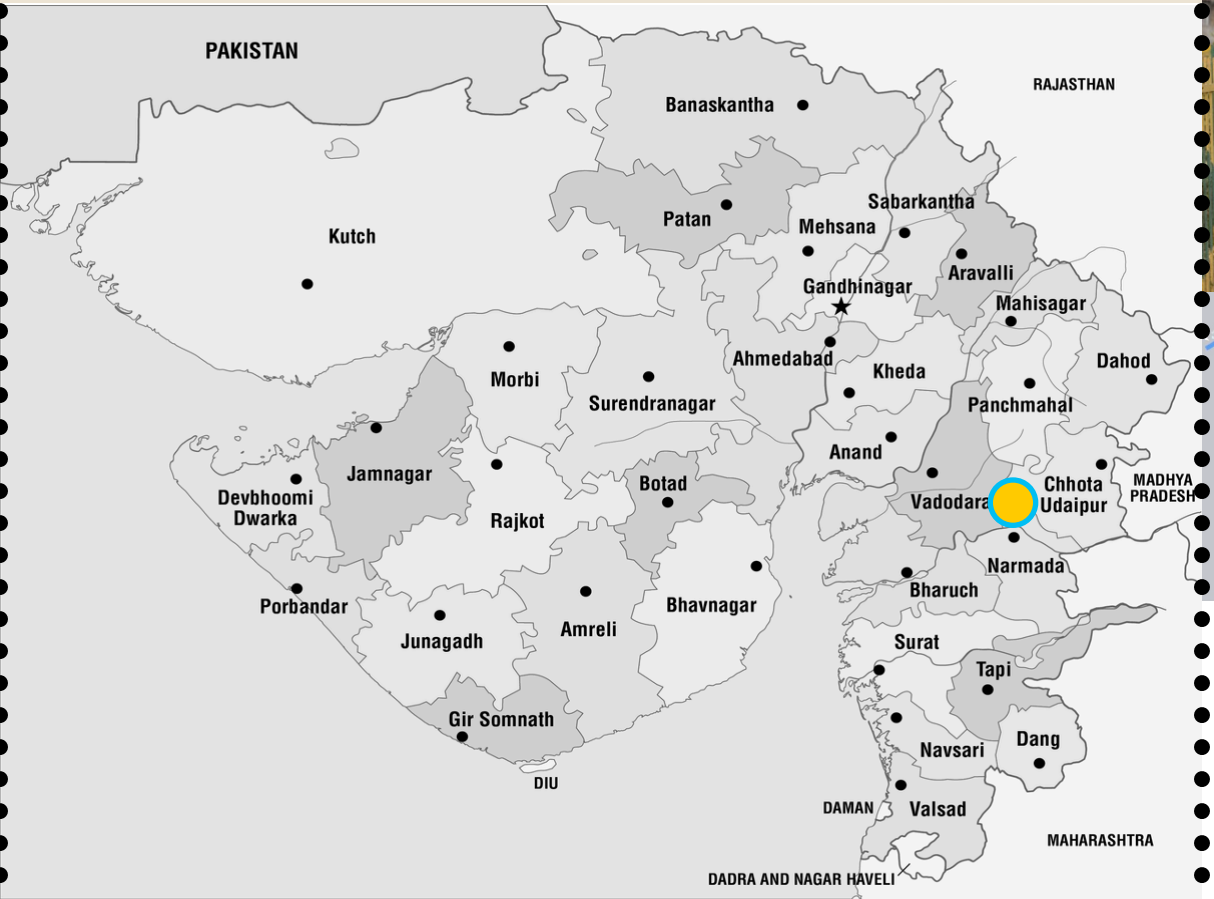
Design Brief

Ideation

Final Concept

Prototyping

Sankheda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RAJASTHAN
Banaskantha
Patan
Sabarkantha
Mehsana
Kutch
Aravalli
Gandhinagar
Mahisagar
Ahmedabad
Kheda
Dahod
Morbi
Surendranagar
Panchmahal
Anand
Jamnagar
Devbhoomi Dwarka
Botad
Chhota Udaipur
MADHYA PRADESH
Vodadara
Rajkot
Narmada
Bharuch
Porbandar
Bhavnagar
Amreli
Junagadh
Surat
Tapi
Gir Somnath
Navsari
Dang
DIU
DAMAN
Valsad
MAHARASHTRA
DADRA AND NAGAR HAVELI


સંખેડા બહાદરપુર
संखेडा बहादरपुर SANKHEDA BAHADARPUR


Bahadurpura
Orsang River
Sankheda

Sankheda

Furniture

The Shift

- Initially used lac for finishing the product
- Now synthetic paints have replaced them
- Mechanisation of lathe and cutting

The System

Retailer

Master Craftsman& Family

Craftsman& Family

Labourer

Customer

The Craftsmen

Master Craftsman

Turning

Painting

Assembling

The Craftsmen

Putty

Sanding

Finishing

Lacquer

Patterns

Base Colour

Drilling

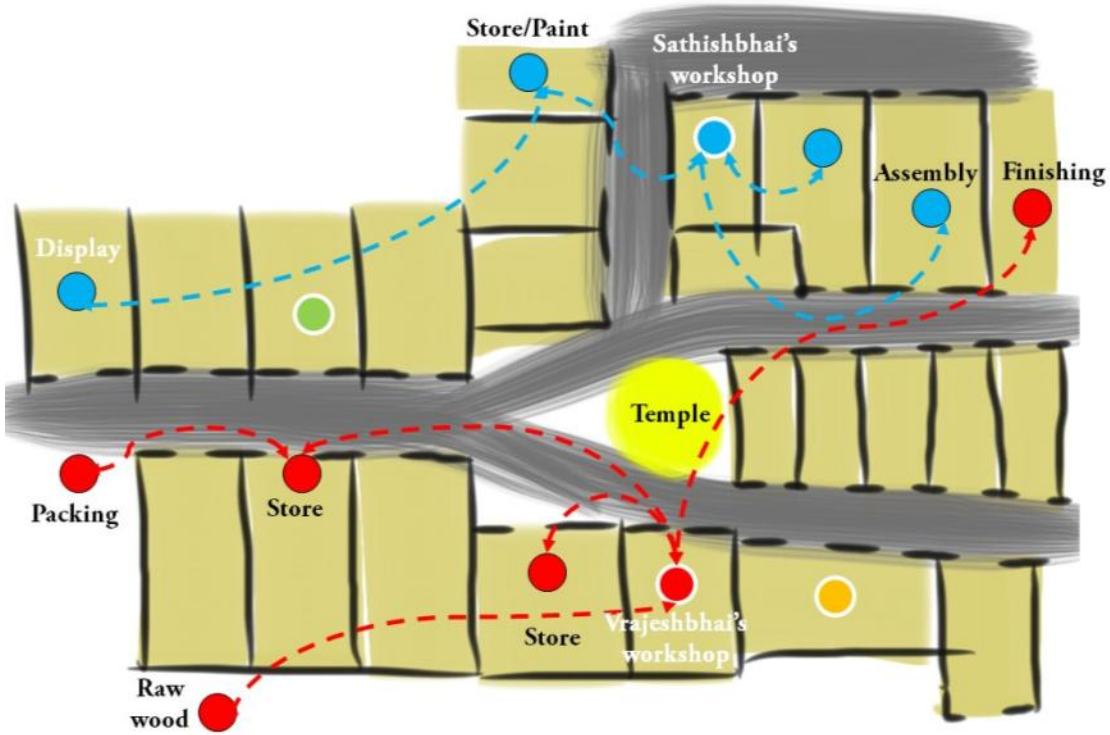
Cutting

Turning

Painting

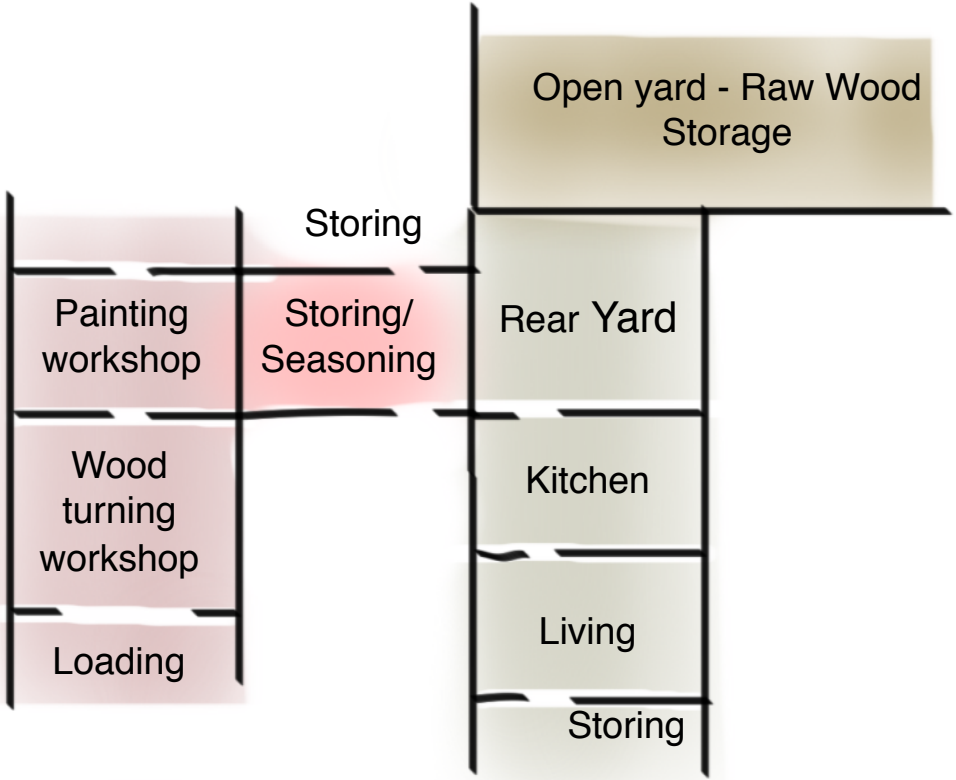
Assembling

The Cluster

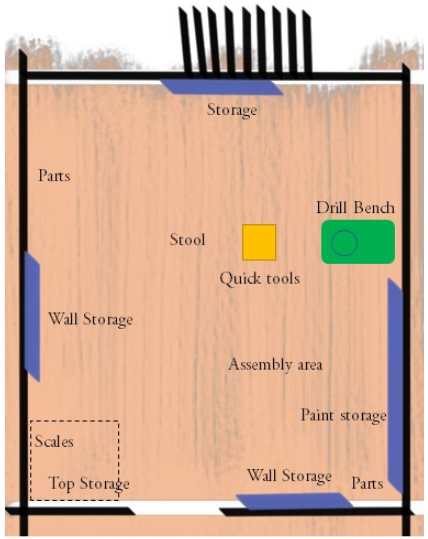

Store/Paint
Sathishbhai's workshop
Assembly
Finishing
Display
Temple
Packing
Store
Store
Vrajeshbhai's workshop
Raw wood

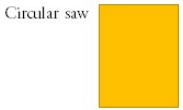

KHARADI JAYANT & BROS

Work Culture

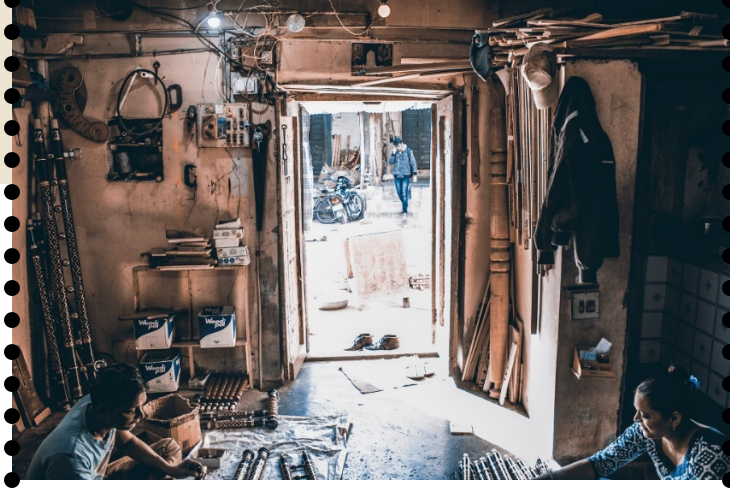


Workshop


Storage
Parts
Drill Bench
Stool
Quick tools
Wall Storage
Assembly area
Paint storage
Scales
Top Storage
Wall Storage
Parts


Circular saw


Lathe
Top Storage
Top Storage
Lathe
Wall Storage
Wall Storage
Lathe
Lathe
Loading area
Circular saw



Inside the workshop…

Tools they use...

Raw materials…

ACQUIRE

STORE

Step by step…








1 – Raw wood


2 – Square profile


3 – Chiselling of edges


4 - Turning


5 - Carving


6 – Filling wood powder


7 – Sanding or smoothening

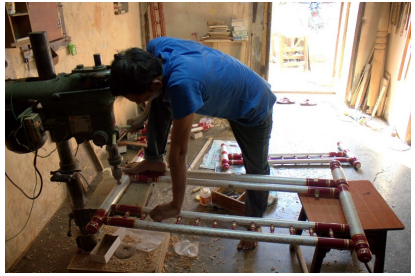

8 – Applying putty


9 – Painting with broad brush


10 – Painting with fine brush


11- Applying melamine

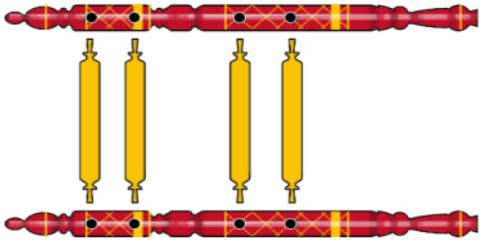
Step by step...

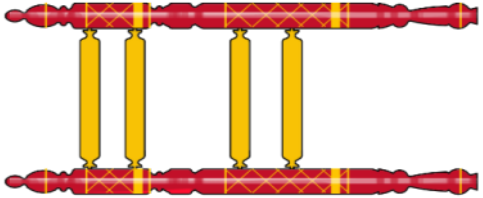


12 – Drilling large holes

13 – Fixing clamps

14 – Applying glue





Situation Analysis…

Furniture Type 1						
No	Process	Activity	Tool/Workstation	Posture	Type	Average Time
Making of Parts						
1	Wood Working	Wood Cutting	**Circular Saw**	Standing	Repeating	6 min/ job
					Non- precise	
2		Wood Turning	**Lathe**	Sitting	Repeating	9 min/ job
			Chisel		Non- precise	
3		Wood Carving	**Lathe**	Sitting	Repeating	7 min/ job
			Chisel		Non- precise	
4	Finishing	Sanding	**Lathe**	Sitting	Repeating	10 min/job
			Sand Paper		Non- precise	
5		Applying Putty	**Lathe**	Sitting	Repeating	7 min/job
			Brush		Non- precise	
6		Painting	**Lathe**	Sitting	Repeating	7 min/ job
			Flat Brushes		Non- precise	
7		Painting	**Lathe**	Sitting	Repeating	3 min/ job
			Thin Brushes		Moderately precise	
8		Painting	**Manual**	Sitting	Repeating	30 min/ job
			Thin Brushes		Precise	

Assembly of Furniture						
9	Fixtures	Wood Chiselling	**Circular saw**	Standing	Non-Repeating	1min
					Precise	
10		Drilling	Drilling machine	Sitting	Non-Repeating	2min
					Moderately precise	
11		Fixing Metal Clamp	Hammer	Sitting	Non-Repeating	2min
					Non- precise	
12	Joining	Edge Finishing	Chisel	Sitting	Non-Repeating	1min
					Non- precise	
13		Drilling Large holes	**Drill Bench**	Standing	Non-Repeating	2min
			Stool		Non- precise	
14		Applying Glue	Stick	Sitting	Non-Repeating	1min
					Non- precise	
15		Hammering	Mallet	Sitting	Non-Repeating	1min
					Non- precise	

Task Analysis – Making of a Single Turned wood part

Work Hours : 10:00 am to 1:00 pm; 3:00 pm – 10:00 pm
Most of the work is repetitive.

90% of the time – Sitting; 10% Standing

49% of the work – Lathe; 41% Manually including painting

60% of the work requires intense force but less precise;

User Study…

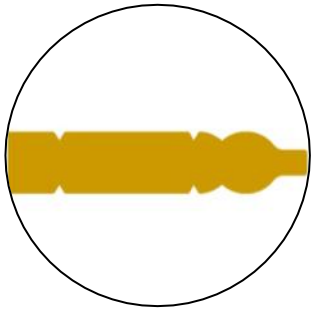
Current System...

- Working on floor - More **Circulation** Space - **Storing** the unfinished and finished parts.
- Working on floor **–** Less **weight of lifting** parts
- Parts on floor - Ease of **assembling.**
- Existing lathe is designed to work by sitting on the floor and **facilitates longer parts**
- Frequent used tools are kept on the floor and are **accessible** quickly.
- Indigenous methods of working and modification of parts for ease of use.

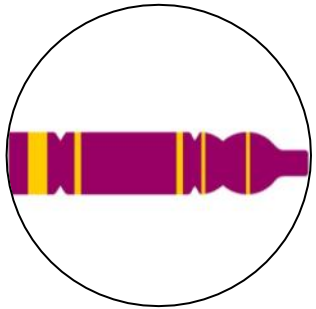
Current System…

- Lack of proper work station – Parts & Assembly
- Badly designed Tool storage
- Lack of proper Seating.
- Drudgery - Repetitive tasks especially in lathe.
- Less Support for body in performing tasks
- Heavy wooden parts
- Multiple tools used
- Exposed parts of Circular saw - Safety
- Improper Wiring and fixtures in Circular saw

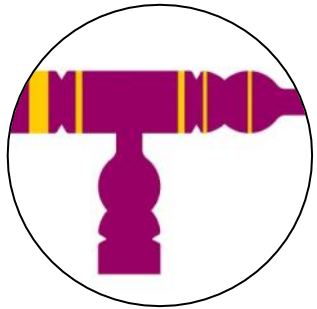
TURNING



PAINTING



ASSEMBLY



- Turning

- Painting

Activities

- Cutting

- Drilling

Design Brief!

Design of workstation for Sankheda craftsmen to reduce drudgery in work environment by ergonomic and user friendly optimisation of wood turning, painting and assembly in manufacture.

This initiative can lead to standardised, ergonomic and production friendly workstations for allied turned wood crafts and other production units

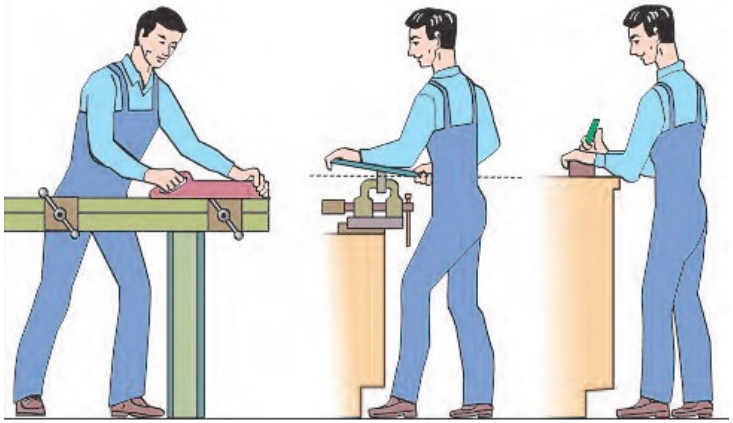
Functions…

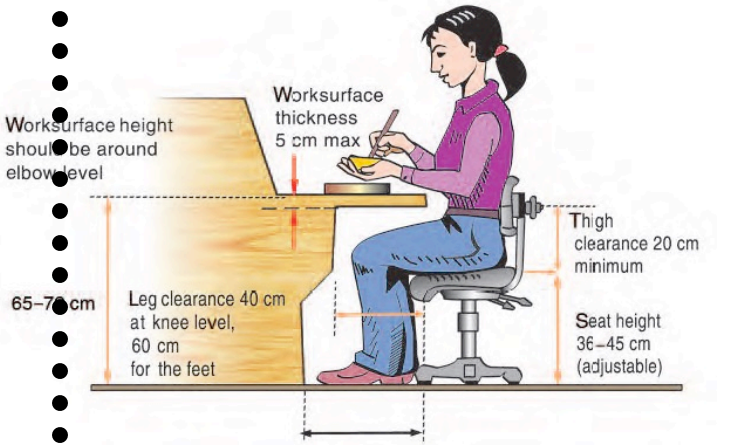
- Assist craftsmen in **Manufacture of parts**
- Assist craftsmen in **Assembly of parts**

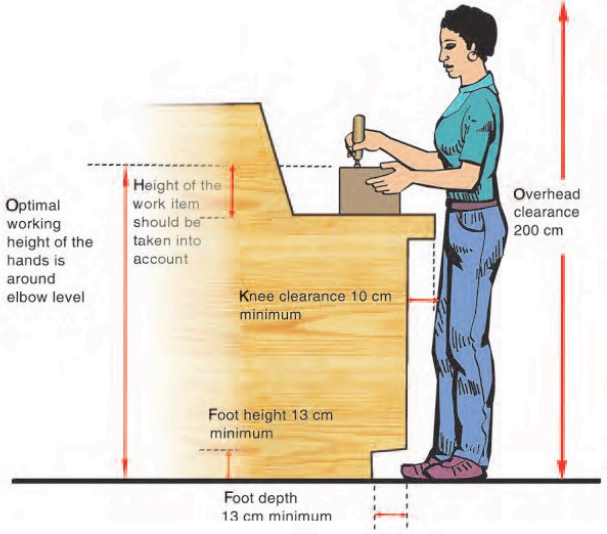
- Storage of **Tools**
- Storage of **Accessories**
- Storage of **Material**

Existing work habits…
Existing tools
Existing machines
Aspirations

Ergonomic Guidelines

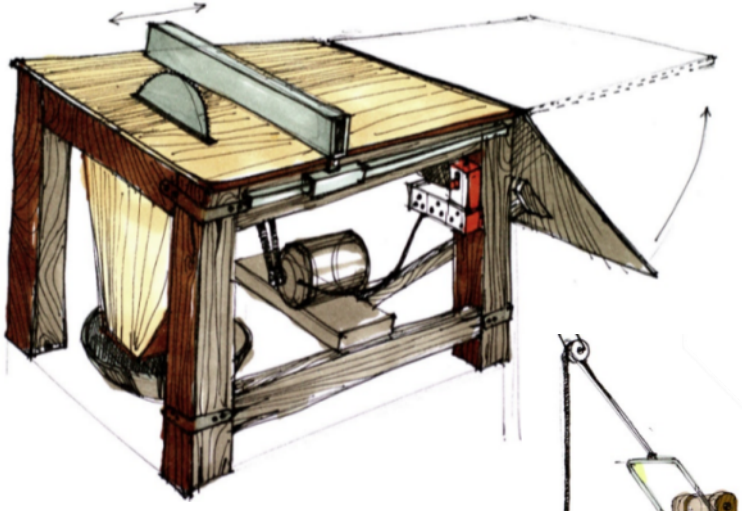


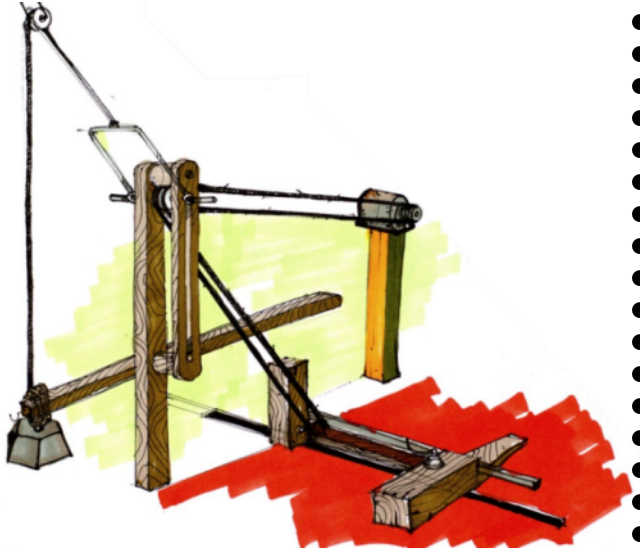




Existing Workstations

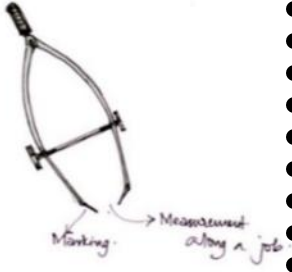
Cutting Work Station

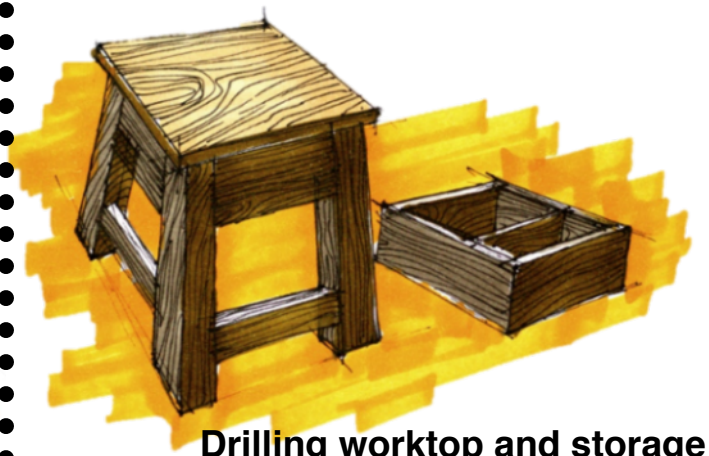




Mechanised Lathe

Tools & Accessories

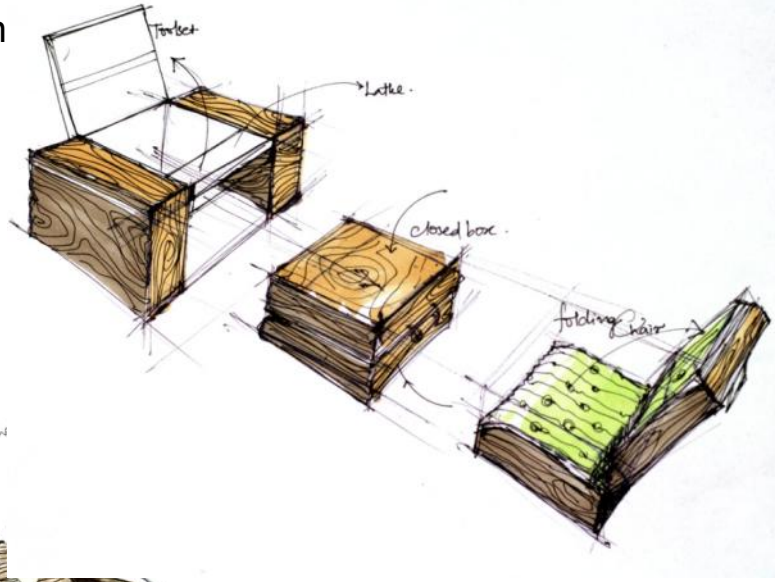


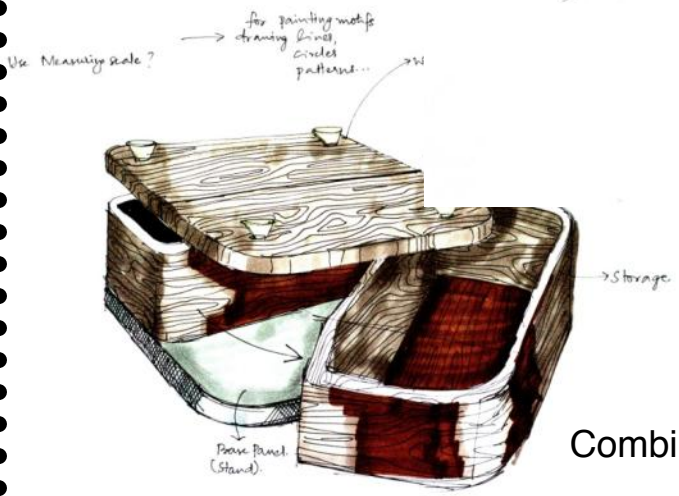


Drilling worktop and storage

Initial Ideas - **Workstation**

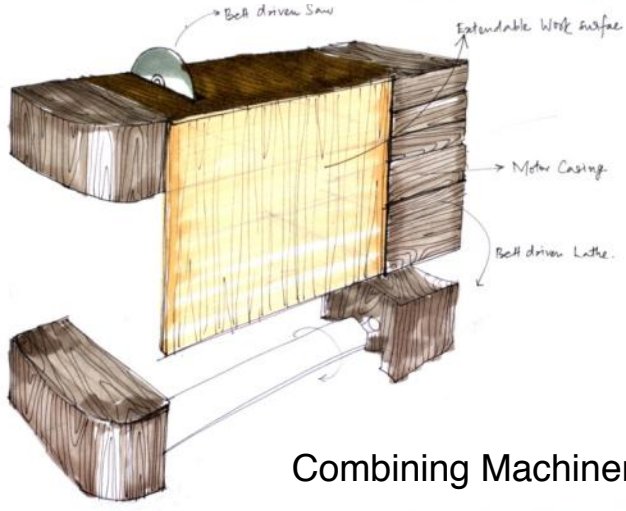
Modifying Work Station





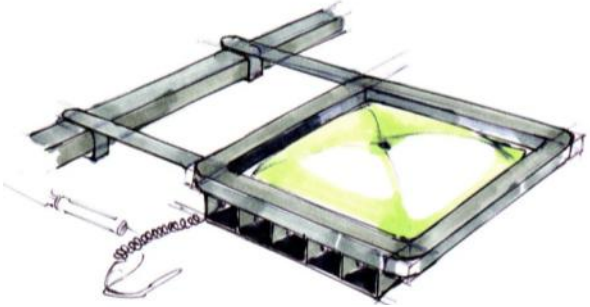
Combining Storage & Worktop

Adding value to activity & Culture



Combining Machinery

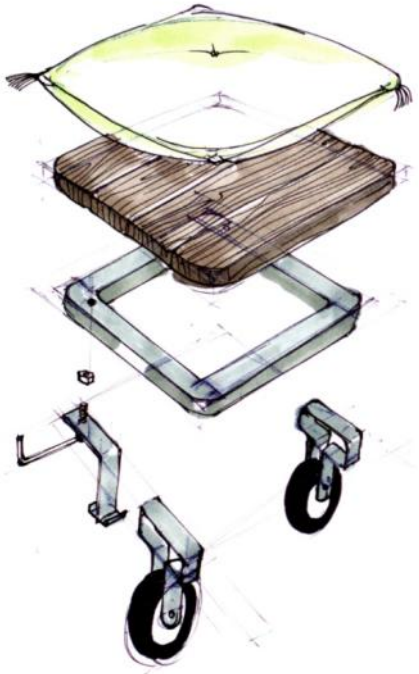
Initial Ideas - Accessories



Tool Storage

Measuring

Using Existing Rails



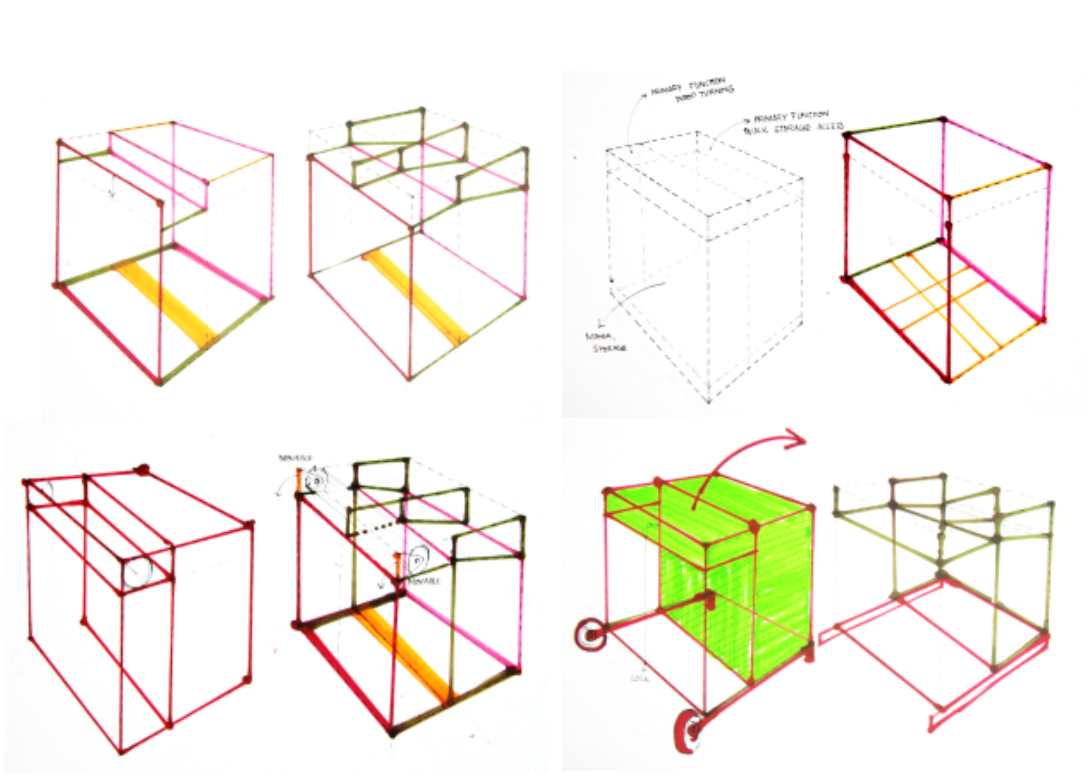
Exploded View

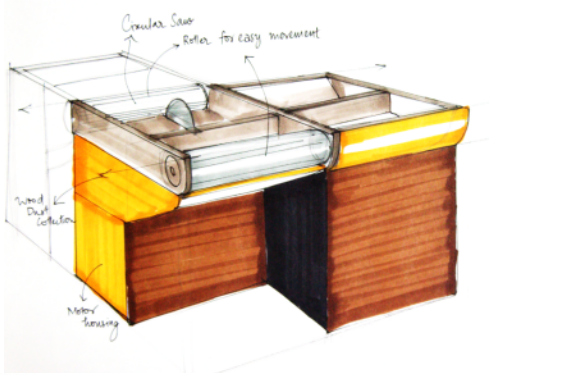
Design of Workstation

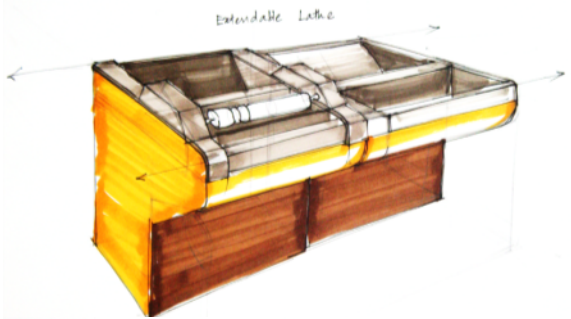
- In any system, the person who performs the work would be the prime consideration. Accessories, machines and other work equipment are aids. The work space should make it easy to use all these facilities.

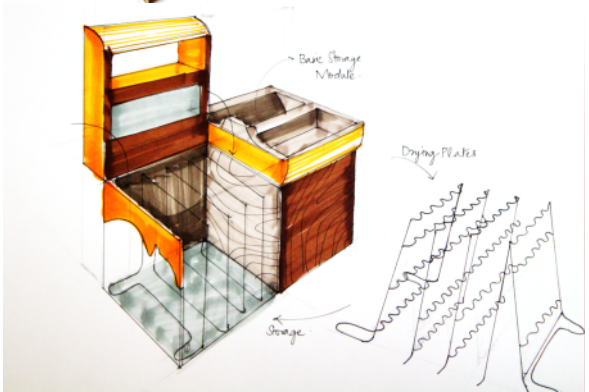
- Indian Anthropometric Dimensions for Ergonomic Design Practice

Ideation Level 1









Similar Products

Wood as a material

Similar Products

Steel as a material

Similar Products

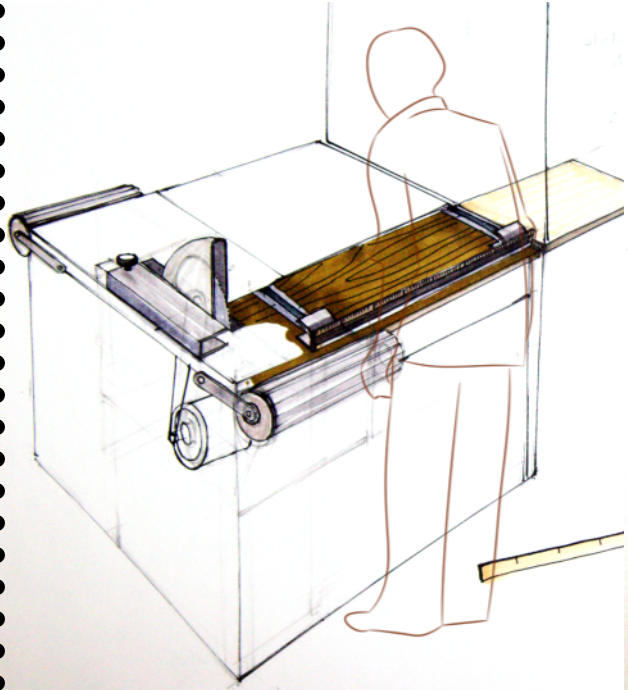
Machinery based work station

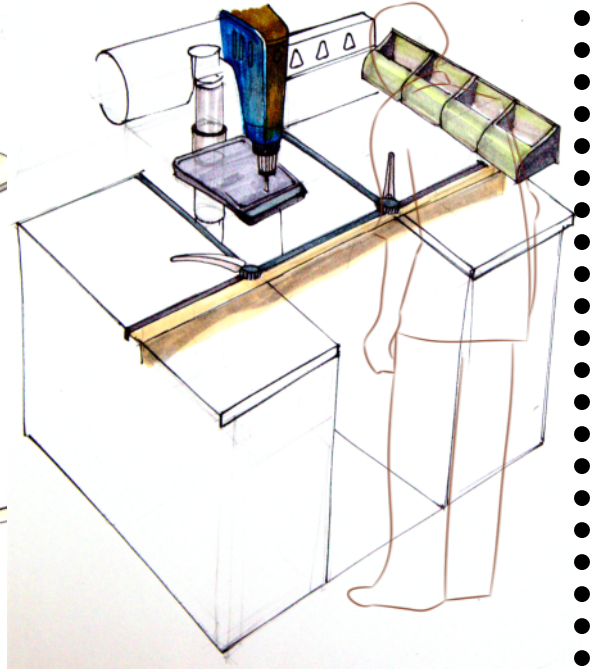
Ideation Level 2

Feature based

Ideation Level 2

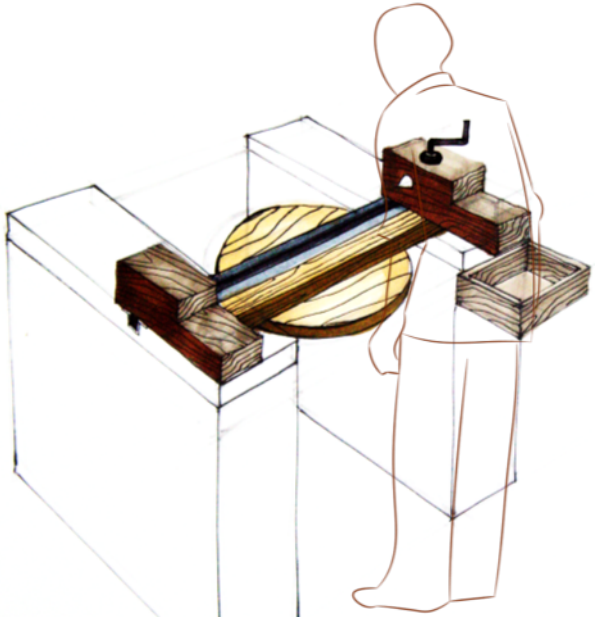
Machinery based

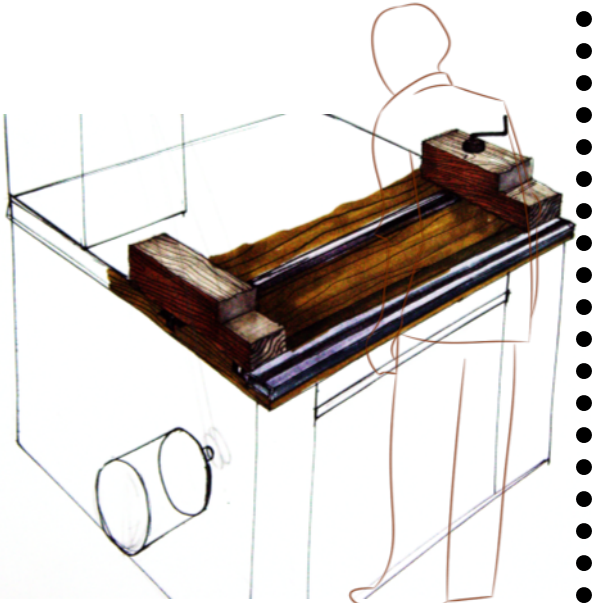




Ideation Level 2

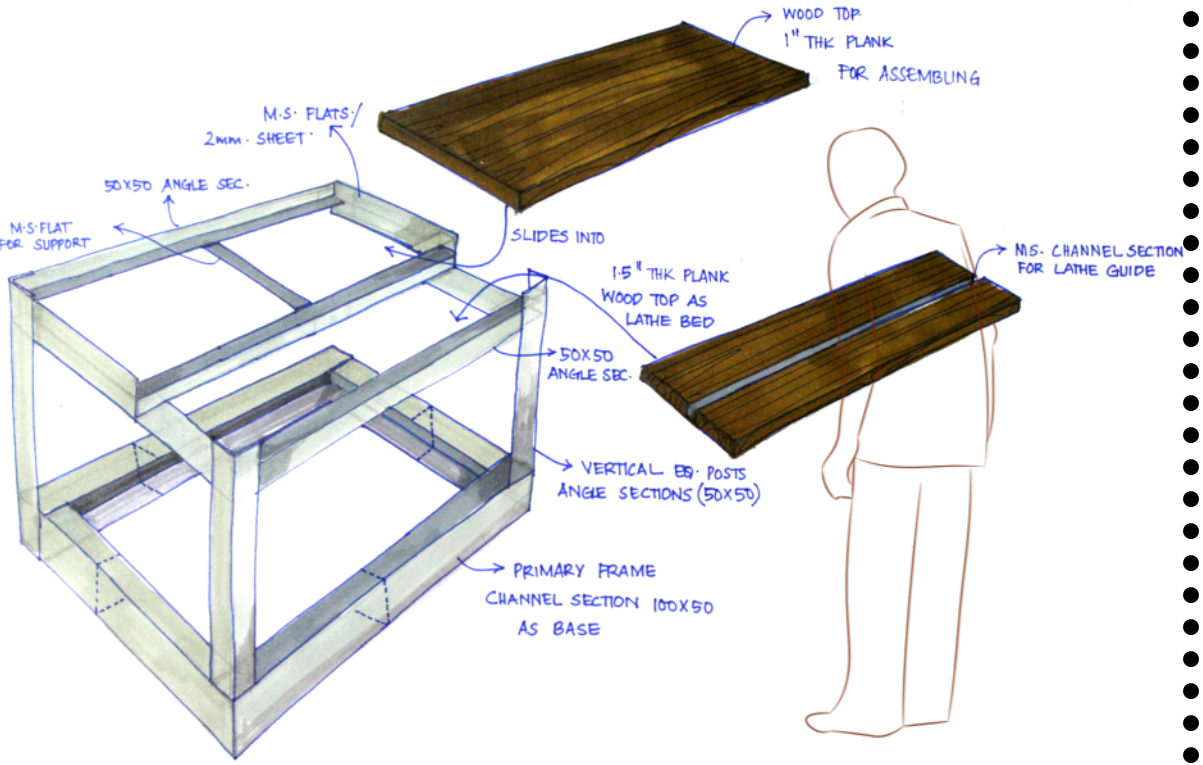
Machinery based



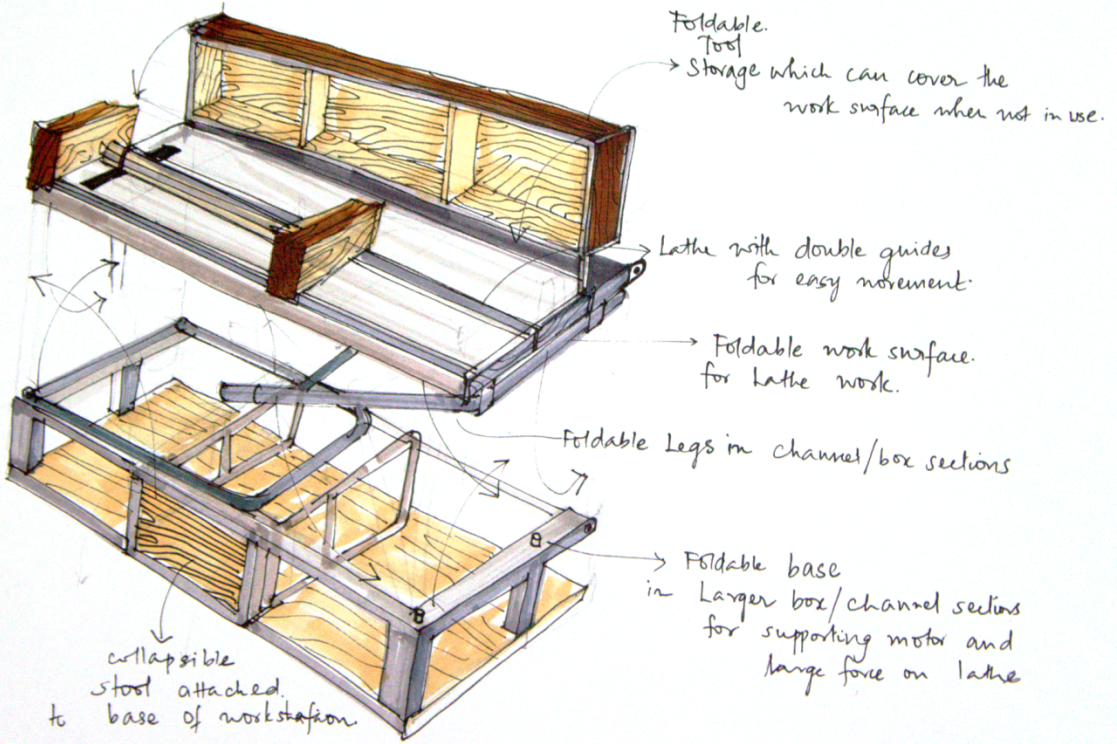


Ideation Level 2

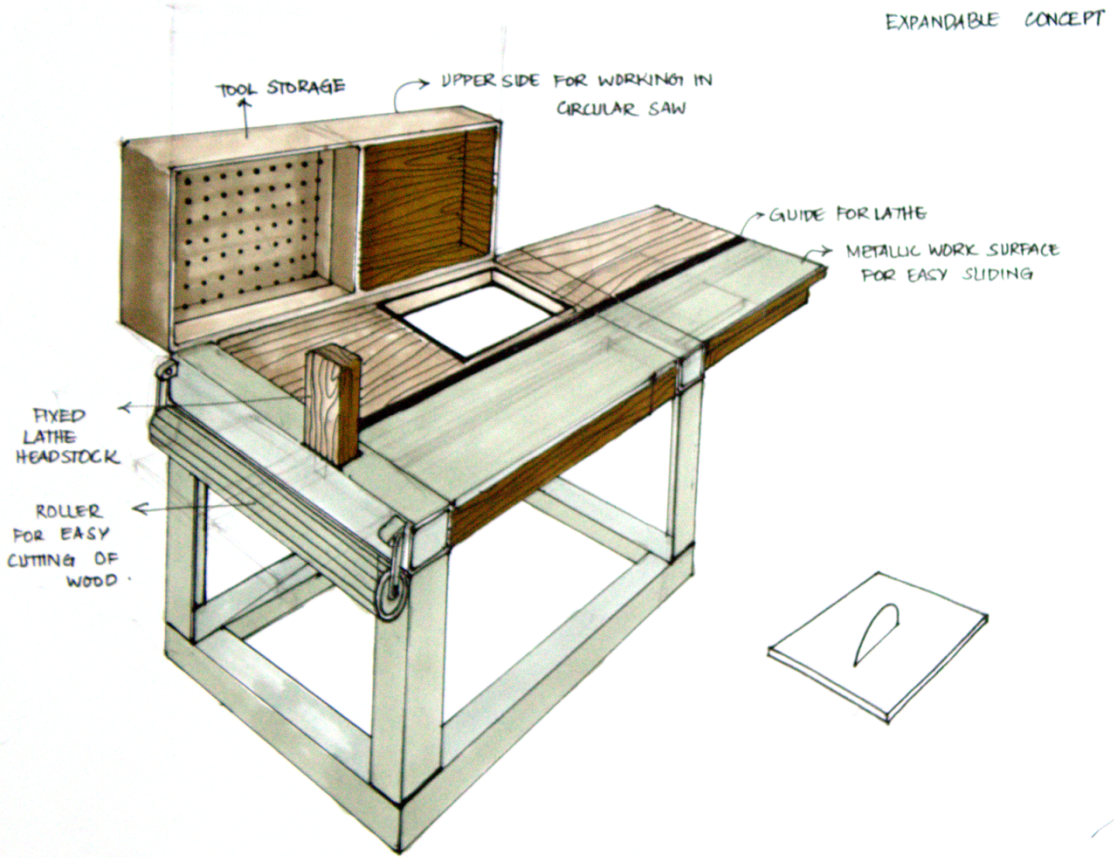
Machinery based



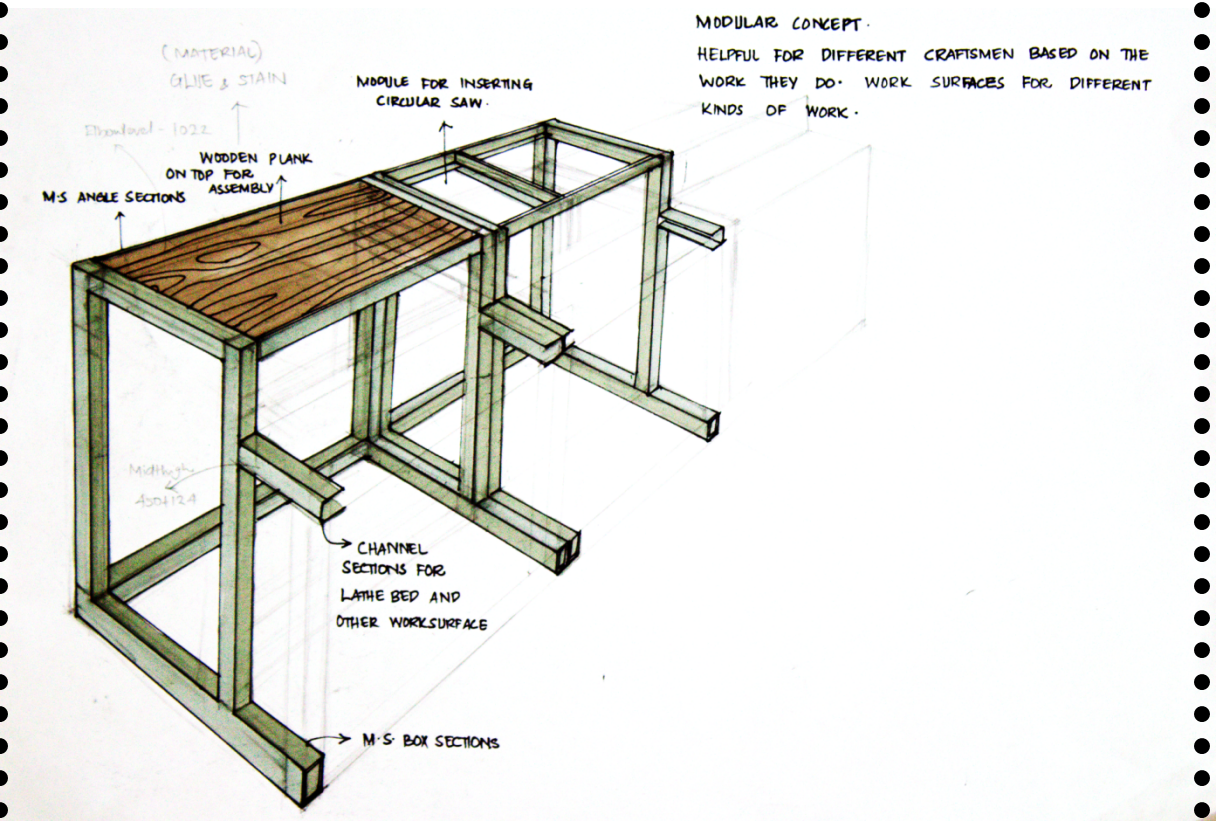
Moving into concepts



Moving into concepts

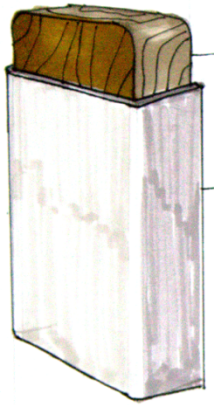


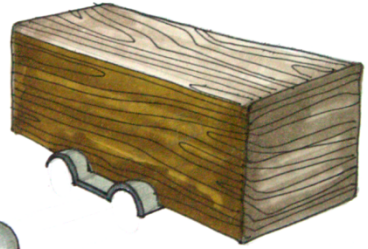
Moving into concepts

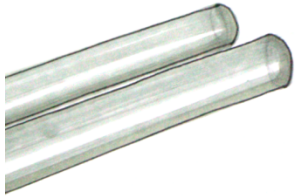


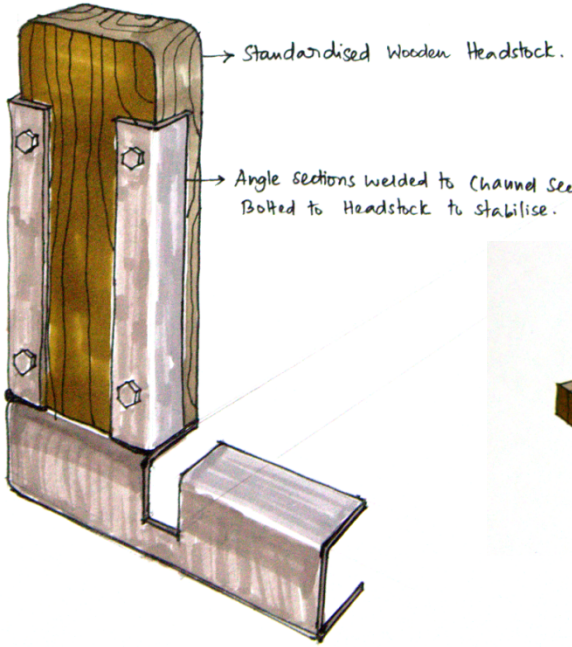
Headstock - Lathe

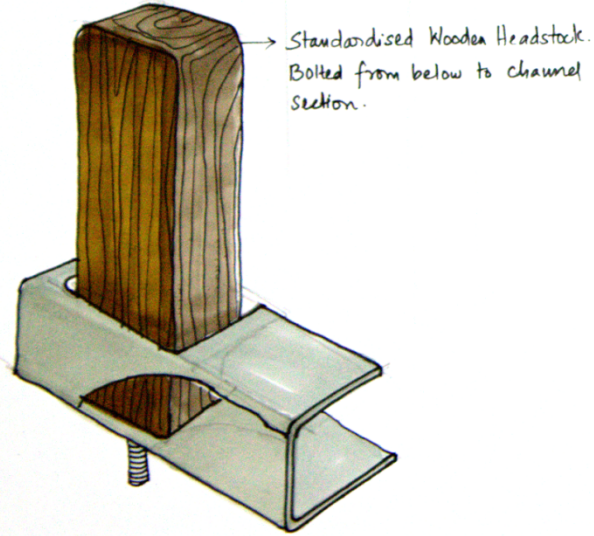
Holding the Headstock



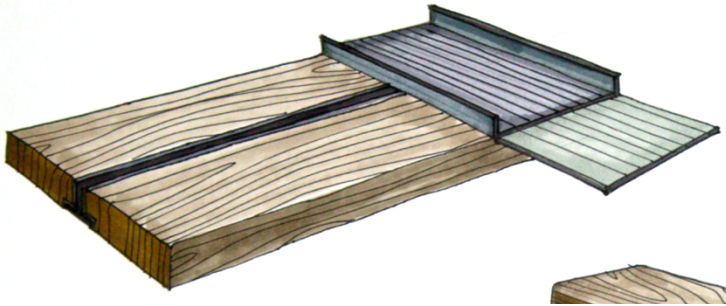


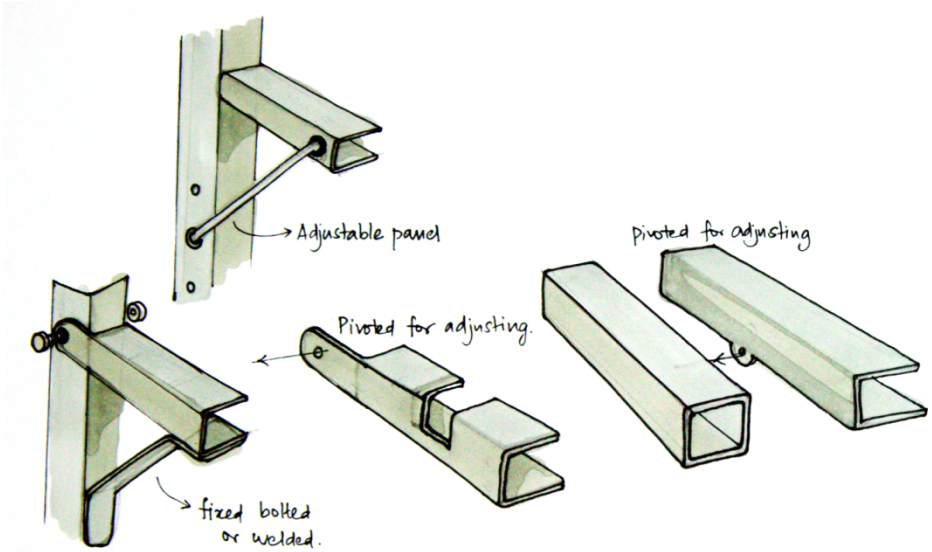




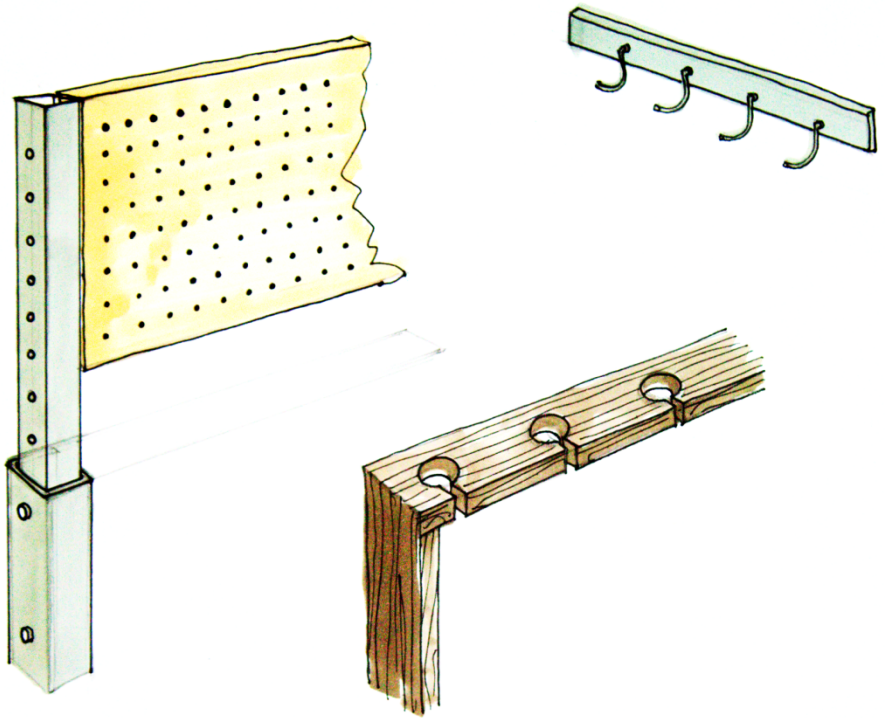


Tailstock - Lathe





Module - Detailing



Storage - Types

- Part 1 – 02 X ~1950mm
- Part 2 – 02 X ~1800mm
- Part 3 – 10 X ~1500mm
- Part 4 – 04 X ~1350mm
- Part 5 – 02 X ~1200mm
- Part 6 – 04 X ~900mm
- Part 7 – 36 X ~300mm
- Part 8 – 20 X ~150mm

Cut from larges pieces as per availability

For making Jhulla the required work surface is approximately 2 metres. A work surface of 1500mm can make most of the parts of the Jhulla

- Part 1 – 1X 1000mm
- Part 2 – 4 X 450mm
- Part 3 – 4 X 300mm
- Part 4 – 2 X 200mm

- Part 1 – 4 X 200mm

For making Sofa set the required work surface is approximately 1metre. A work surface 450 mm can make most of the parts of the Sofa set

- Part 1 – 04 X ~**1500mm**
- Part 2 – 26 X ~**900mm**
- Part 3 – 06 X ~**600mm**
- Part 4 – 06 X ~**500mm**
- Part 5 – 32 X ~**400mm**

For making Sofa set the required work surface is approximately 1.5 metres. A work surface 900 mm can make most of the parts of the Sofa set

- Part 1 – 4 X 1650
- Part 2 – 8 X 650mm
- Part 3 – 12 X 1000mm
- Part 4 – 60 X 500mm
- Part 5 – 12 X 450mm

For making Sofa set the required work surface is approximately 1.7 metres. A work surface 500 mm can make most of the parts of the Sofa set

Dimensional Guideline

Standing Elbow Level – M&F Combined – 5th percentile – 908mm - **Top**

Sitting Elbow Level – 450mm(Seating)+124mm (Thigh-95th percentile)

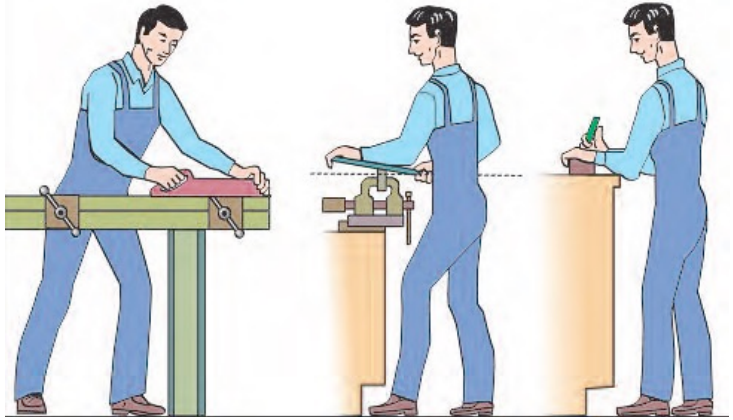
Thigh Clearance – 644mm (95th percentile) – **For low table top**

Forward arm reach – 700mm (5th percentile) – **For shelf and storage**

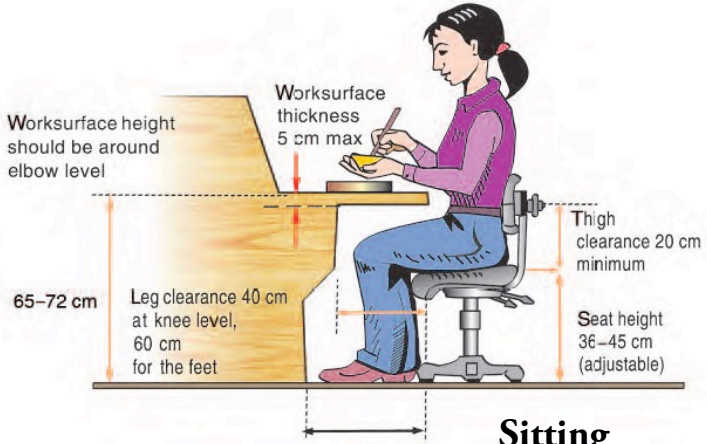
The following machinery are taken as per standard.

- Circular saw – for 10” diameter
- Drill press – Floor mounted – as per the user
- Lathe – Measured on site and standardised.

1500 mm workspace
900mm workspace

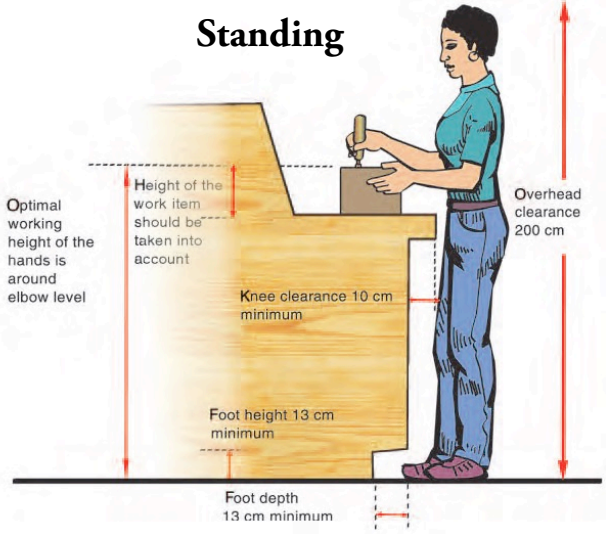


Standing



Sitting

Standing



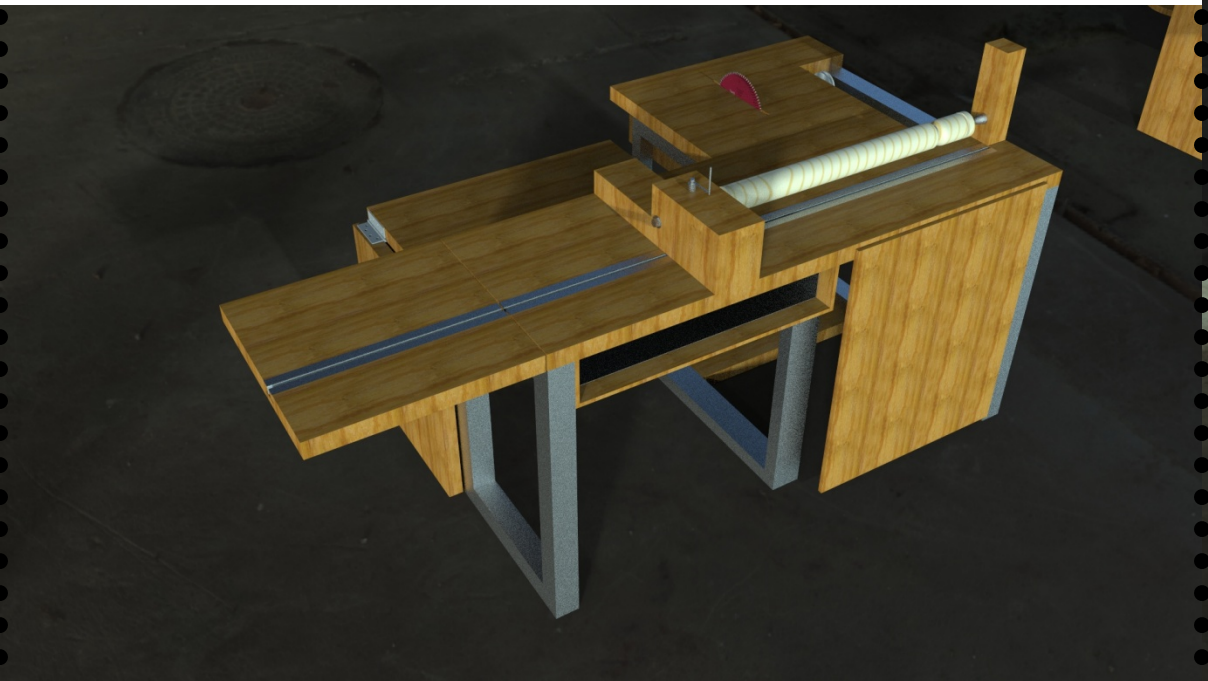
Dimensional Constraints

- The following machinery are taken as per standard.

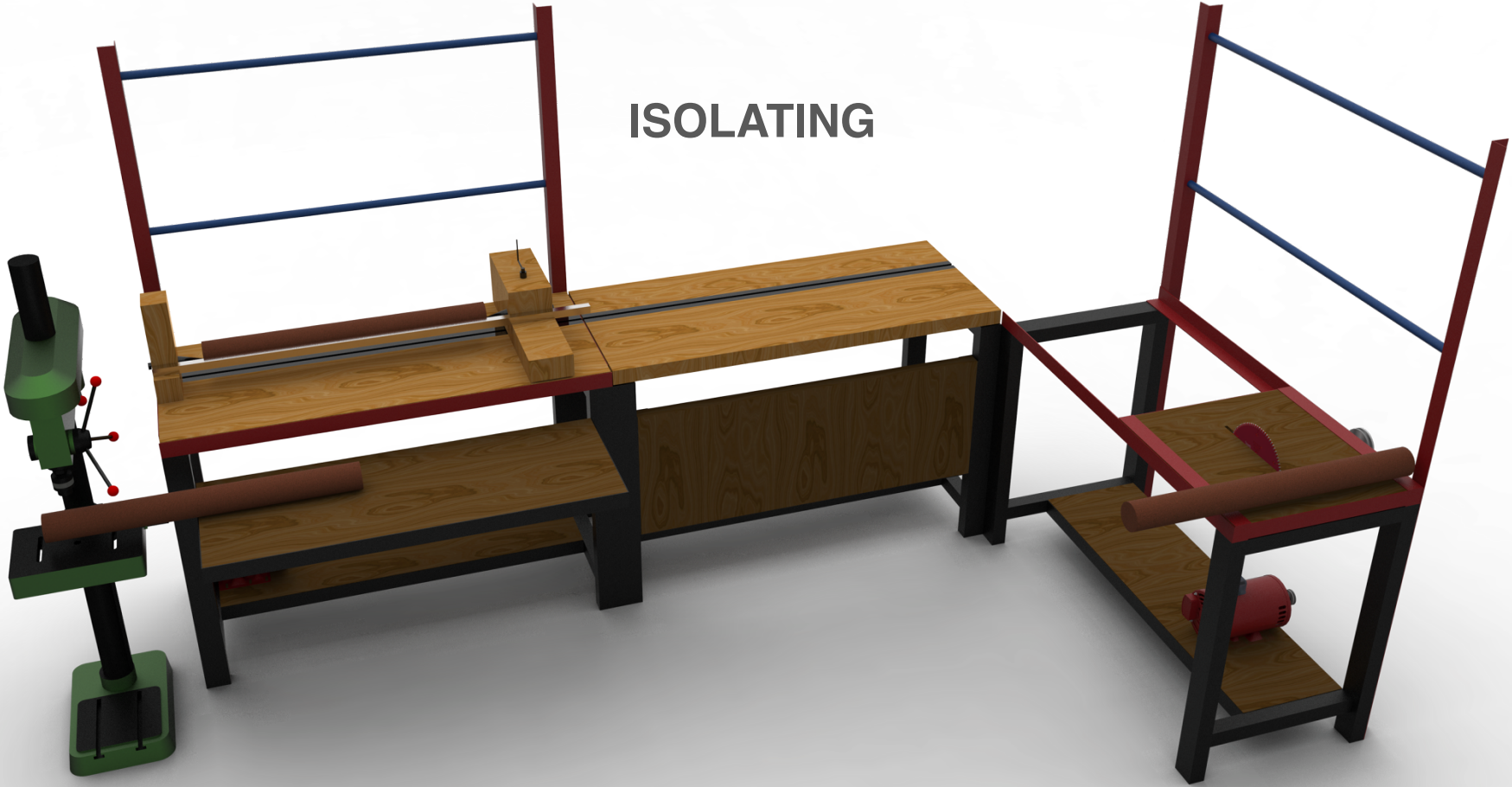
  - Machinery -
    - Circular saw – for 10” diameter
    - Drill press – Floor mounted – as per the user
    - Lathe – Measured on site and standardised.

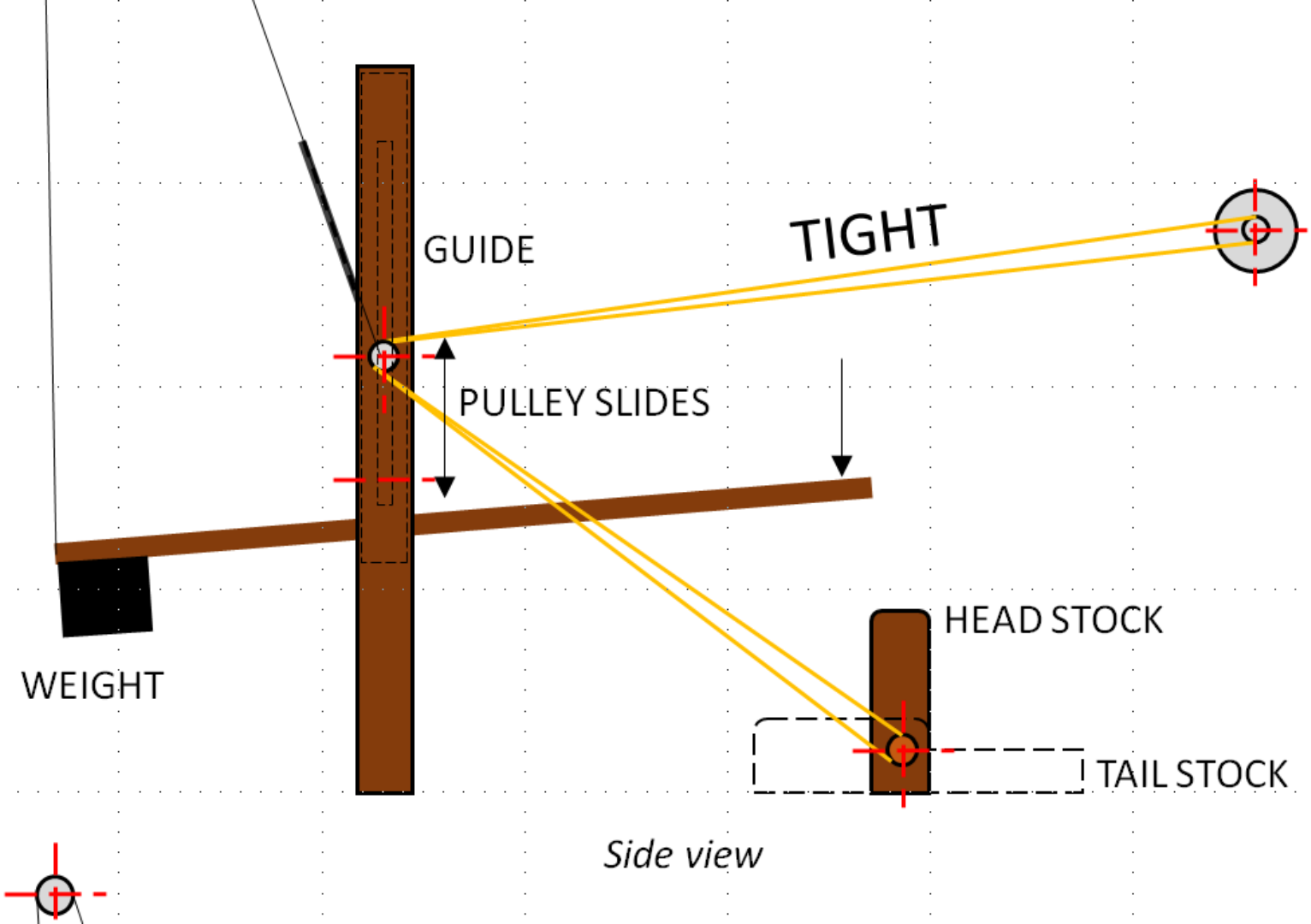
Concept - 1

COMBINING

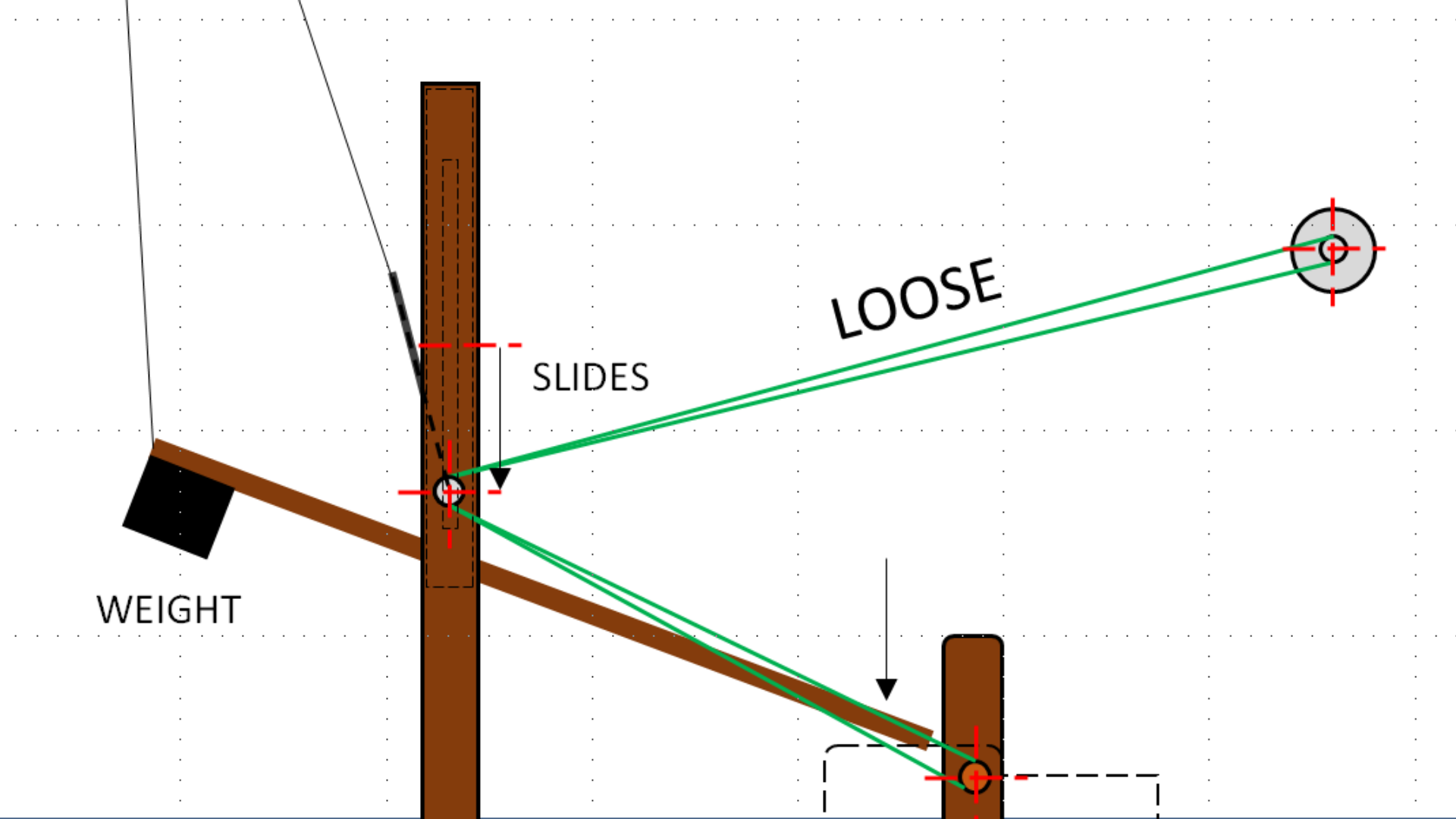


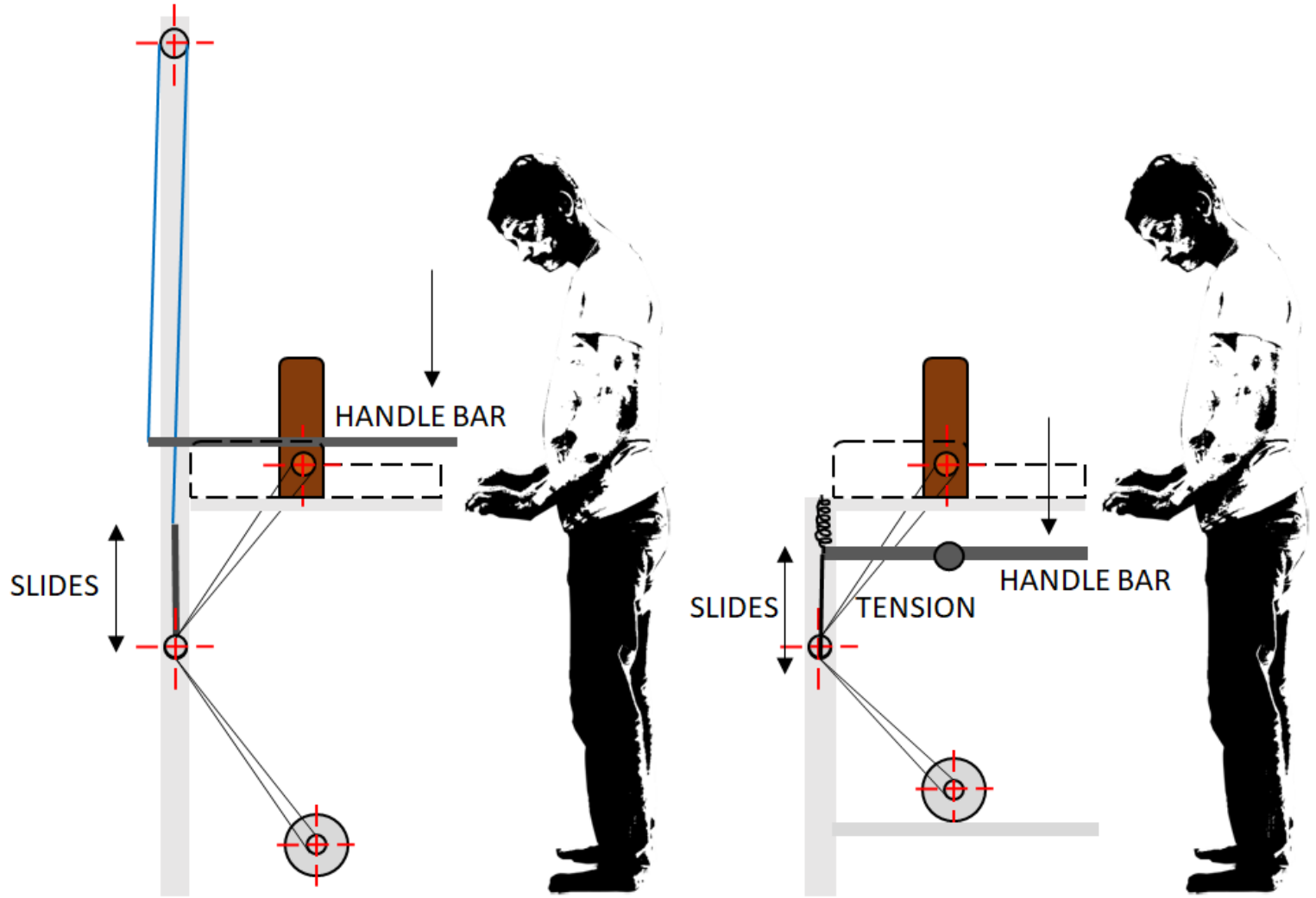
ISOLATING





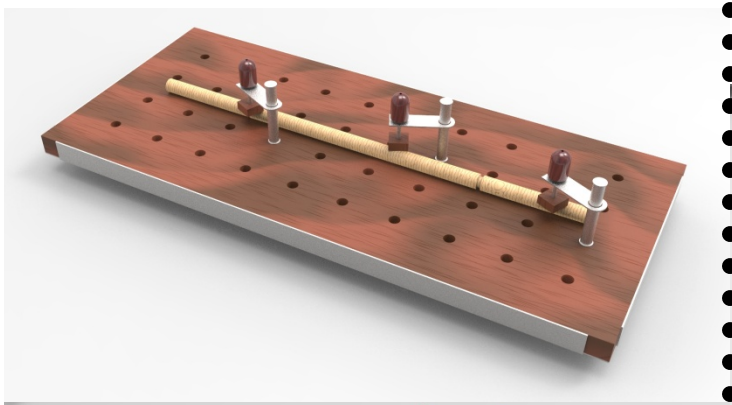
Side view

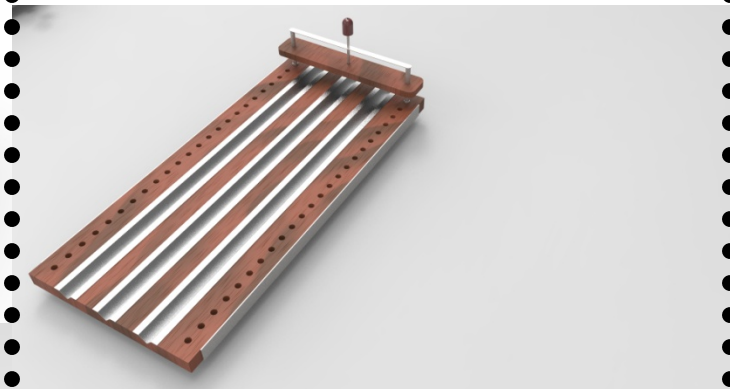

LOOSE
SLIDES
WEIGHT

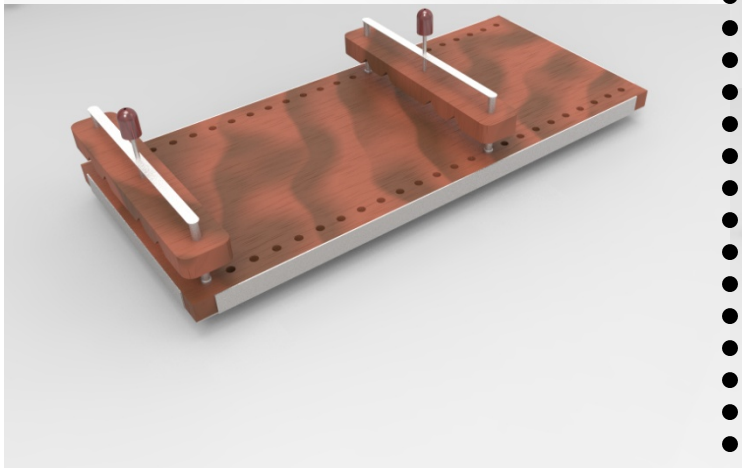

HANDLE BAR
SLIDES
SLIDES
TENSION
HANDLE BAR

Worktop for Painting

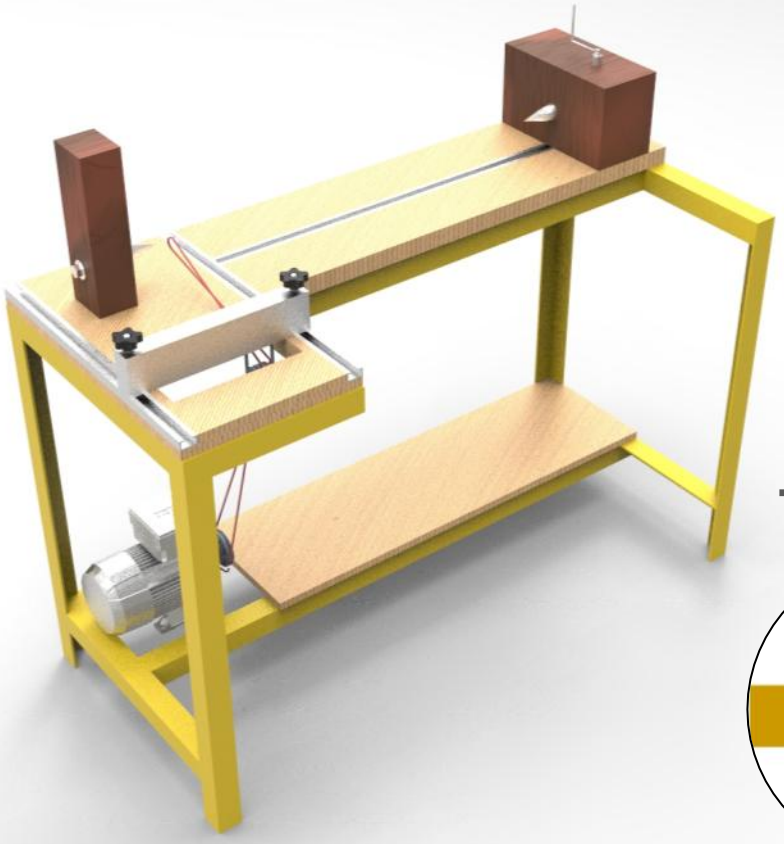
Clamping Ideas



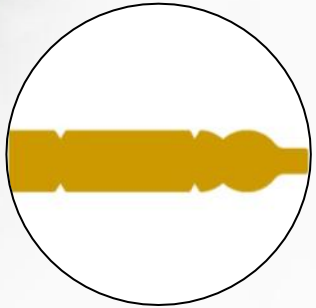


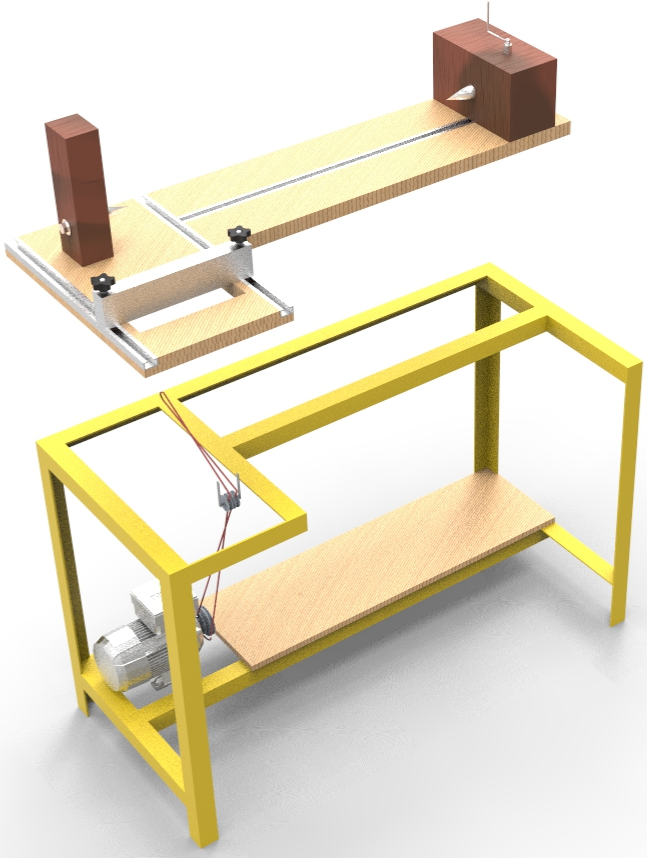


Final Concept



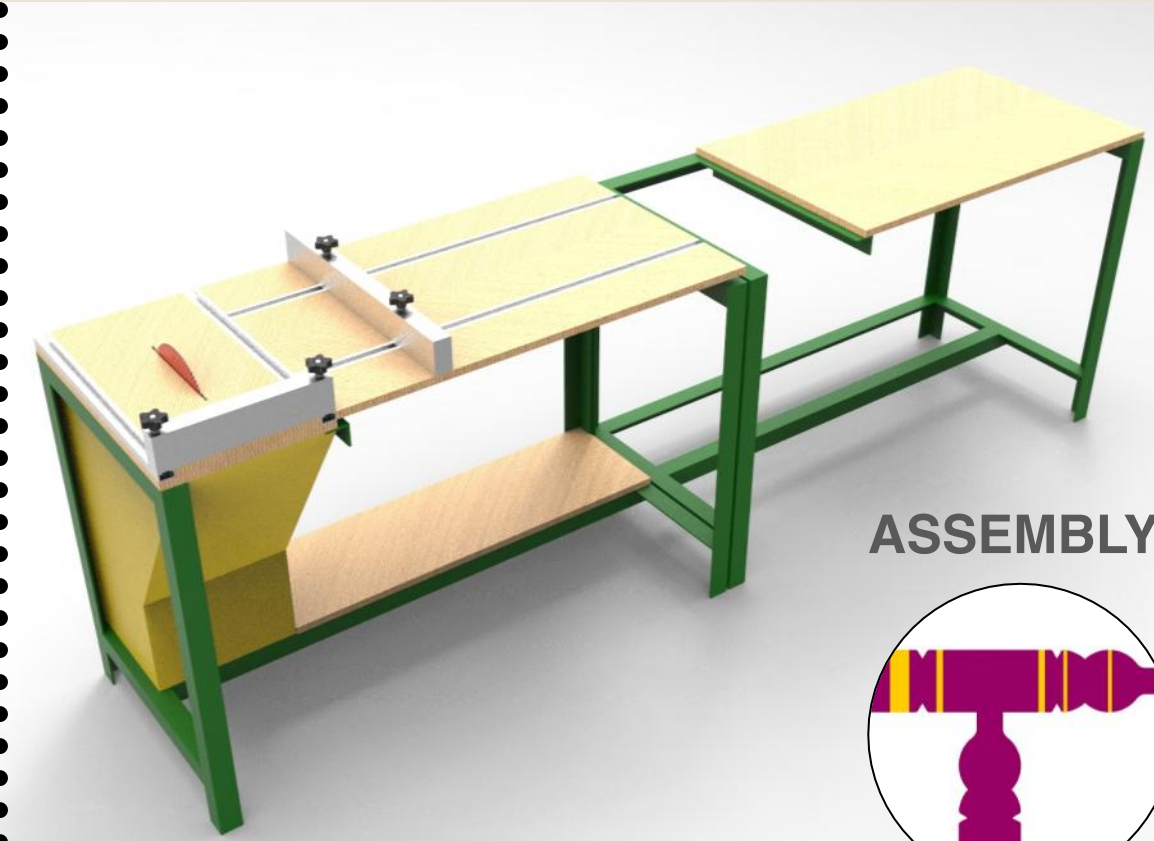
TURNING



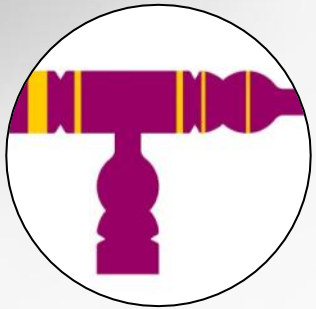


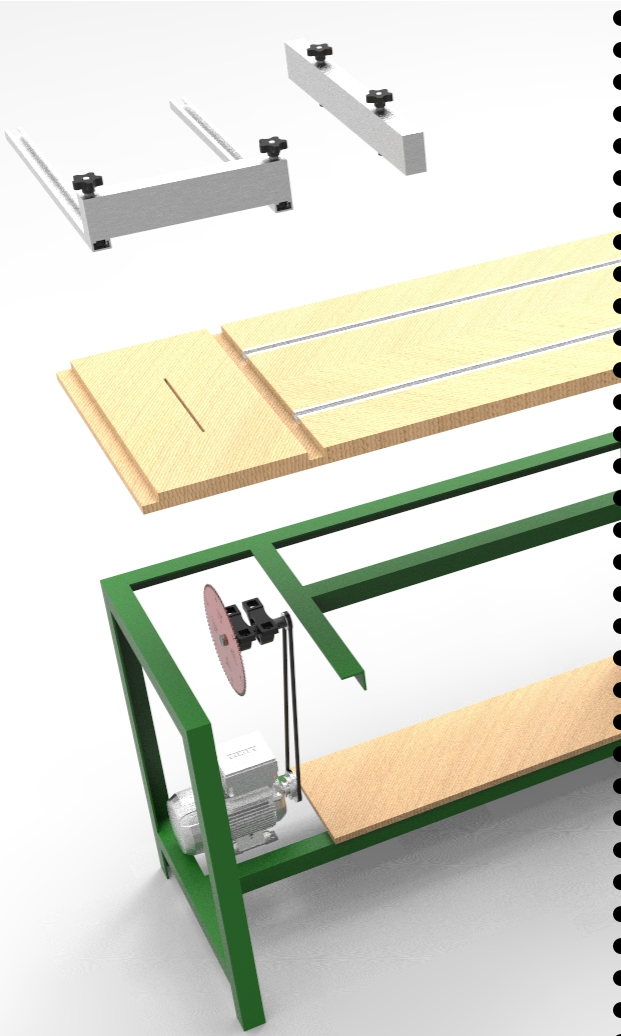
Final Concept

Final Concept



ASSEMBLY





Concept validation

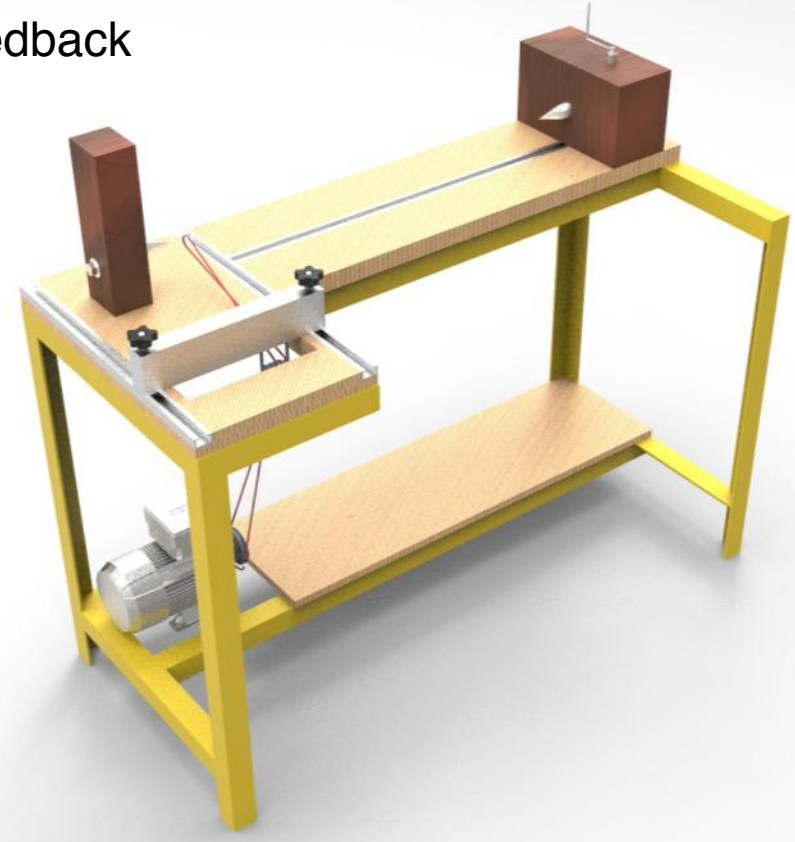
Mock-up models

Concept validation

Feedback

Concept validation

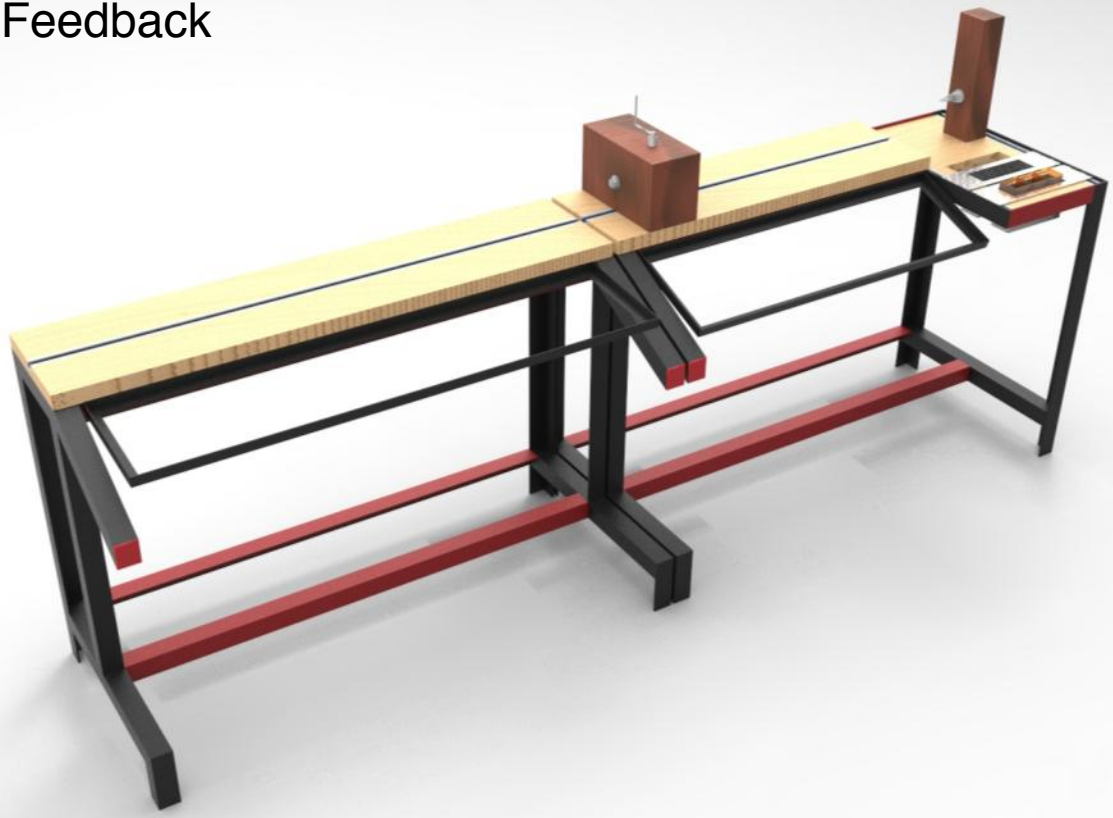
Feedback



- Direction of turning
- Agree on a lathe on higher position
- Adjustable for different heights
- Lathe chuck not required
- Idea of extension is good
- Previously owned lathes
- Indigenous lathe

Concept validation

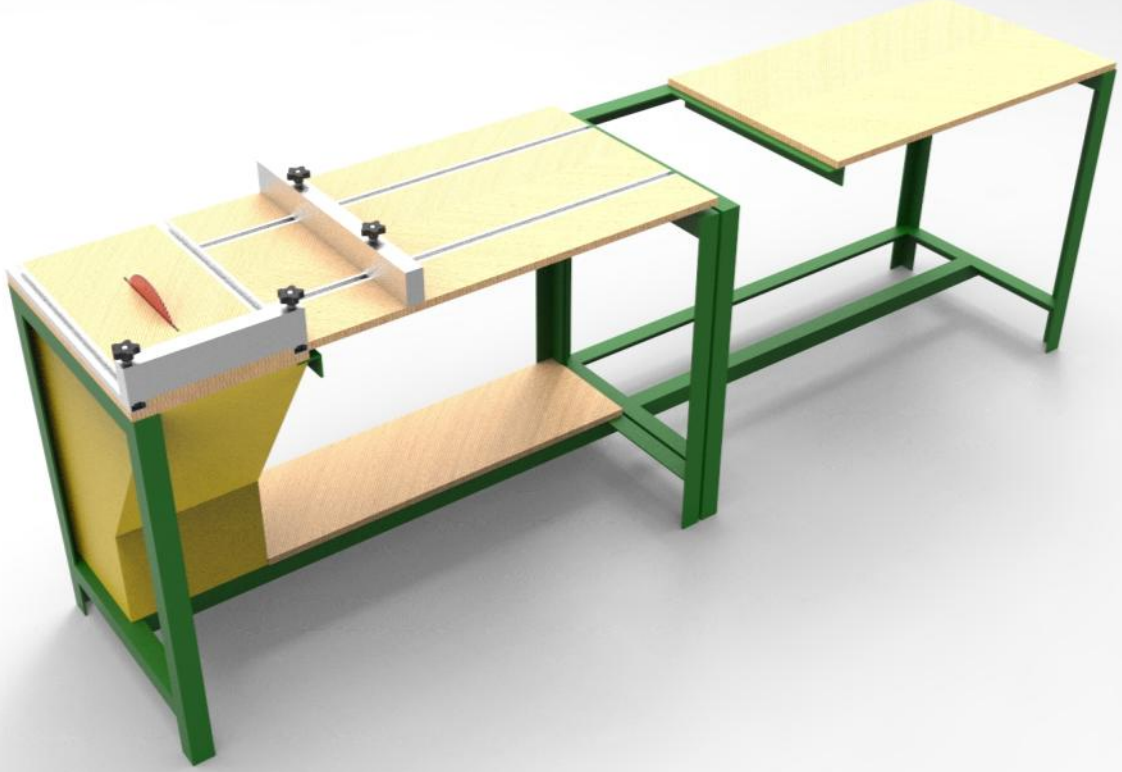
Feedback



- Time varies with person to person
- Tilting surface not required
- **Flat surface is required**
- **Clamping not required**
- Orientation of working keeps changing
- Clamping not required
- **Standing or Sitting**
- Tools should be nearby

Concept validation

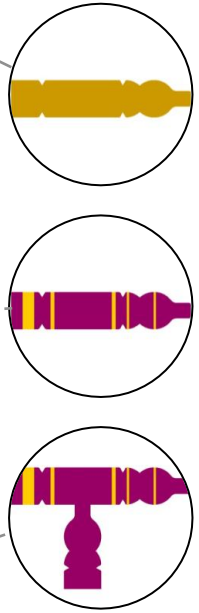
Feedback



•Clamping increases time taken for drilling, not required.

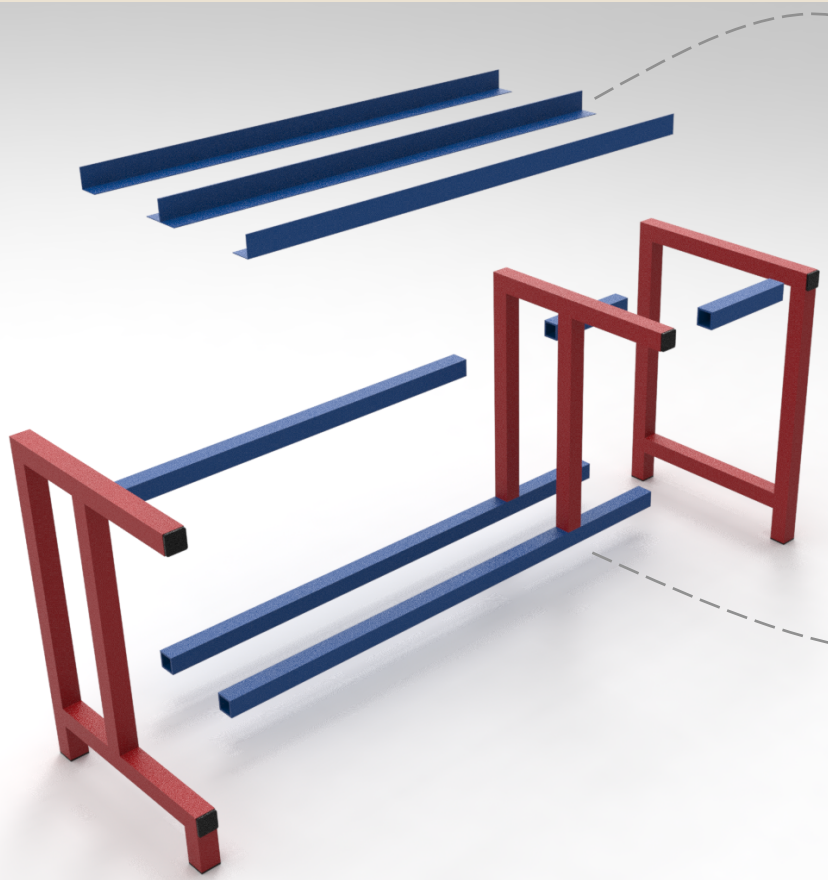
Final Design

Frame design



Final Design

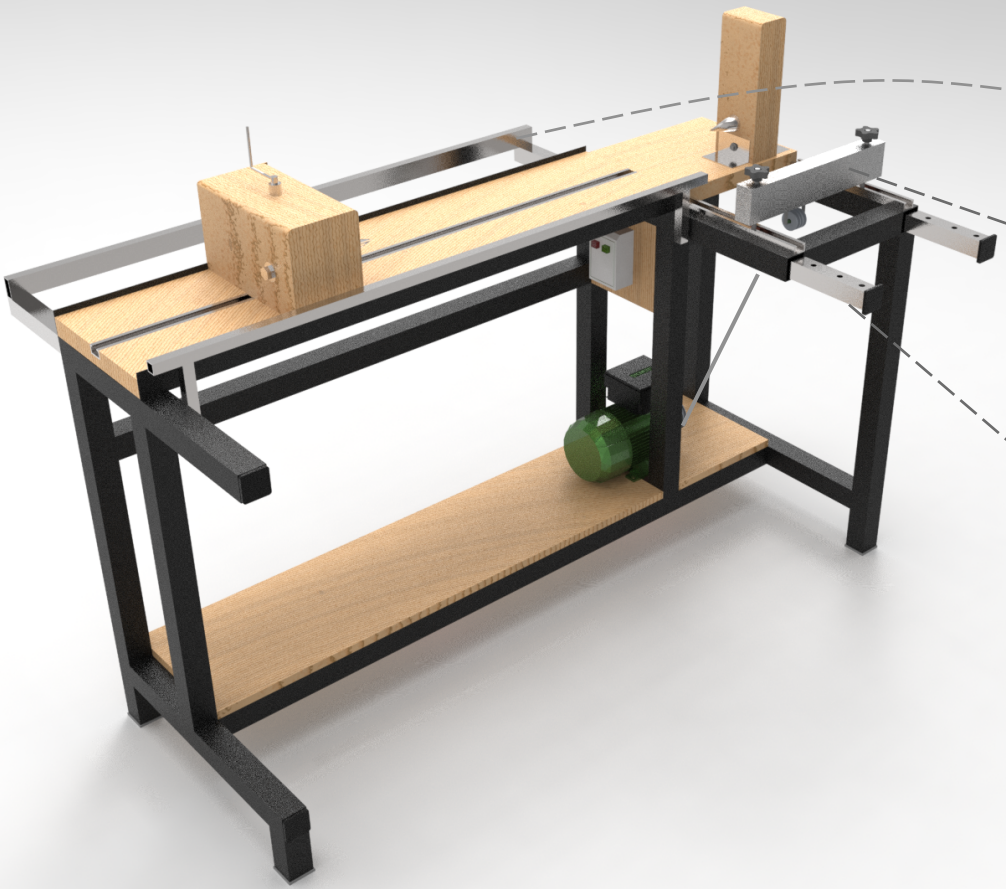
Frame

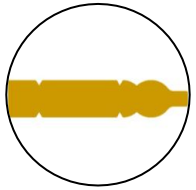


Angle Sections
Bolted to main frame

Square tube sections
welded together

Final Design





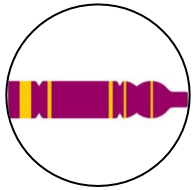
Turning

Sliding holder

Sliding handle for controlling belt of lathe

Sliding tool holder

Final Design



Painting

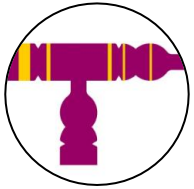
Storing wood pieces

Sliding section supporting Wood to be painted

Wood panel for supporting wood end and paint

Final Design

Cutting



Sliding Roller

Final Design

Drilling

Drill Bench top align to the worktop

Manufacturing

Section to be chosen based on the load on the workstation, Motor power and Vibration.

Suggested Sections by Manufacturer

40X40

MS Square Tube Section – 14 Gauge

50x50

MS Square Tube Sections – 16 Gauge

(Ideal for welding)

Worktop

1600X30

With MS Sliding section

Worktop

400X600

With attached machinery

Thank you