COPPER BELLS OF KACHCHH

Internship Report

Khamir CRC | IDC-SOD IIT Bombay
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Project-1/Summer Internship Report

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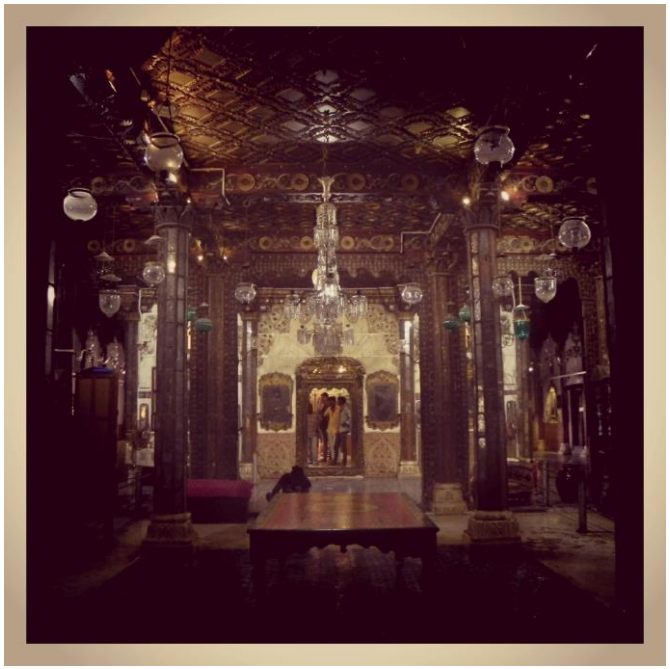
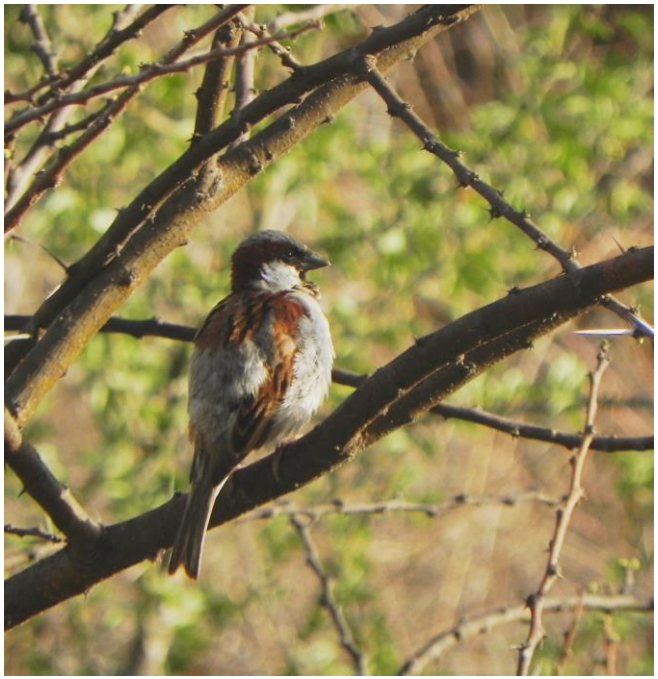


Introduction

Kachchh



Kachchh, commonly written as "Kutch," is the largest district in India and is located in Gujarat state. Kutch an ethnic web of inter-woven cultures, a land of colorfully vibrant art and craft heritage. This cultural mix plays host to a thriving exposition of textiles, ornaments, living style, eulogized within a contemporary framework. Kutch literally means something which intermittently becomes wet and dry; a large part of this district is known as Rann of kutch which is shallow wetland which submerges in water during the rainy season and becomes dry during other seasons.

The Rann is famous for its marshy salt flats which become snow white after the shallow water dries up each season before the monsoon rains. The district is also famous for ecologically important banni grasslands with their seasonal marshy wetlands which form the outer belt of the Rann of Kutch. The District is surrounded by the Gulf of Kutch and the Arabian sea in south and west, while northern and eastern parts are surrounded by the Great and Little rann (seasonal wetlands) of Kutch. The language spoken predominantly in the Kutch district is Kutchi and Gujarati. The script of the Kutchi language has become extinct. It is now mainly written in the Gujarati script.

Centuries of migrations by different peoples and their absorption and amalgamation in Kutch have culturally enriched the design perceptions of its colorfully vibrant Art and Craft forms. The region enjoys close cultural ties to Sindh and is home to a variety of pastoral and semi-nomadic communities, which has generated a marked influence in the design traditions of this region.

In the last few decades, the traditional crafts have undergone tremendous change. As local villagers seek cheaper mass produced functional wares, artisans are compelled to find new markets. Fortunately, sophisticated urban markets have welcomed the concept of traditional crafts. There are active organisations and people to enhance the craft sector and to improve artisans livelihood.

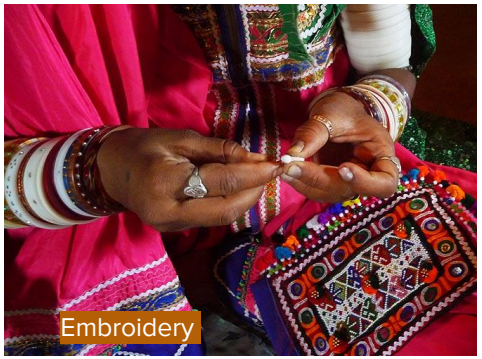
Crafts of Kachchh


Ajrakh block print


Kachchhi bandhani


Kala cotton weaving


Camel wool weaving


Embroidery


Rogan art


Mashru weaving


Metal bells


Lacquered wood


Namda

Other crafts include:
Bela printing, batik printing, kharad weaving, knife work, leather work, pottery, recycled plastic weaving, silversmithy and wood carving

Khamir CRC

Khamir craft resource center is an umbrella organisation dedicated to preserving and encouraging Kachchh crafts in all their diversity. It is situated at Kukma, a village about 13 kilometers away from bhuj city.

It was founded on the year 2005, as a joint initiative of Kachchh Nav Nirman Abhiyan and the Nehru Foundation for Development. Today, it serves as a platform for the promotion of traditional handicrafts and allied cultural practices, the processes involved in their creation, and the preservation of culture, community and local environments.

Khamir focuses on several aspects of the craft sector in kutch. They encourage craft excellence, sustainability in traditional skills and its acceptance as a livelihood option. It gives exposure to artisan communities and helps to increase the market value of crafts. Khamir is also a knowledge resource center, it encourages research on the history and the enhancement of crafts and it provides a platform for designers, artisans and students. These activities can bring artisan communities together and can create collaborative approaches between artisans. Thus there can be better quality products and and better value products. Khamir also incorporates environmental and sustainability issues.

Internship Brief

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The internships brief included following broad areas of intervention, which will help the metal bell artisan community in longer run.

- Understanding the recording product process of metal bells, the technology and tools used by artisans along with final products.
- Development of new design concepts and design interventions with metal bell craft artisans of various skill sets. The design intervention can be in following directions:

i. Surface designing of bells
ii. Developing new chimes.
iii. Integrating more crafts with metal bells etc.

- Preparing a paper on the improved kilns developed by Khamir for the artisan communities with suggestions to improve the same.

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Copper bells - Overview

Background

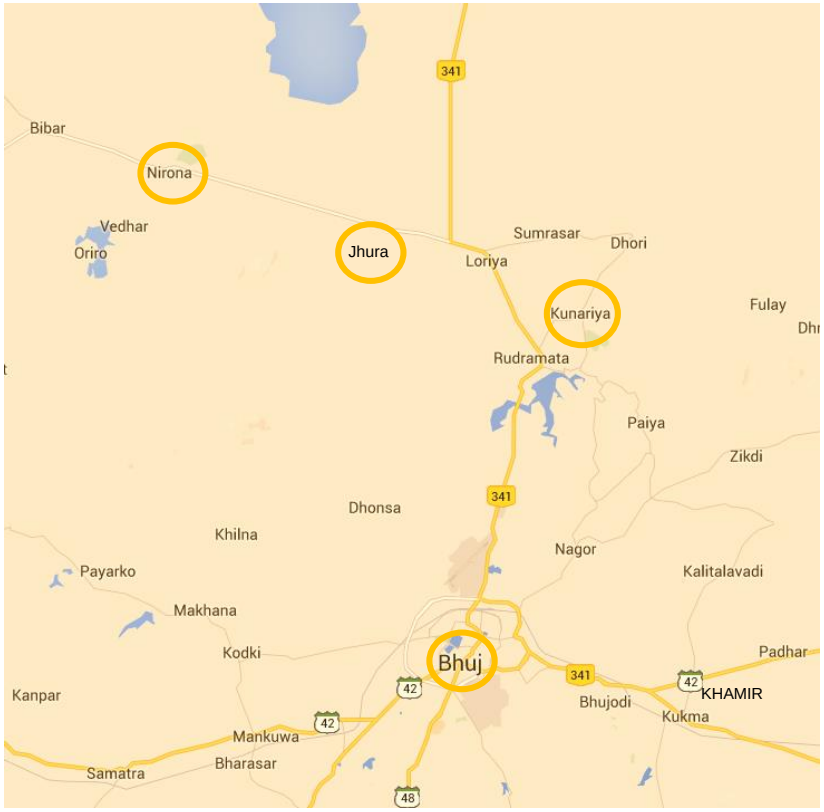
The copper bell craft is one of the most unique crafts in India. It gives aesthetically appealing and very good acoustic bells. The craft had its inception at about a hundred years ago in Sindh, which is now a part of Pakistan, the craftsmen used to make bells for maldharis or shepherds as cattle bells. There are different sizes if bells which are been categorized in terms of size. The numbers have a range of 0 – 15. The particular feature of these bells are each bell has a distinctive sound, as they are tuned accordingly. Bells from size 4-6 are used in cows and buffaloes that are generally left behind in the herd, so that when they don't come back in time the sound of the bell could help in locating them and thus avoiding any kind of accident or missing. 2-3 size bells are used in goats, sheep and camels. Thus the shepherd could easily identify each cattle in a heard. The traditional name of the bell changes from region to region in Kutch, but generally, they are called Gharki.

The metal bell craft is a sustainable craft. It uses scrap metal, as the basic raw material, and it there are now complicated tools or processes. The artisans use minimal tools and equipment although, the craft requires skilled labour. Interestingly, the entire family is a part in the making of the bells. The men makes the bell and fires it while the women gets involved in the copper and clay coating.

The community which practices the crafts are muslim lohars, lohar means blacksmiths.

The craft has been grown within the past few decades, more evidently after the earthquake. Initially, there were only bells which were made by the artisans. Now the craft gives a variety if products such as Chimes, Jhumars, Saregama etc.

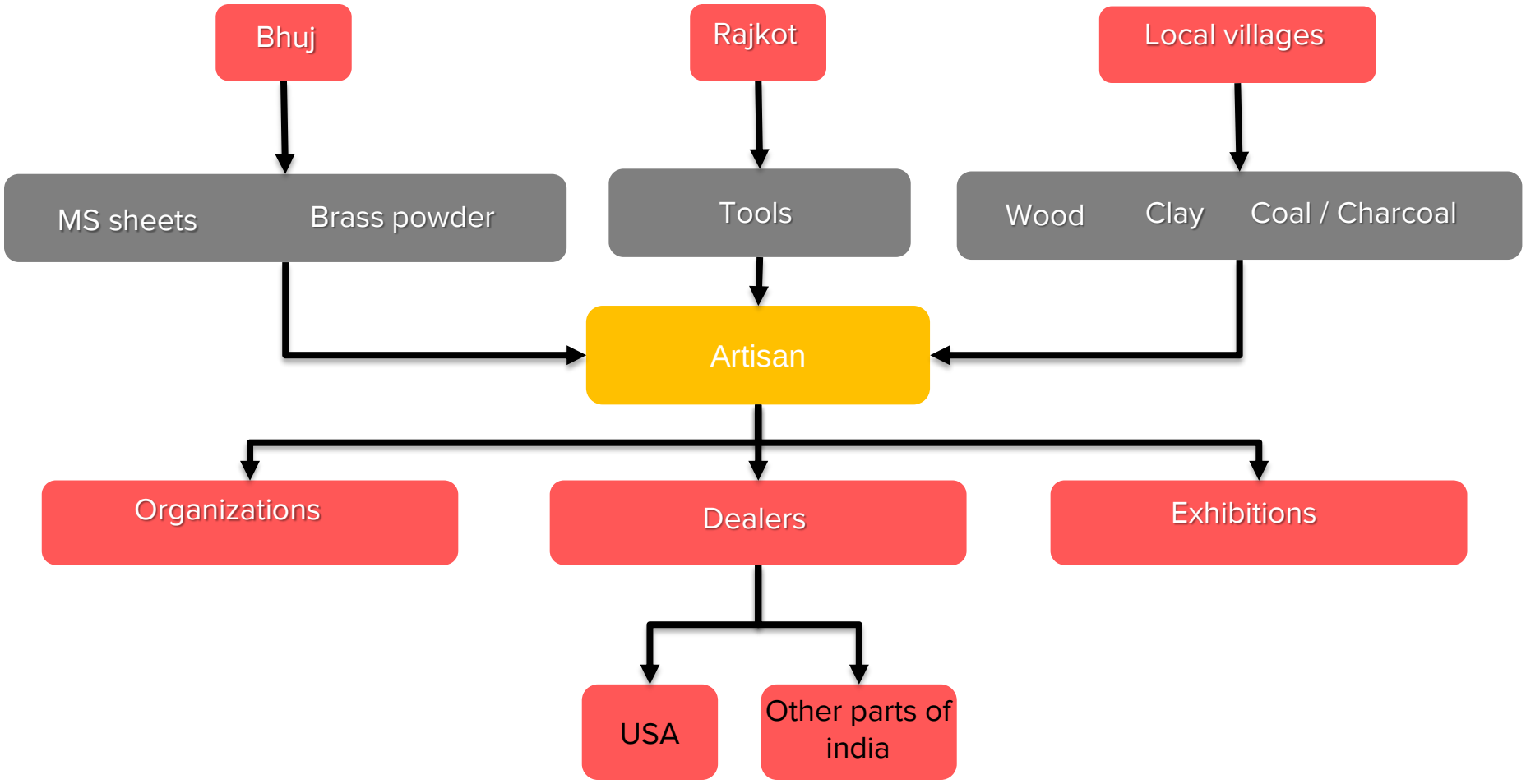
KHAMIR, has a vital role in uplifting the craft. it encourages the craftsmen to come up with new ideas and helps the artisans to reach out to newer markets and better processes.



The craft is practiced in the villages called Jhura, Nirona, Nakhatrana and Kunariya.

Jhura which is at about 35 kms from bhuj, leads in the production. It has the highrst number of practicing units. The second largest is nirona followed by bhuj city and kunariya.

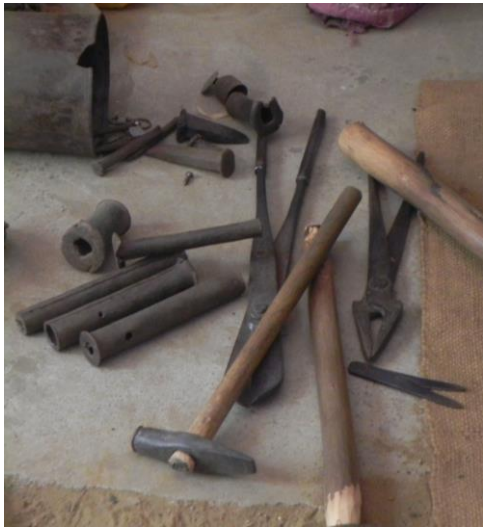
Trade cycle

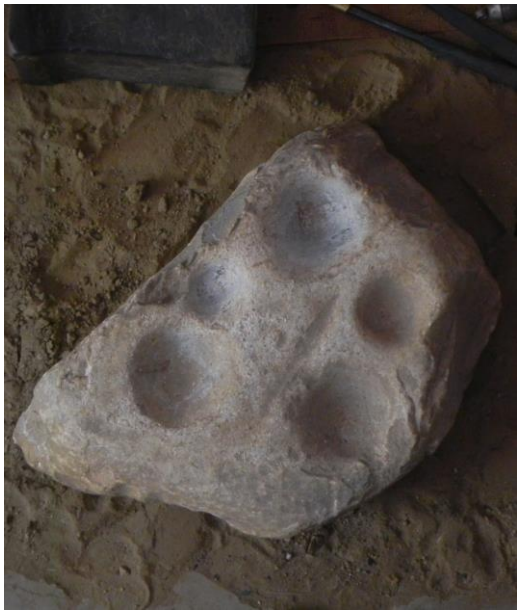

Bhuj
Rajkot
Local villages
MS sheets
Brass powder
Tools
Wood
Clay
Coal / Charcoal
Artisan
Organizations
Dealers
Exhibitions
USA
Other parts of india

Copper bell specifications

No.	Description	Approx. Weight	Size in centimetres		Oval mouth		Crown (Height* Dia* Thickness)			Wooden clapper
			Height	Metal gauge	Dia 1	Dia 2	Height	Dia	Metal gauge	Dia* h
1	Copper Coated Bell No 0	10gms	02.30	23-24	02.00	02.10	00.70	00.80	23-24	Flat*03
2	Copper Coated Bell No.1	15gms	03.20	23-24	02.40	02.60	00.80	01.00	23-24	0.5*3.5
3	Copper Coated Bell No.2	20gms	03.50	21-22	02.80	03.00	01.00	01.10	21-22	0.5*4.5
4	Copper Coated Bell No.3	25gms	04.00	21-22	03.00	03.50	01.20	01.30	21-22	0.8*5.0
5	Copper Coated Bell No.4	50gms	05.00	19-20	04.00	04.50	01.50	01.60	19-20	0.8*6.0
6	Copper Coated Bell No.5	70gms	06.00	19-20	04.50	05.30	01.80	02.00	19-20	01*7.5
7	Copper Coated Bell No.6	100gms	07.00	19-20	05.00	06.00	02.00	02.10	19-20	01*8.5
8	Copper Coated Bell No.7	150gms	08.00	19-20	05.50	06.50	02.10	02.20	19-20	01*9.0
9	Copper Coated Bell No.8	235gms	09.50	19-20	06.50	07.50	02.20	02.30	19-20	1.3*1.2
10	Copper Coated Bell No.9	350gms	12.00	17-18	07.50	09.50	02.50	02.50	16-17	1.5*1.2
11	Copper Coated Bell No.10	450gms	12.50	17-18	08.50	10.00	03.30	03.30	16-17	02*18.5
12	Copper Coated Bell No.11	700gms	16.00	17-18	09.50	12.00	03.40	03.40	16-17	02*20
13	Copper Coated Bell No.12	1.200kg	19.00	16-15	11.50	14.00	03.80	04.30	13-14	2.5*23
14	Copper Coated Bell No.13	2.200kg	25.50	16-15	15.00	18.00	04.50	05.20	13-14	3*27

Tools





Stones with made depressions used for making bhabri

Standard measurements of bhabris of a range of bell numbers

Artisans use a variety of tools. Includes a variety of hammers, pliers, cutters and dies. Most of the tools have been in use for generations and all of them are readily available in the market

Nuts are used as a mould for making topis

Bell Making - The process

Bell making process

Preparing kachcha maal

1. Making Babri (Main body)
2. Topi (Crown)
3. Kadi (Loop)
4. Assembly

Coating

1. Clay slurry & brass mixture
2. Mud bath
3. Sprinkling Brass powder and flux mixture
4. Covering the bell with thick roti of (Clay and cotton)

Firing

1. Firing
2. Quenching
3. Removing burnt mud

Tuning

1. Hammering to make a crease
2. Attaching wooden clapper
3. Checking the sound

Finishing

1. Using coarse flat file
2. Grinding wheel
3. Buffing

Making kaccha maal

Bhabri (Main body)

Cutting the MS Sheet into the rectangular shape according to size guide

Shaping by hammering on a stone mold using round hammer

Shaping by hammering on a stone mold using round hammer

Cutting the notch on babri

Technique to lock the notch

Locked notch made a cylindrical babri

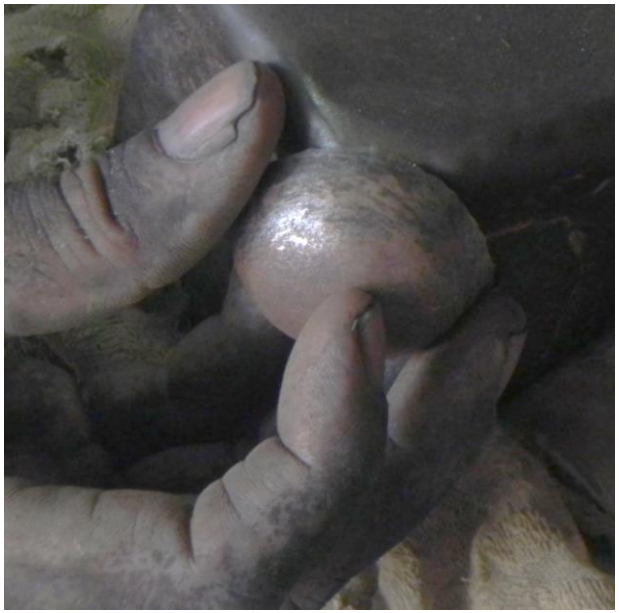
Thinning of one side of the edge of babri

Topi (crown)

Cutting a circle from metal sheet for topi

Hammering it to get hollow hemispherical shape

Forged topi (Crown)



Making the edges thin by hammering

Checking the sizes by keeping topi on babri

Making a hole in the the topi (Space for putting kadi)

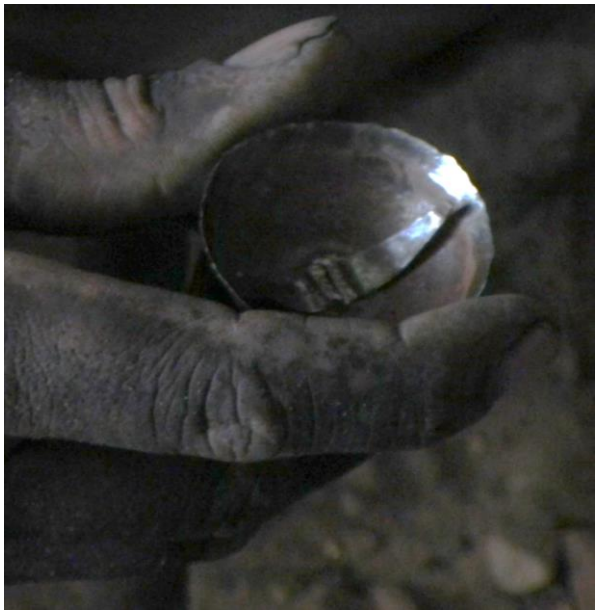
Kadi (Hook)

Cutting the kadi from MS metal sheet

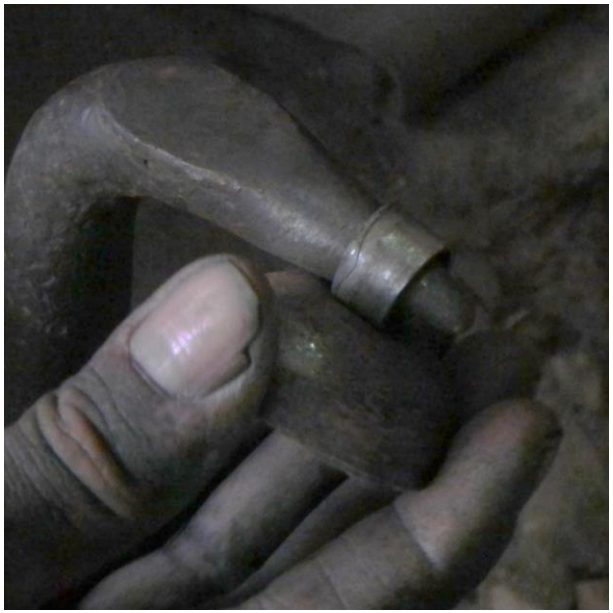
Hammering it on edges to get larger thickness and strength

Shaping the sheet into circular hook shape

Inserting the kadi in the hole pierced on the topi



Locking the ends of hook by diverging them from inside



Shaping the hook to form proper circular ring

Turning the ends to form hook from inside which will carry the wooden clapper from inside

Assembly

Inserting the kadi in the hole pierced on the topi

Locking the ends of hook by diverging them from inside

Shaping the hook to form proper circular ring

Brass coating

Clay slurry & brass mixture

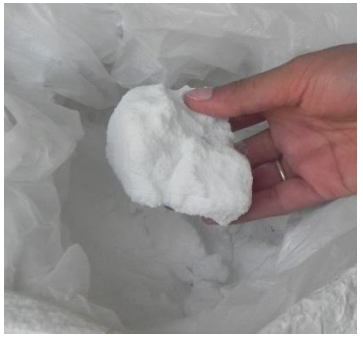
Dry clay

Water

Clay Slurry

Mixture

Brass powder



Borex

Mud bath & Sprinkling Brass powder and flux mixture

Dipping the bell into clay slurry just so that its surface becomes wet

Sprinkling the brass mixture on wet slurry dipped bell

Brass mixture coat on full body of the bell

Cotton and mud mixed together using power hammer to get a uniform mixture dough

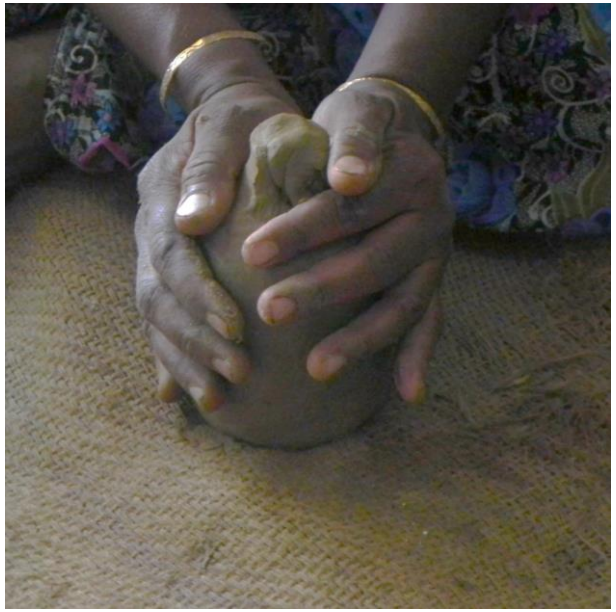
Covering the bell with thick roti of (Clay and cotton)

Taking a lump of dough

Flattening it by paws to get a thin chapatti of 3 mm thickness

Keeping the bell on chapati

Rolling the bell body over the clay chapati



Closing the top end

Mud coated bell ready for firing

Firing

Rolling the bell body over the clay chapati

Closing the top end

Mud coated bell ready for firing

Bell just taken out of the furnace has red hot coal particles stick on its surface

Coating becomes black after keeping for sometime on room temperature

Quenching

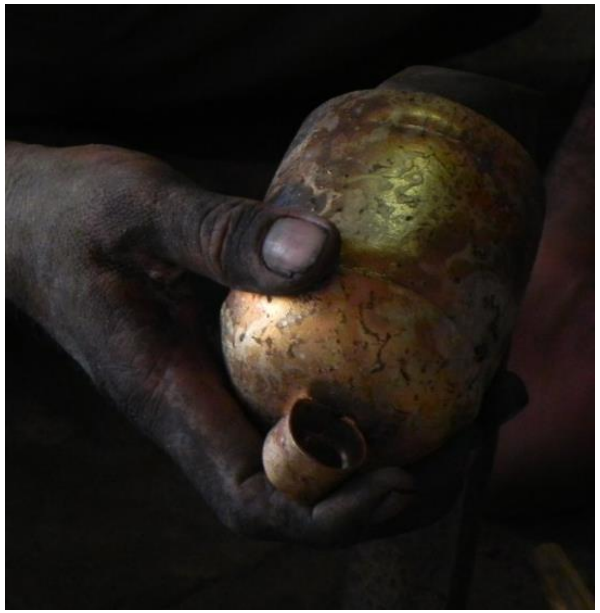
Dipping the bell into normal water to cool it and hence quench

If it is still hot, Putting water onto it to cool the bell down

Cracking open the bell coating

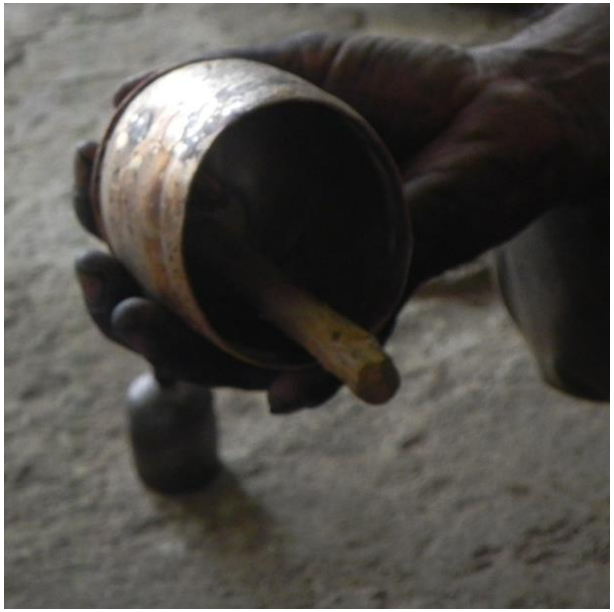
Tuning

Hammering near the edges



Making a crease at a distance of about 10-15mm from edge

The crease

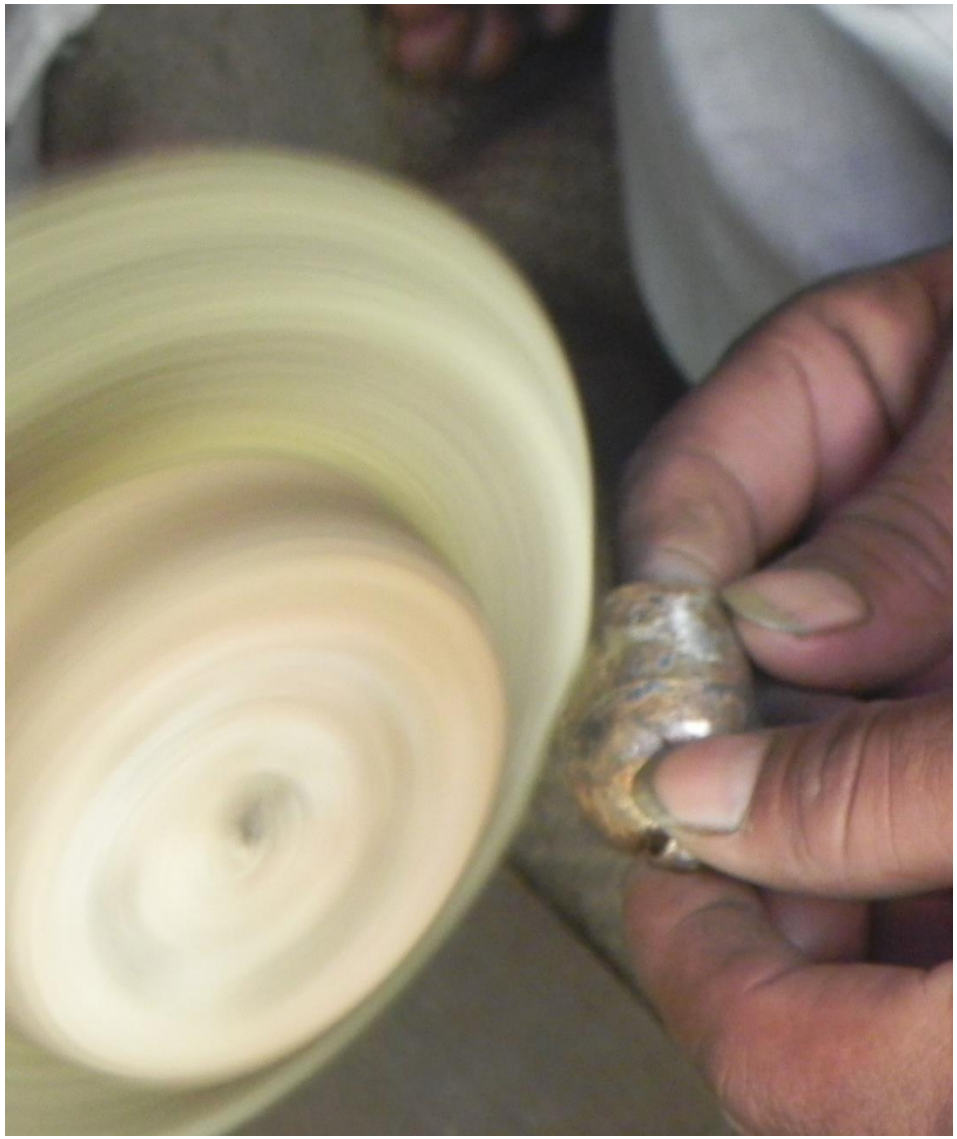


Attaching the wooden clapper on the bell

Hammering the crease and checking the sound

Checking the sound

Finishing



For finishing, flat file, grinding wheel and buffing machine are used respectively

Bells before and after finishing

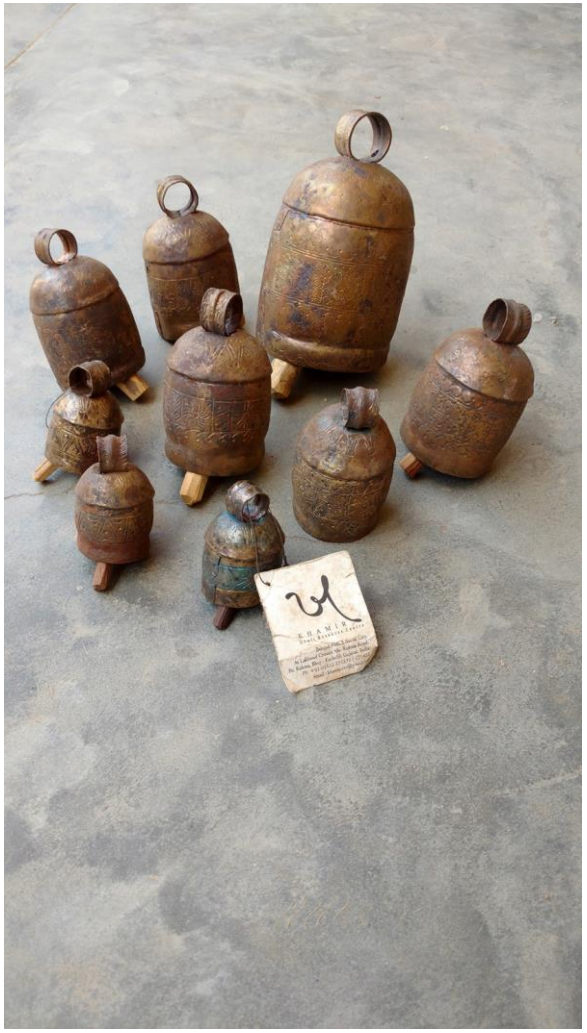
Products and Market

Existing design & product range

Product range of copper bell craft in the present scenario:

- **Bells**
- **Wall hangings (Moon, Fish, Star, Sun etc.)**
- **Key chains**
- **Table showpieces**
- **Photo frames**
- **Jhoomer(Chandelier)**
- **Trays**
- **Saregama**
- **Wind chimes**
- **Non bell products**

Bell Products



There are not much of variety in terms of design when it comes to conventional copper bells.

There are customized handiwork in bells. They make cuts,holes, embossing and etching in the bell parts before when they are assembled.

There are no considerable collaboration between metal bell artisans and other artisans. Products like keychain and decoratives, the leather work is seperateley bought instead of getting them made customised for them.

Non bell products

There are several non bell products that had been developed by artisans and researchers. Those include toys, trays, lamps, soap trays, candle holders, pots, plates, showpieces etc.

In terms of production, non bell products are very less. This mainly is, due to less demand, and less value.

Most of the products take expert craftsmanship to make them, because of this not every artisan can make any product. Also the products need to have customized dyes and measures, which need to be arranged additionally.

Market overview

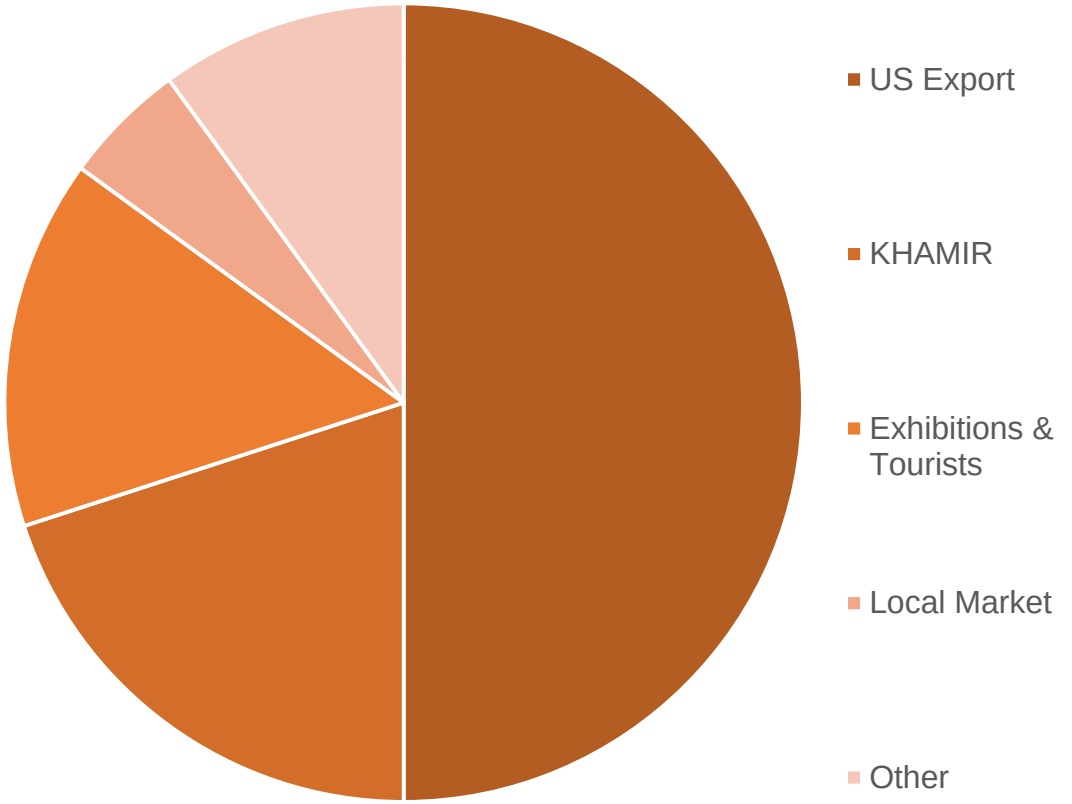
The products are predominantly exported to the US
It is estimated that US accounts 50% of the sectors turnover.
The buyer is connected with Indo-US agents at. The finished goods are transported to Surat, then shipped to US.

KHAMIR is the next major buyer, makes up 20% of the sector turnover.

The third major market is exhibitions and tourists. They make up approximately 10-15 of the sector turnover

Artisans sell the products to the local stores, a small percentage is sold within village markets and local craft stores, this makes up 5% of the annual turnover.

Artisans have connections with individual wholesale buyers across India. This makes up 10% of the total turnover



Design Interventions

Design for artisans

The designs that are already available in the market are not well thought of or “designed”. When we think of bringing up design interventions, it is important to know and understand artisans and the nature of work they do.

From what we have noticed, every artisan is thorough with the dimensions and the process of making the bells, not on non bell products. So we did set a constraint, to use bell parts as our product parts. We are using their methods, their standards and measurements. This way, the products will be easier for them to make.

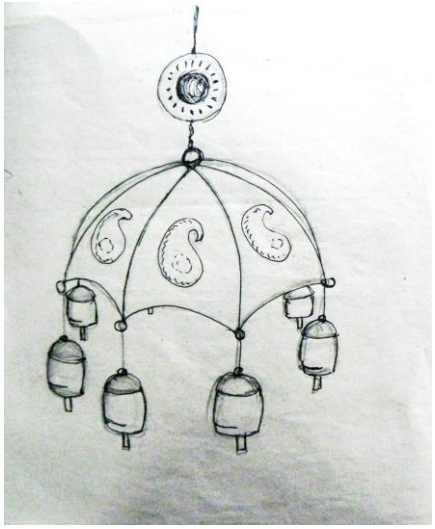
Wind chime Design

The existing designs are eye-catching and beautiful. Here, the artisan is the designer. He thinks of any random design in his mind, makes a quick picture and he makes them within minutes with metal wires and bells

The designs of wind chimes are all two dimensional, they are visually imbalanced and from a designers point of view, it is to be called incomplete.

Approach #1

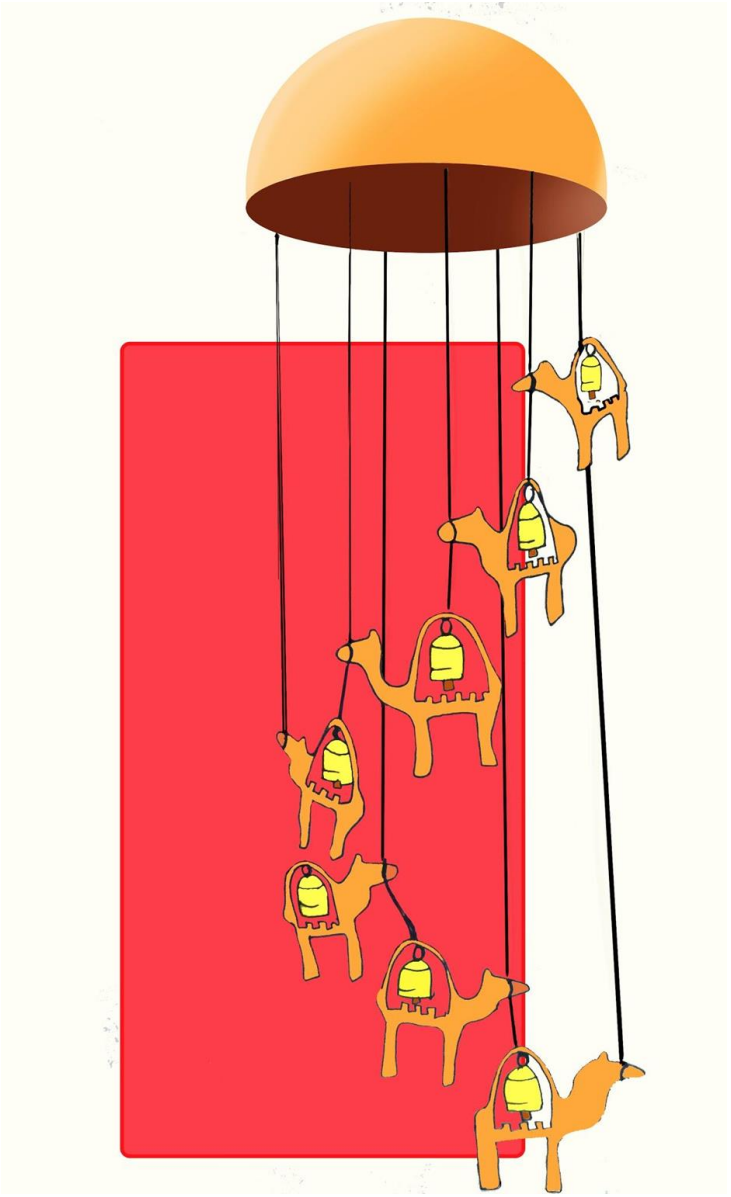
Designs inspired from south indian festive exhibits.



Approach #2:

Camel windchime

Camels are one of the most beautiful attractions of the desert region of Kutch. Integrating and showing a camel herd which are tied to each other using a rope with bells is a thought in this design. Camel's hump is exaggerated here to accommodate a bell of “no.0”. The camels are hanging on the dome which actually is a “topi” of no.12 bell.

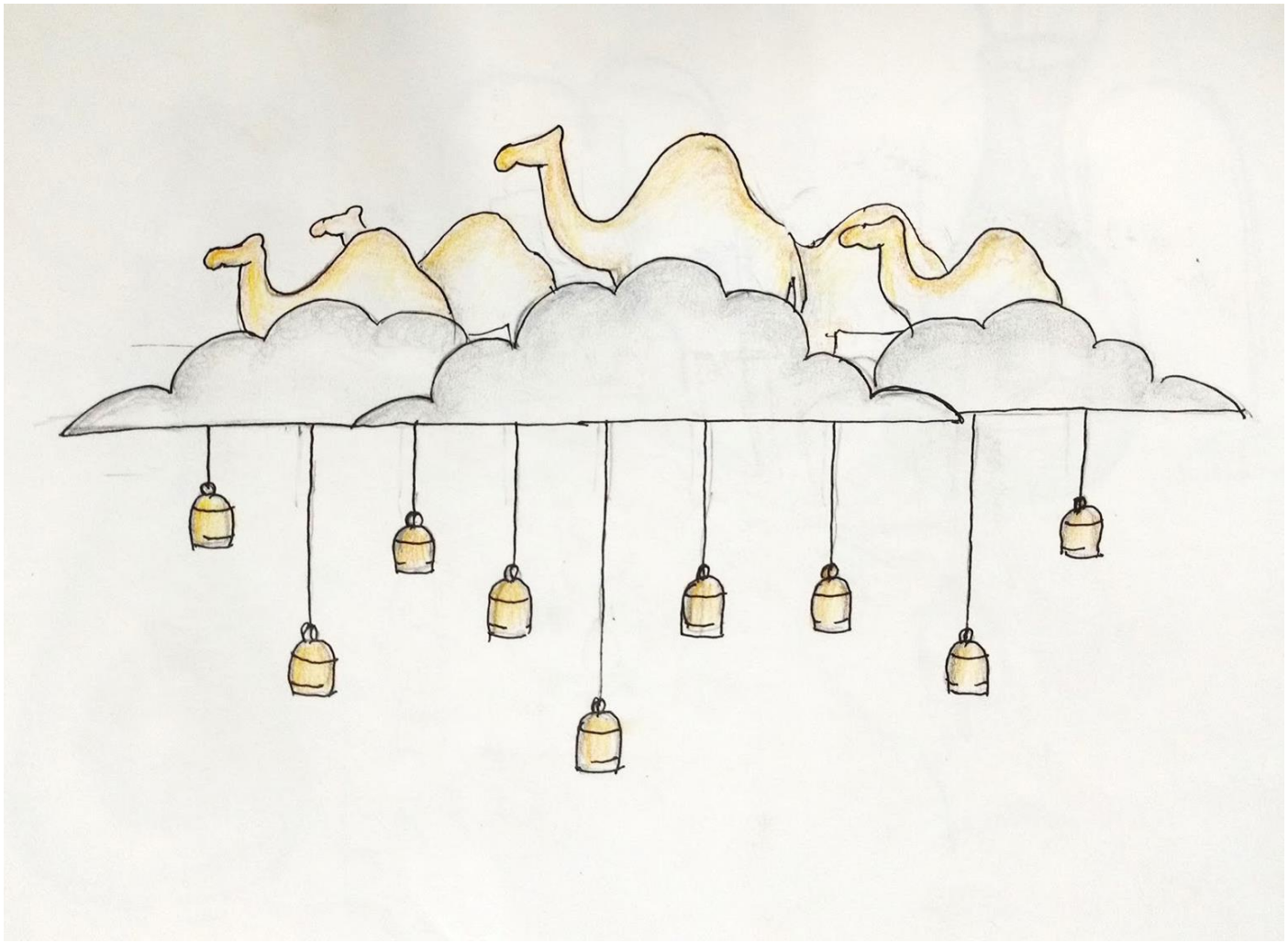


Camel is made by cutting MS sheet by using a pair of scissors which is used to cut metal. The central part has been cut using hammer and chisel. Finally they are sanded and buffed to get smooth edges

Approach #3

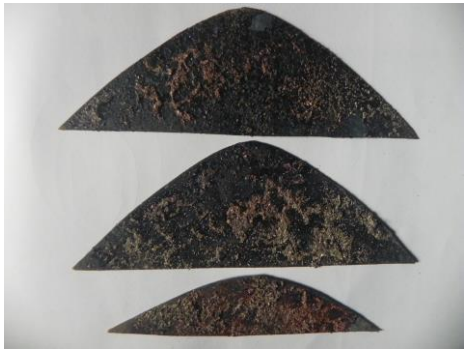
Wall mounted jhumar

Camel and clouds. A story of maldharis in kutch. The wall mounted jhumar represents desert scenery, a heard of camels and the dust that spreads over. The bells hanging from the sand dunes represents the roots of the craft. It depicts the connection between maldharis and copper bells.



The form was simplified to camels and sand dunes.
To try out prototypes, a model was made consisting of 2 camels and 4 sand dunes. The model is completely made using MS sheets.

The texture of the sand dunes were made using a new method, the sheets are to be heated in the furnace until it turns red. The sheets are then sprinkled with borax-brass powder. The powder fuses to form a black rugged surface.



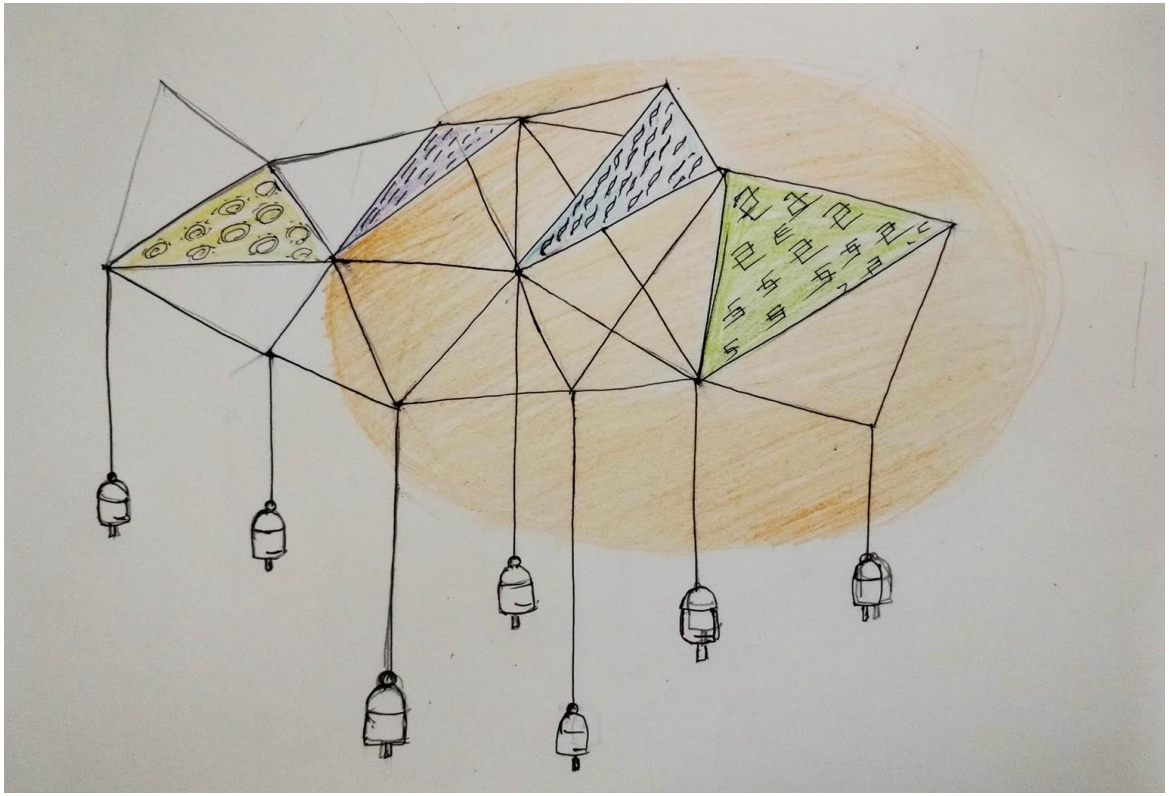
The sheets are welded on top of a metallic hook frame (cloth hanger),

The welds leaves a black patch on the copper layer, but this can be removed by buffing

Approach #4

DIY/Modular wind chime

“Cloud and bells”
The individual modules join together to form a cloud. It shows geometric growth and patterns. The individual modules will be equilateral triangles of 5in side.

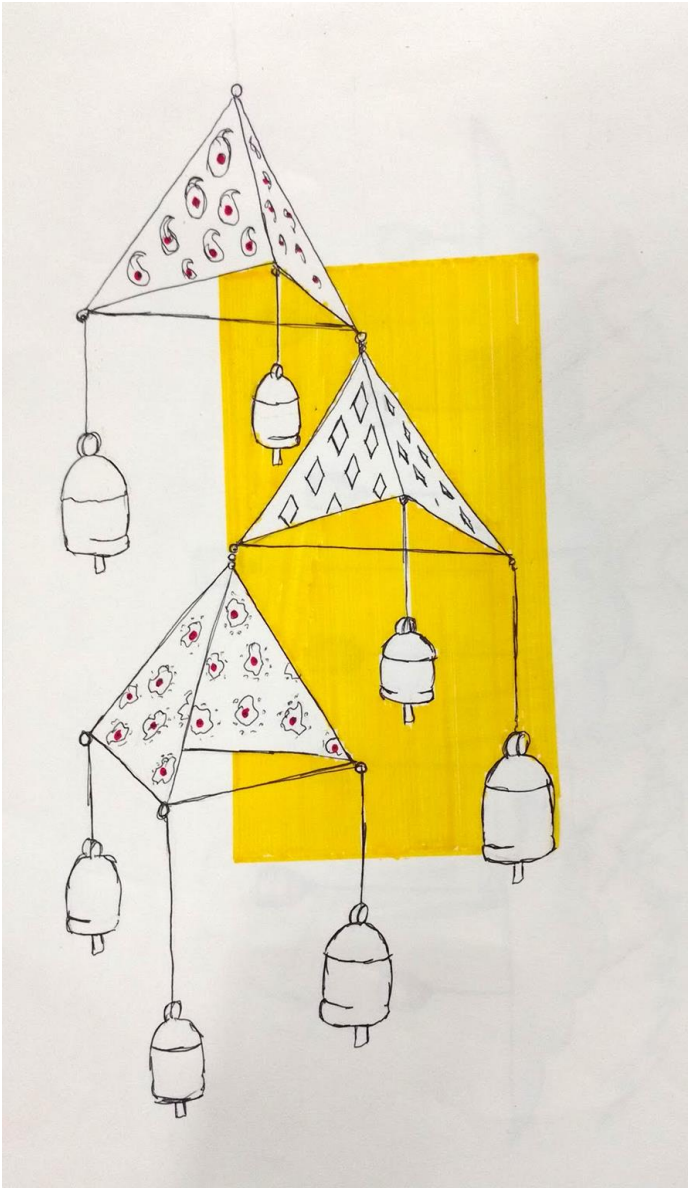


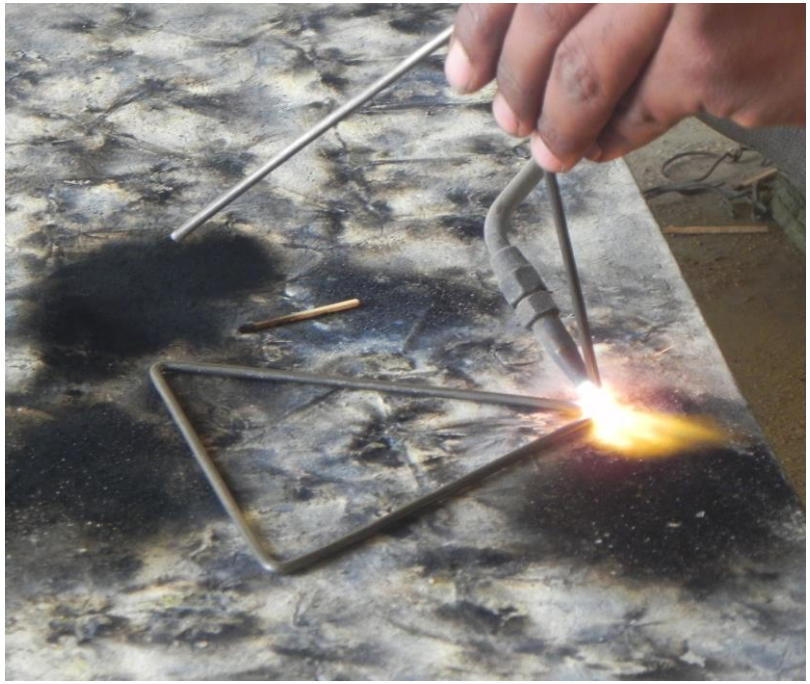
Approach #5

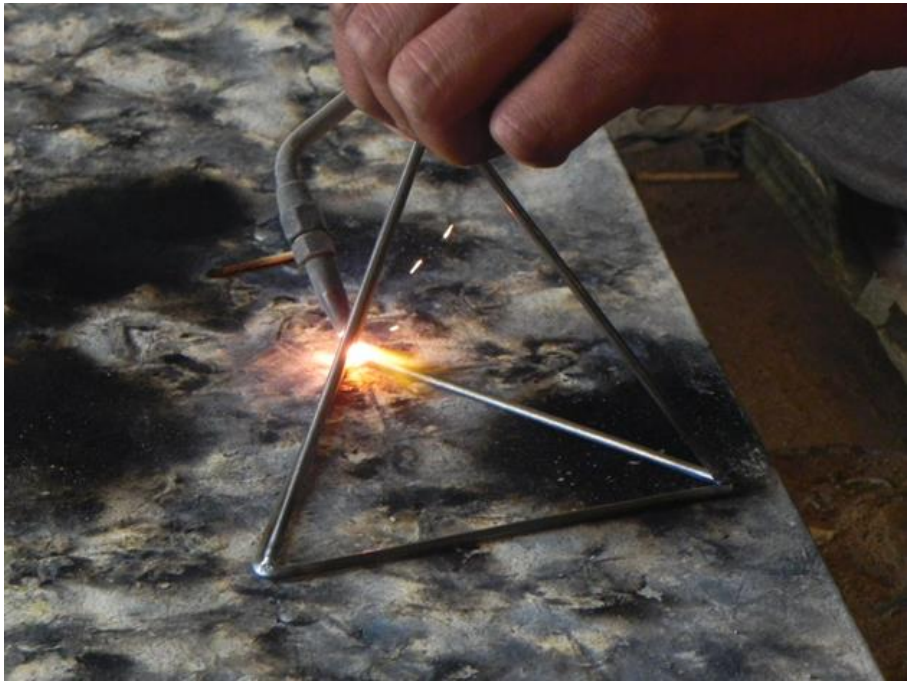
DIY/Modular wind chime

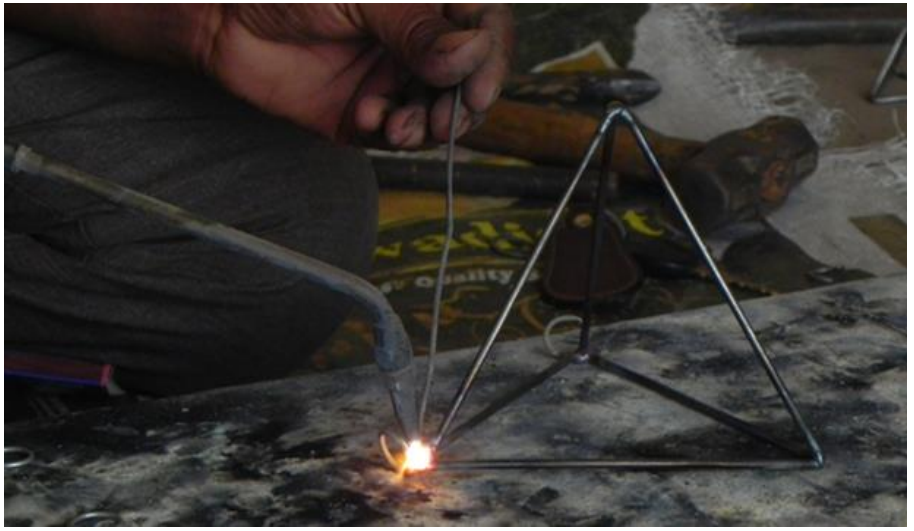
Form inspired from tetrahedral kites.

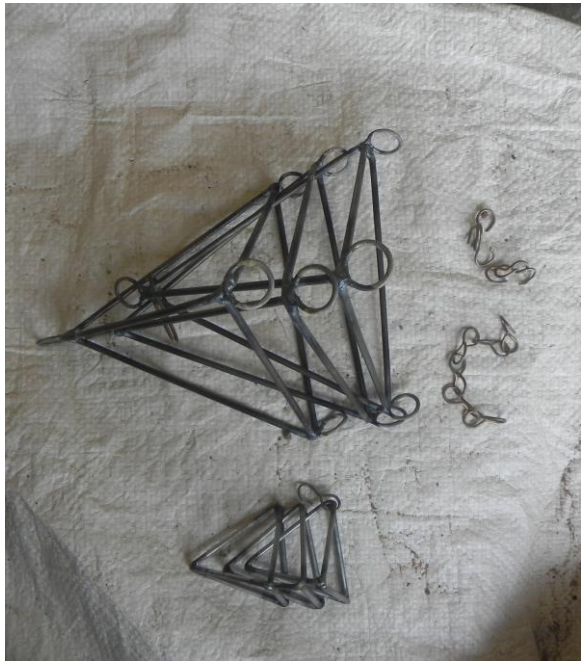
The design is made using three dimensional approach, to make use of space. The modules are geometrical. Each module is a tetrahedron with side 6 inches. As it is inspired from Tetrahedral kites of Gujarat, therefore we tried covering 2 faces of tetrahedron wire mesh to get a direction to the air. Here, the faces are covered with famous mashru fabric. The design incorporates stackable modules.





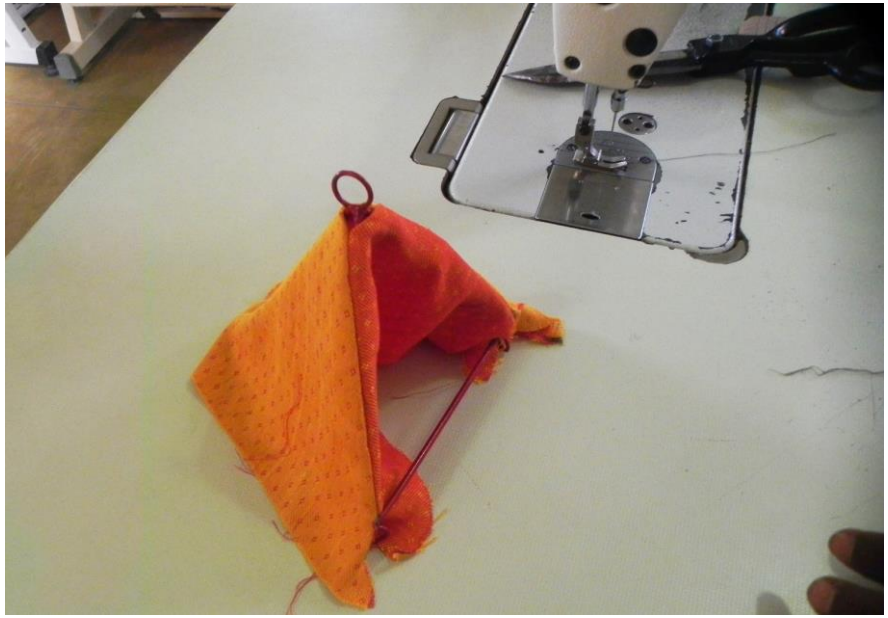




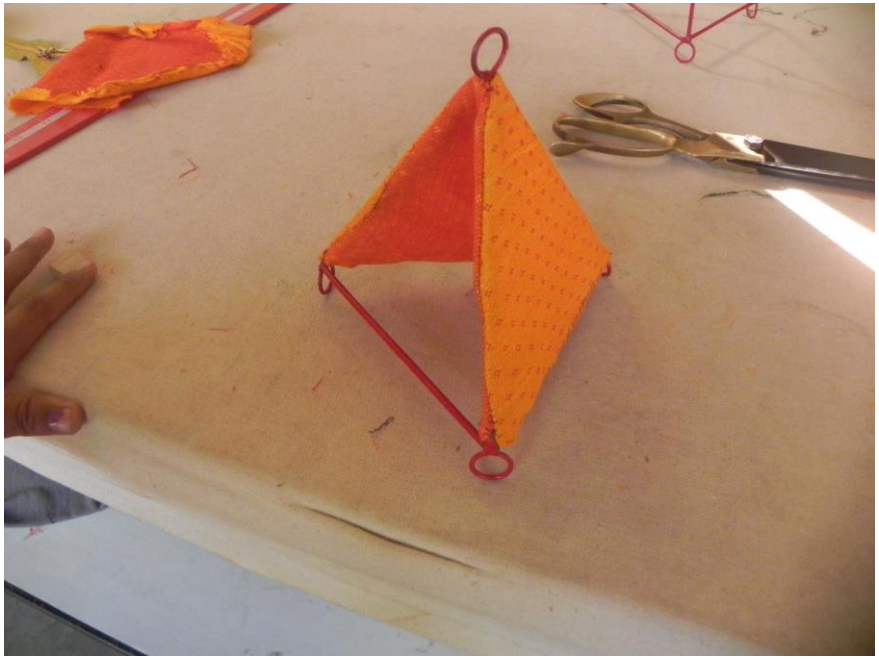


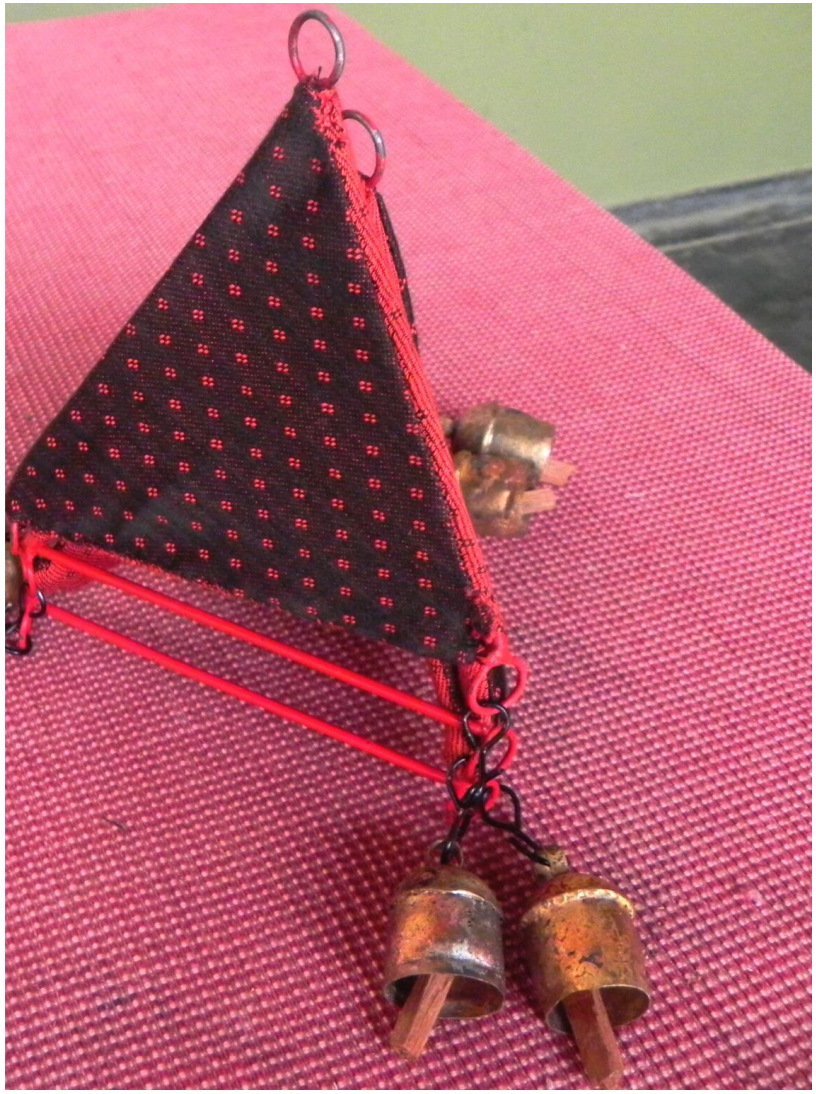
The tetrahedral frames are made by gas welding MS wires of 3mm thickness.

The larger ones are having length side 6 inches and smaller ones have side 2 inches.

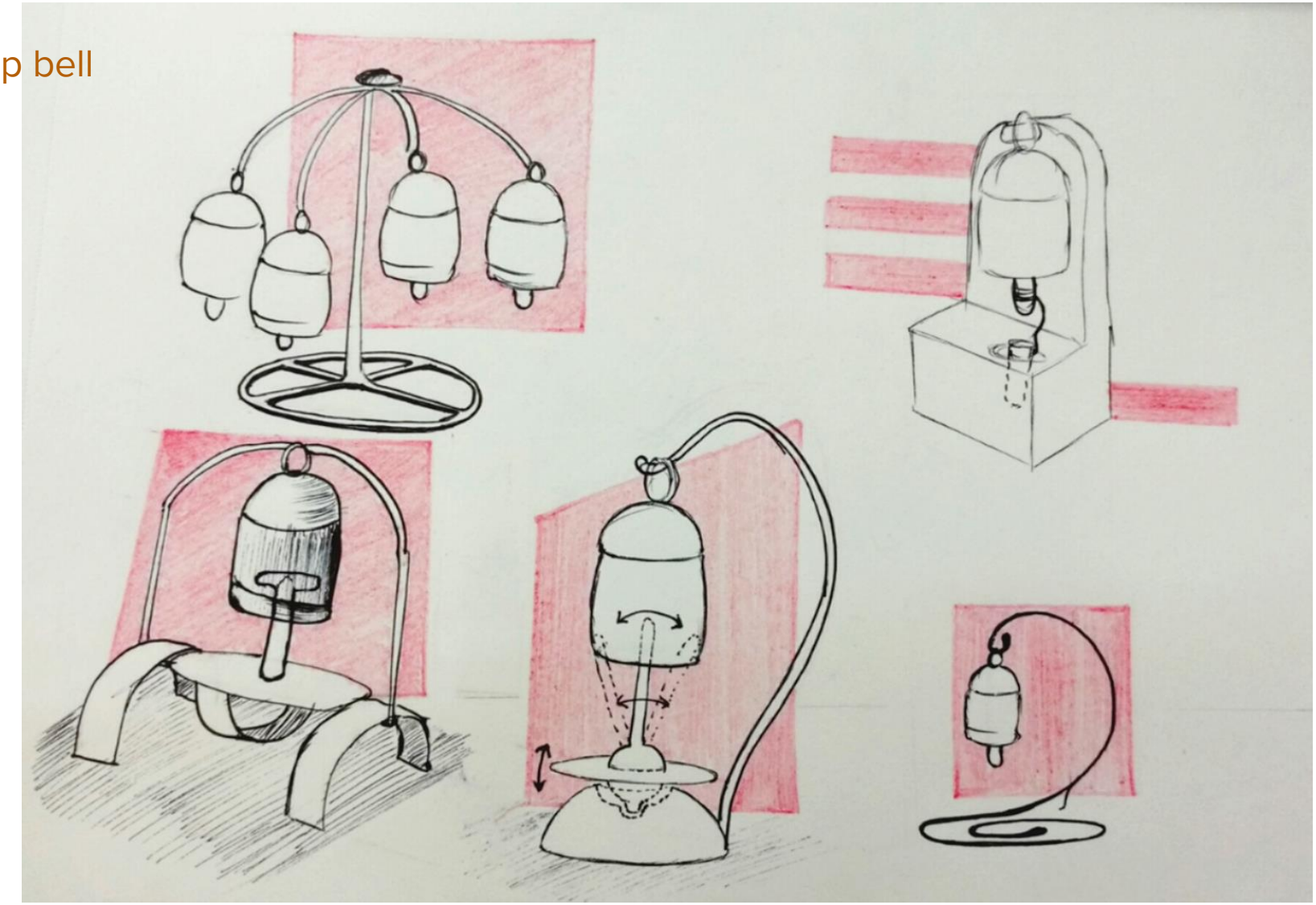



JUKI





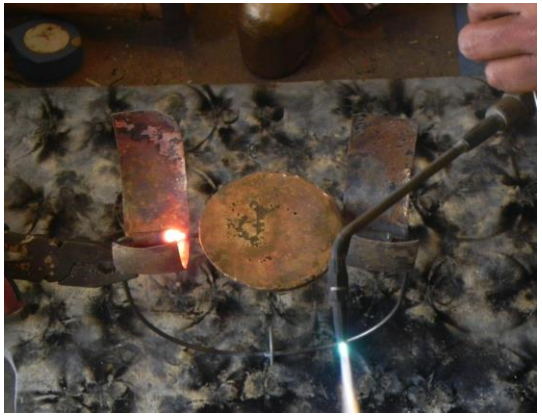
Tabletop bell







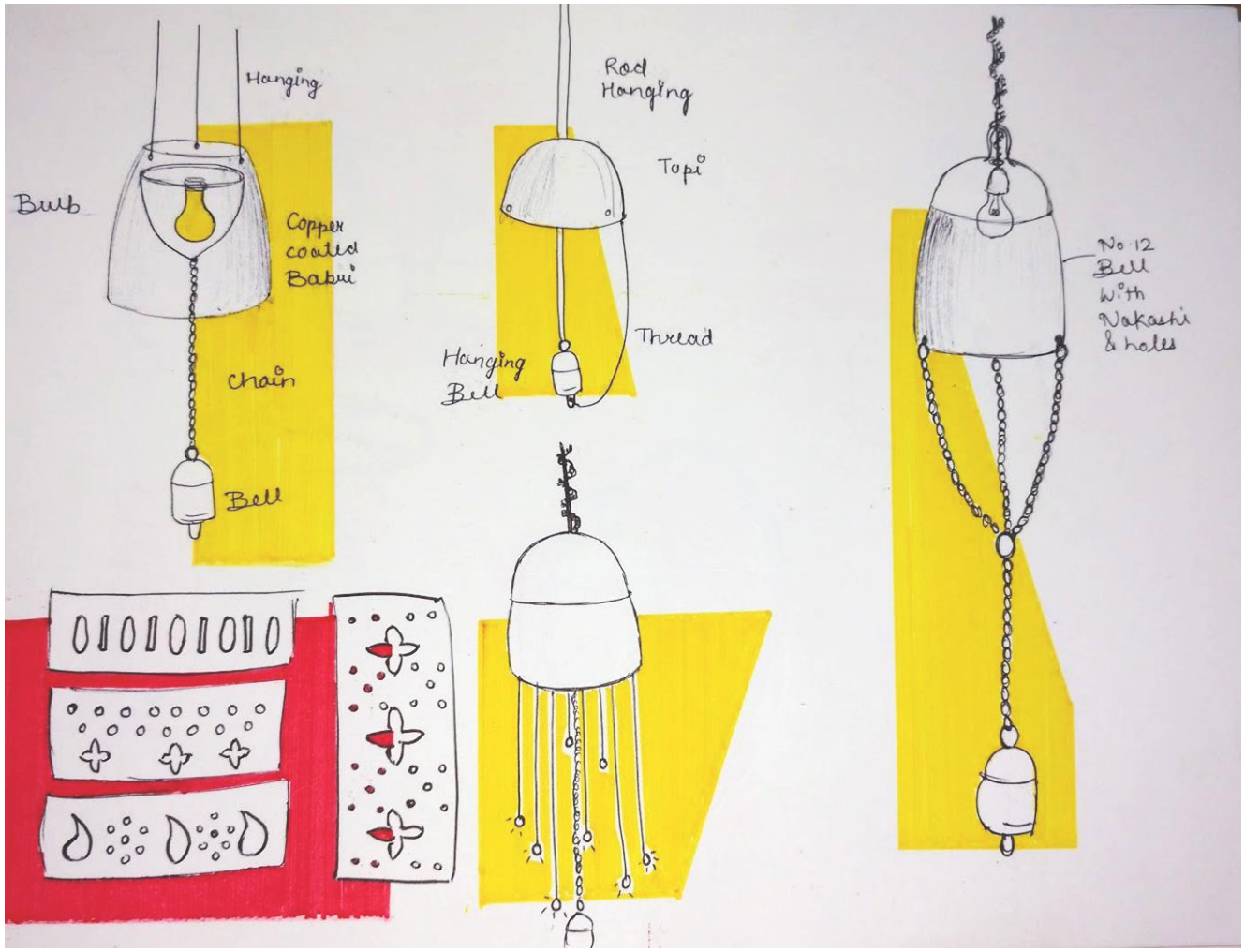
The table bell consists of a swivel base and semicircle bhabri parts. The topi base is of no. 10 and the legs are bhabri parts, having dimensions 1.5*7 inches.

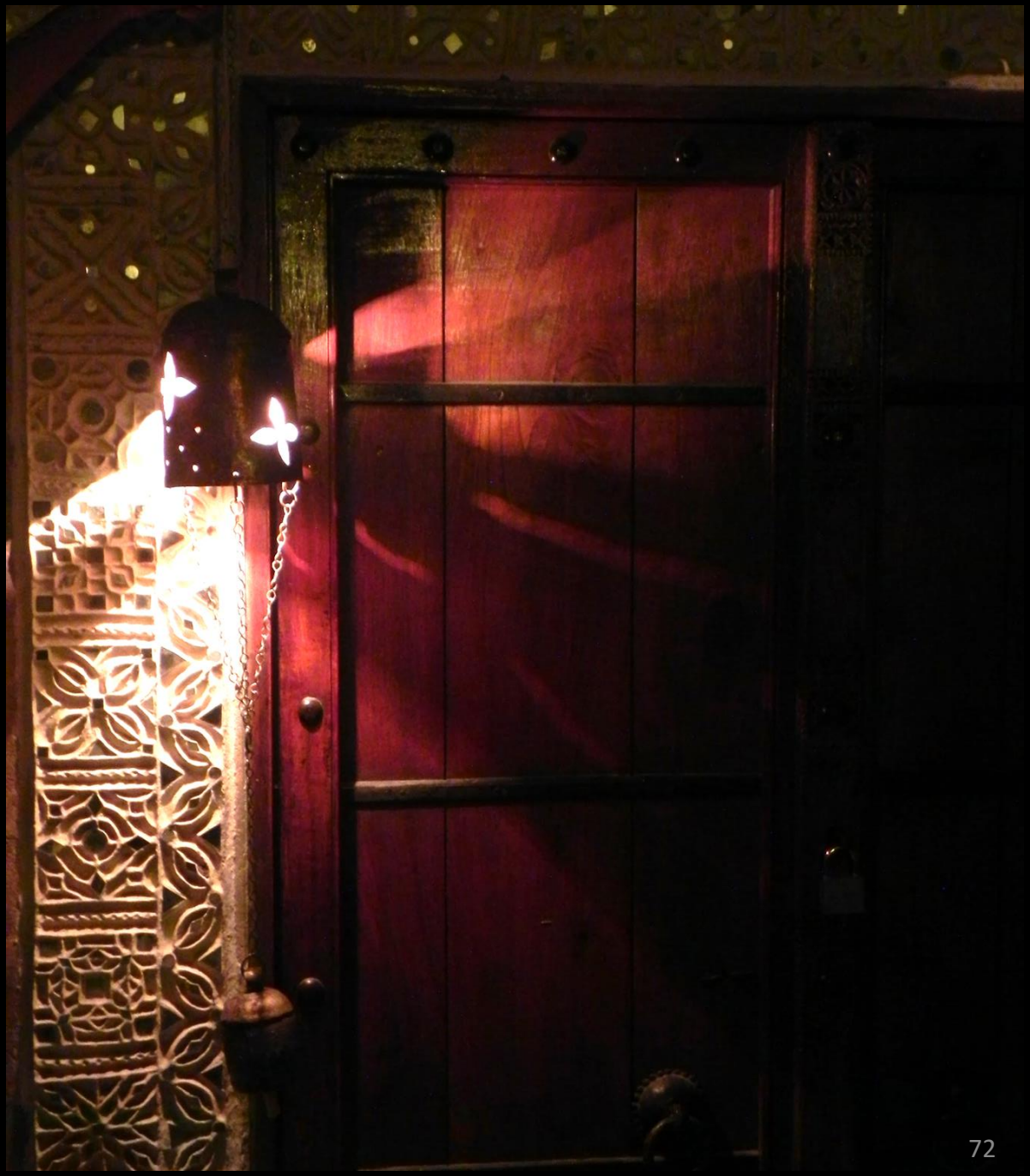


Hanging bell Lamp Shade

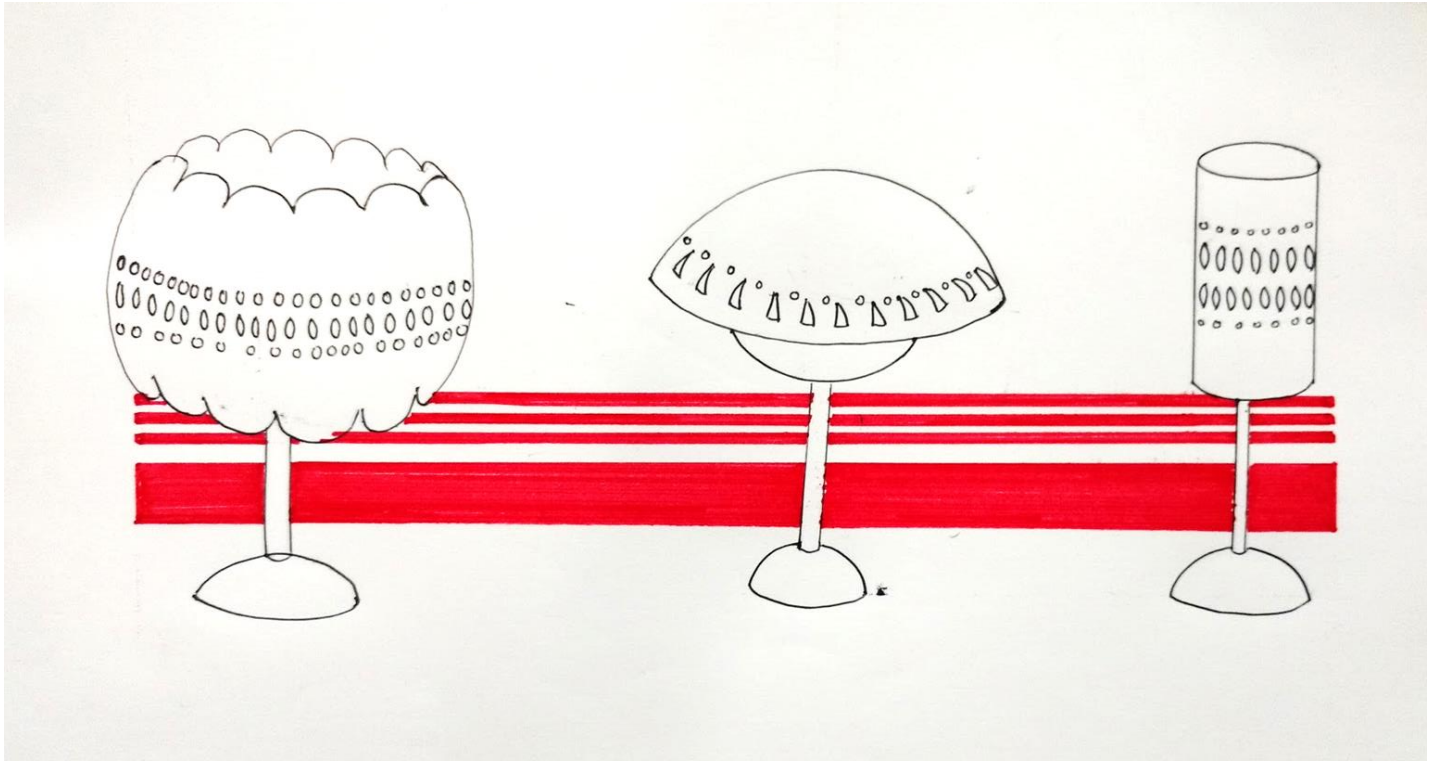
conceptualising

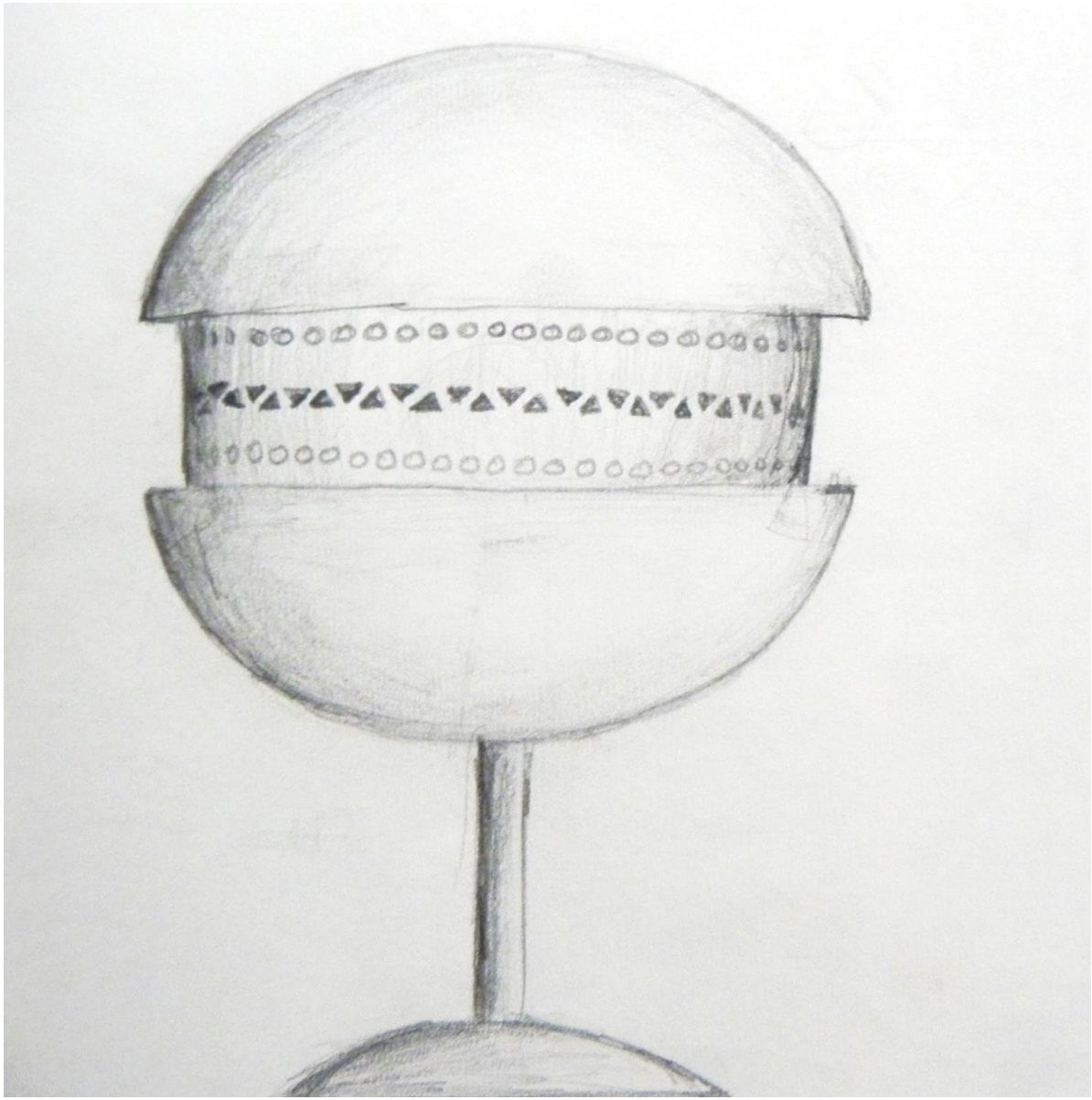
A wall hanging bell concept was conceived for restaurants and homes, the product consists of a lampshade which would be a hanging bell, in which kachchhi motifs are cut in.



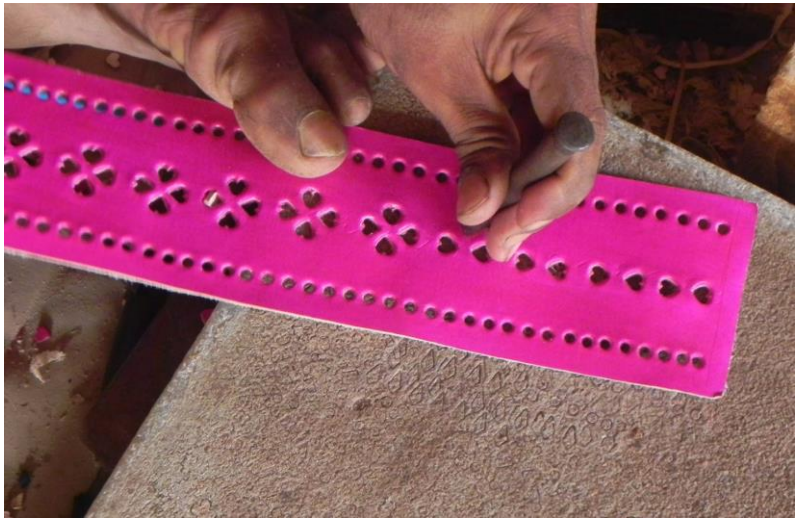


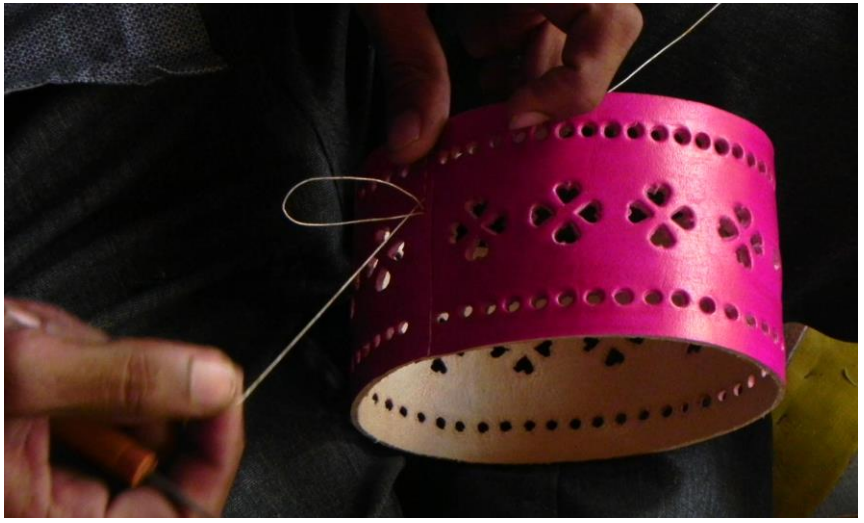
Lampshade





Manufacture



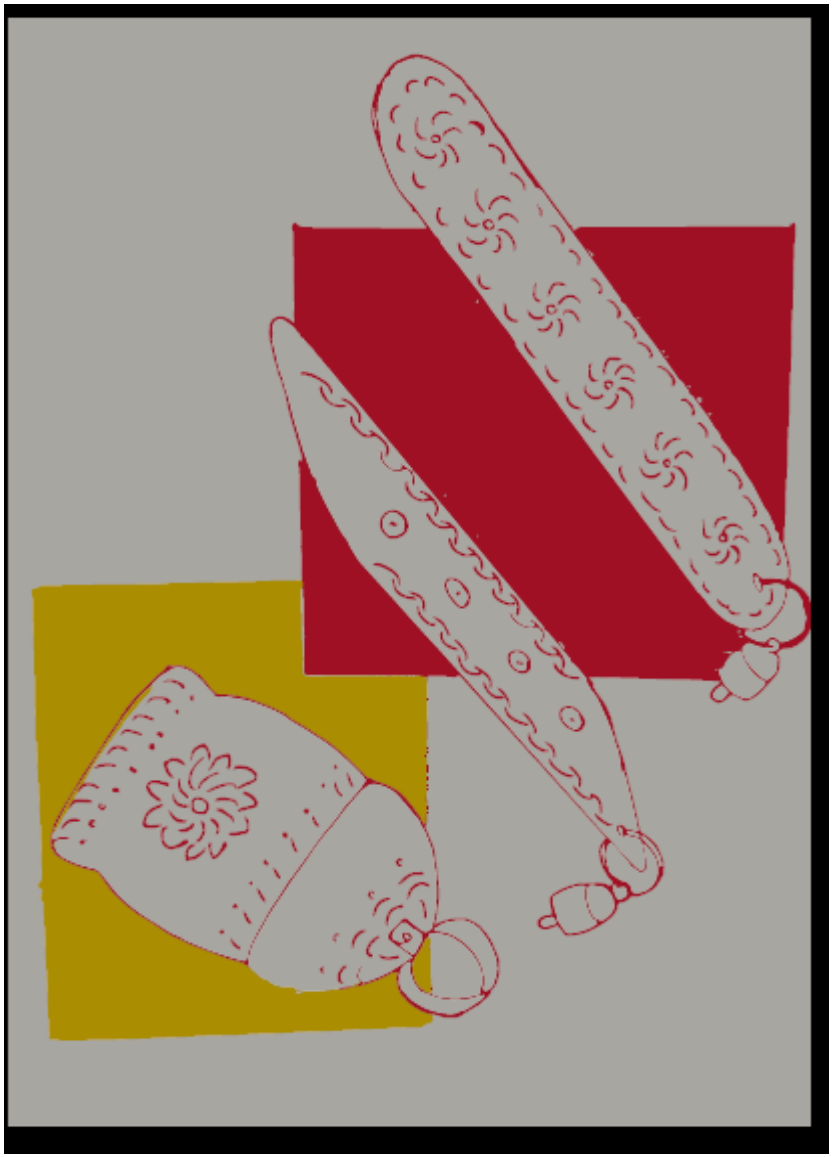


The lampshade consists of 6 parts 2 topis of bell no 12 for the head and another piece of topi of no. 11 for the base. The light shade is made out of leather

Parts are welded and assembled


2:06

Bookmarks



Study on Furnace design

Study and Suggestions to improve the existing furnace developed by Khamir

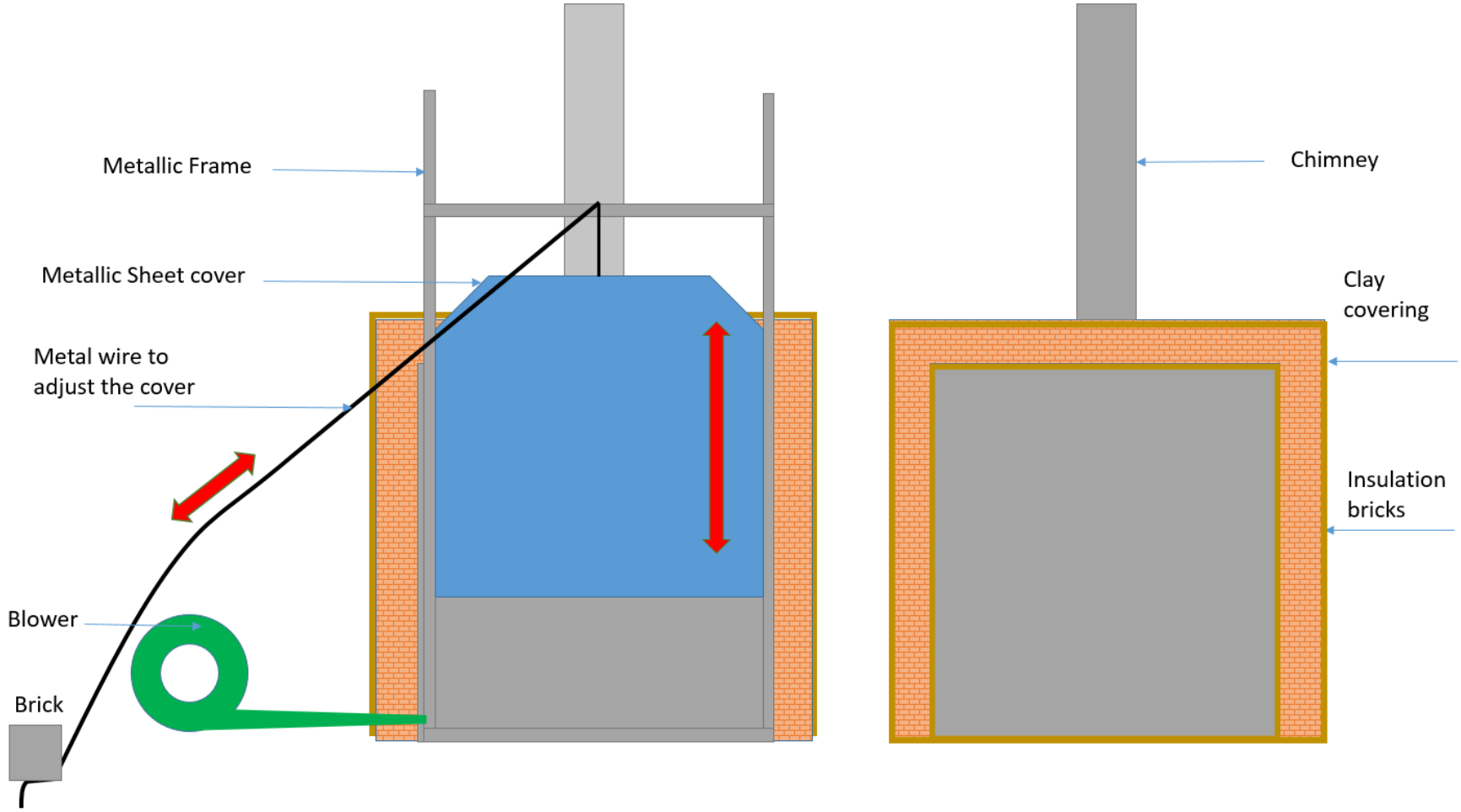
Old furnace

Issues in Older design

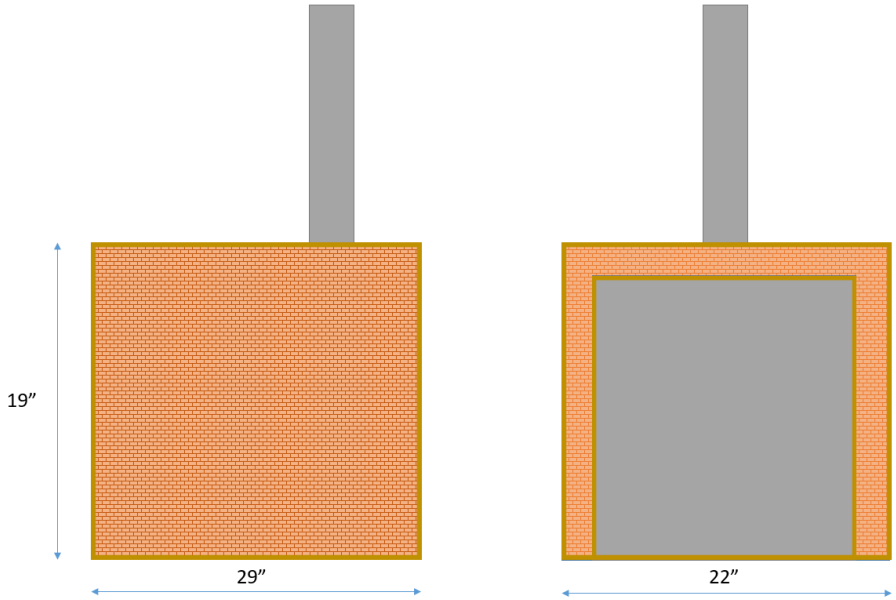
- No chimney
- Normal bricks used were breakable
- Lower life of furnace
- No sheet cover to protect the person from heat
- In some cases, lack of electric blower. Blowers used were manually operated.

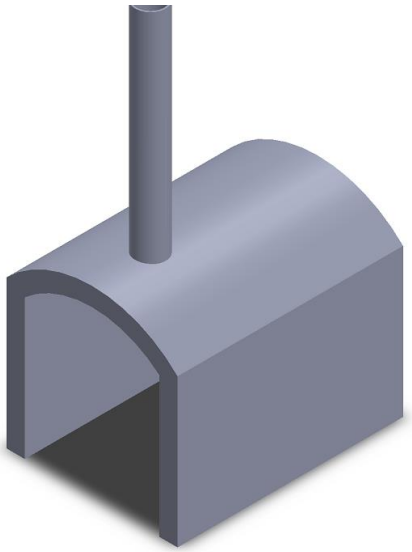
Current design

Current furnace design and arrangements



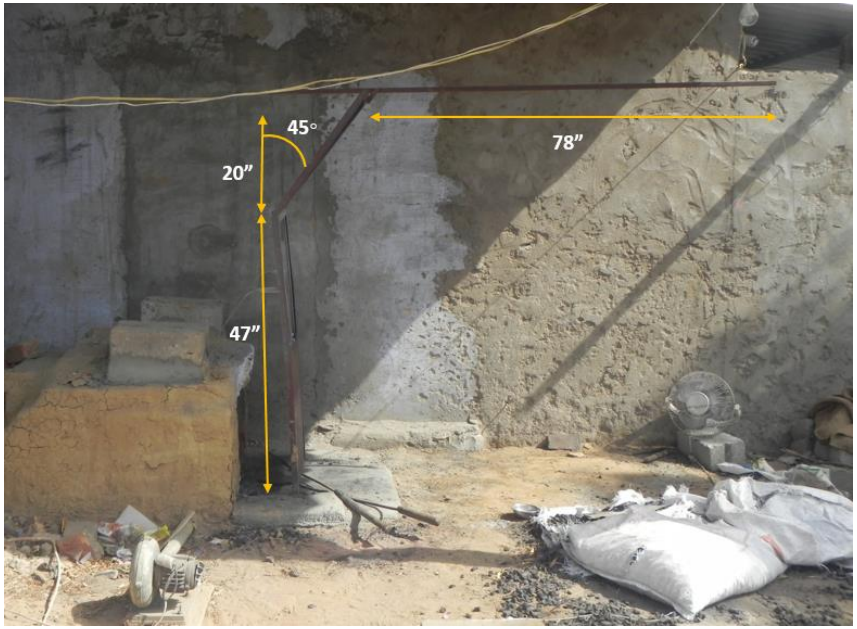
Dimensions of current furnace



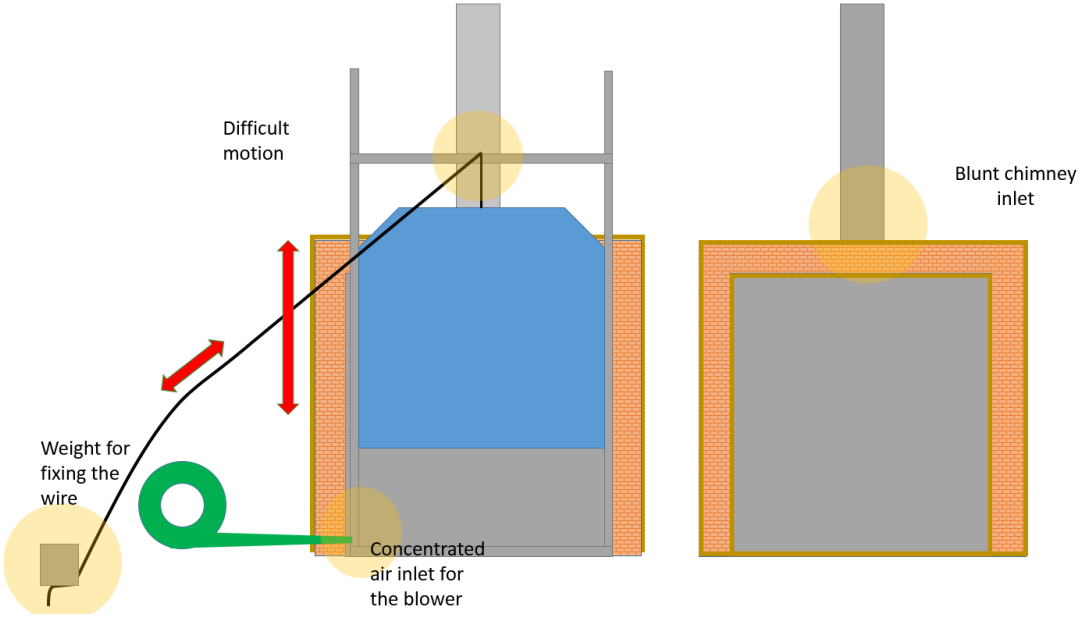


- Three walled furnace with dome shaped roof with chimney on the front of roof

Dimensions of furnace covering arrangement

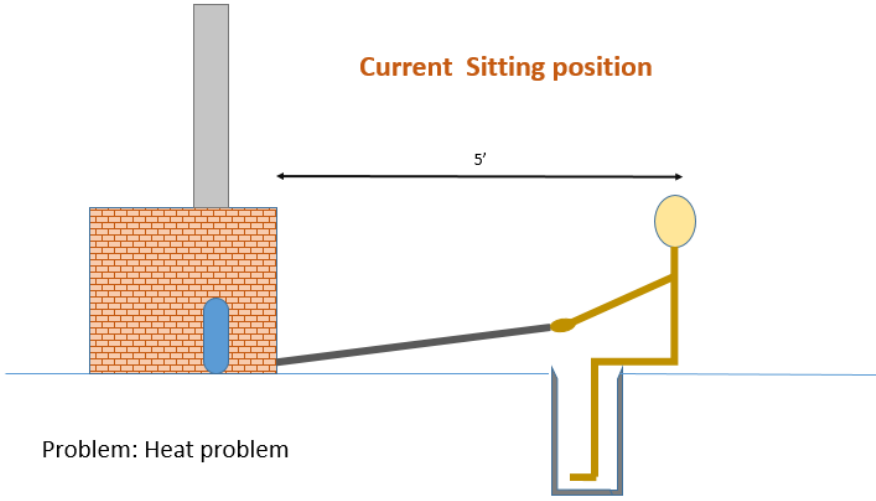


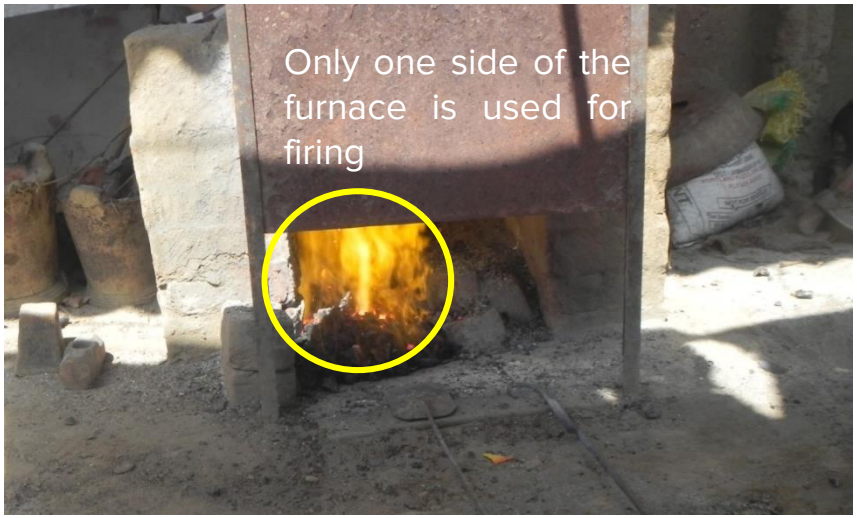
Issues in current design

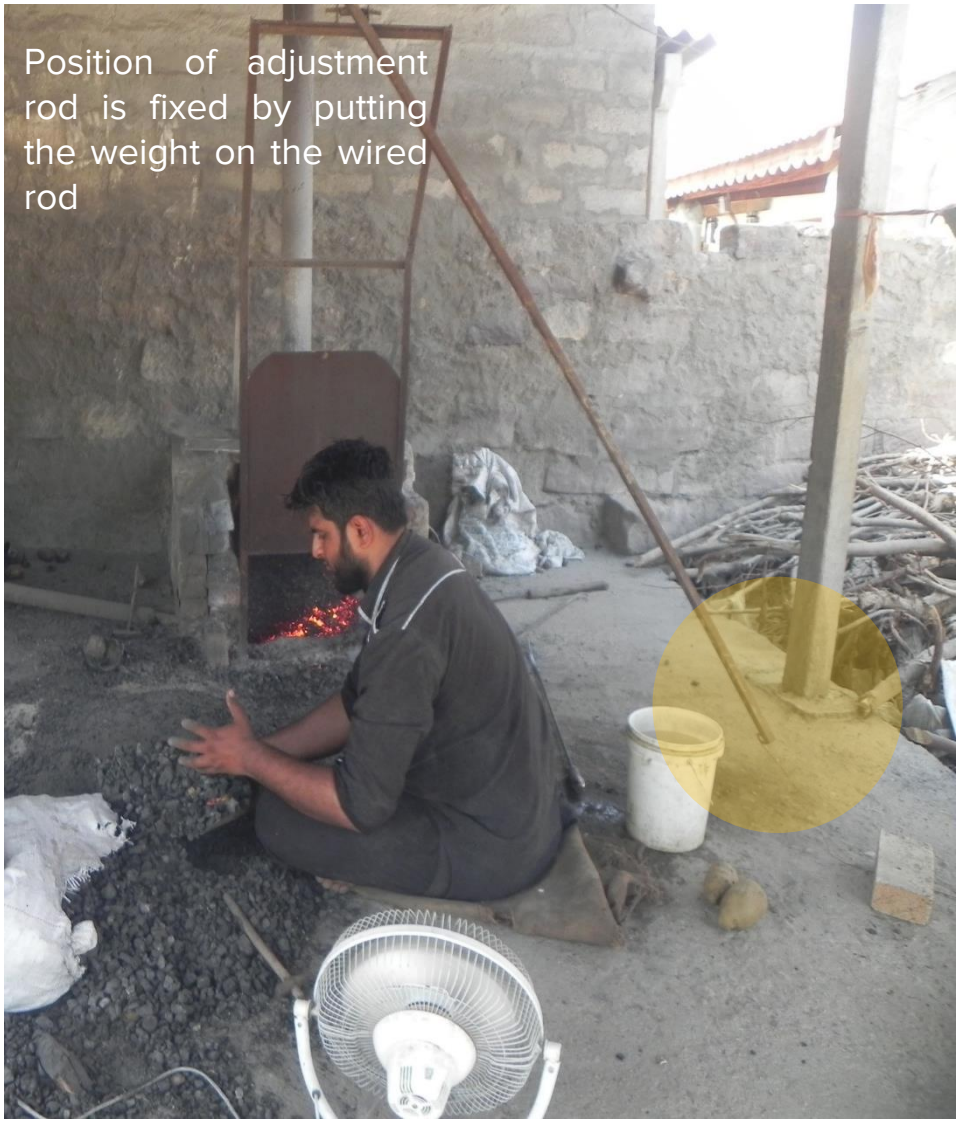


- The chimney opening at the furnace end is blunt which resists the fumes to exhaust from the system creating bad work condition.
- The air from blower is concentrated only on one side of the furnace resisting the other half to ignite properly.
- The furnace cover is stabilized in one position by wire by keeping a brick on it. Also, it is very difficult for artisan to adjust the cover position

Sitting distance of the artisan from furnace is about 5 feet. Due to excessive heat and fumes, artisan has to sit far away from the furnace




Only one side of the furnace is used for firing

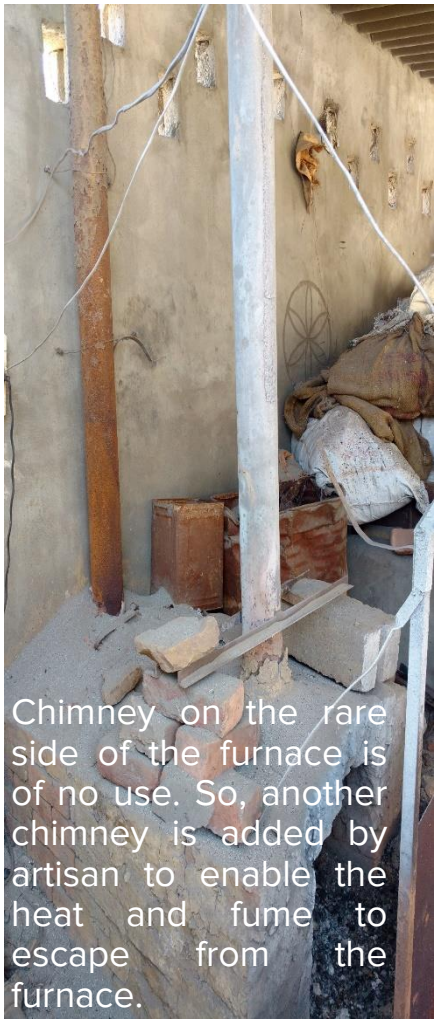

Position of adjustment rod is fixed by putting the weight on the wired rod


Broken Furnace wall (Life:2 years)
Adjustment for blower pressure (as valve)
Broken Bricks (used as separator)
Empty other side of the furnace


Open side and top


Extra fan is needed as the work environment temp goes high

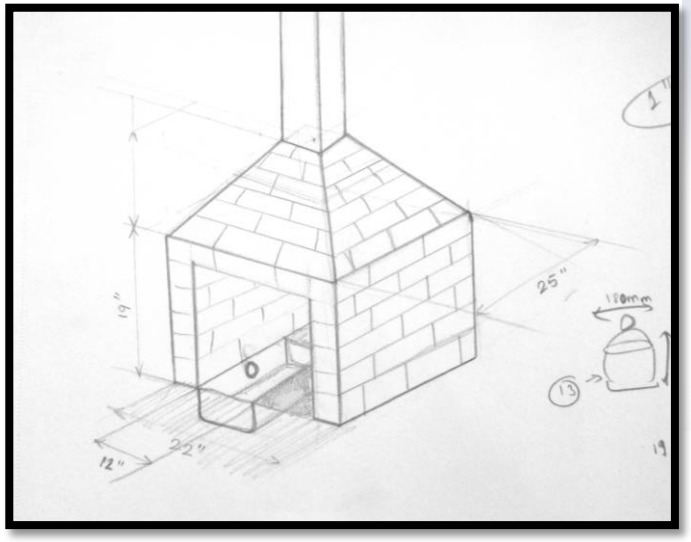

Added weight is needed to hold the adjustment rod in one place and the cover sheet in downward position

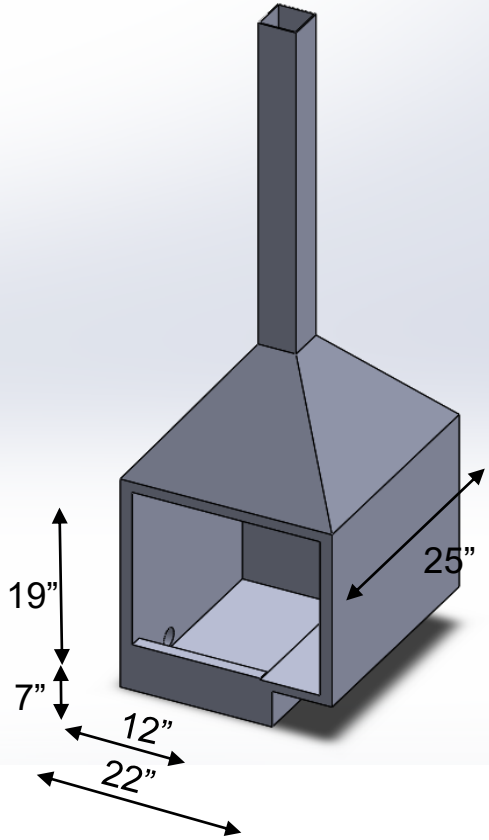

Chimney on the rare side of the furnace is of no use. So, another chimney is added by artisan to enable the heat and fume to escape from the furnace.

Design suggestions

Design suggestion 1

- The roof of the furnace is pyramidal to give direction to the flow of flue gases.
- The depression is made in underground on the floor of furnac which do not allow heat to dissipate easily from the furnace while firing bell
- The size of underground depression is such that it allows firing all sizes of bells easily
- The need to rotate the bell while firing can be reduced
- The depth of furnace is reduced so that the wastage of heat ca be reduced inside the furnace.

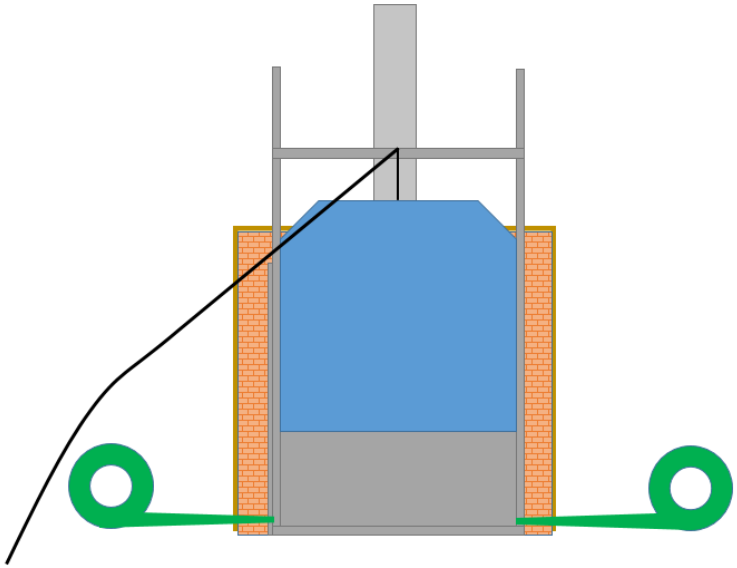




Design suggestion 2

Two Blower furnace

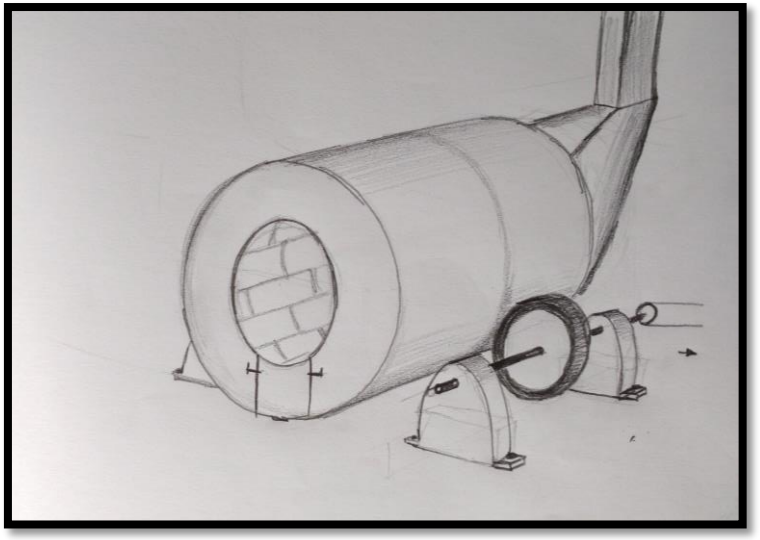
- Using two blowers from opposite sides will allow to heat the coal in less time while firing bigger bells or 1st bell provided the blower outlet reaches the firing area properly.
- One of the blower can be fixed while the other can be kept temporary and adjustable.



Design suggestion 3

Rotating drum furnace

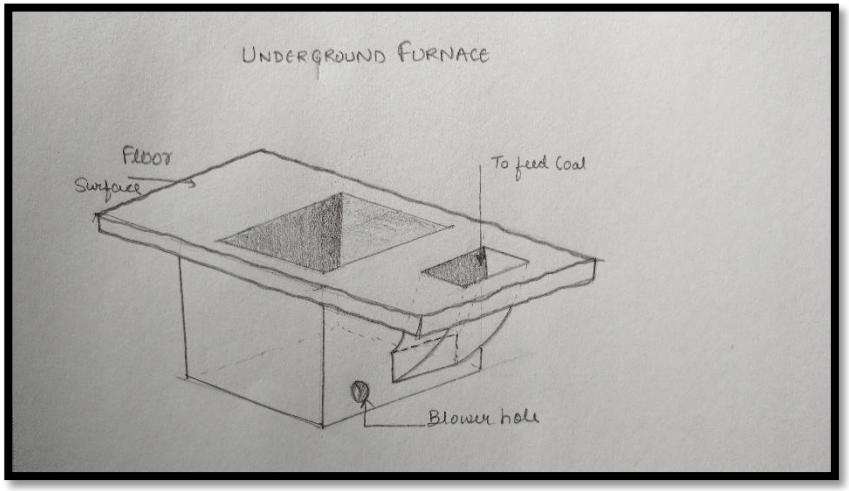
- This is a very basic idea where just like the rotating furnace drum used in industry, the same idea can be used here to fire the bells with uniform heating and without any need to rotate the bells manually.

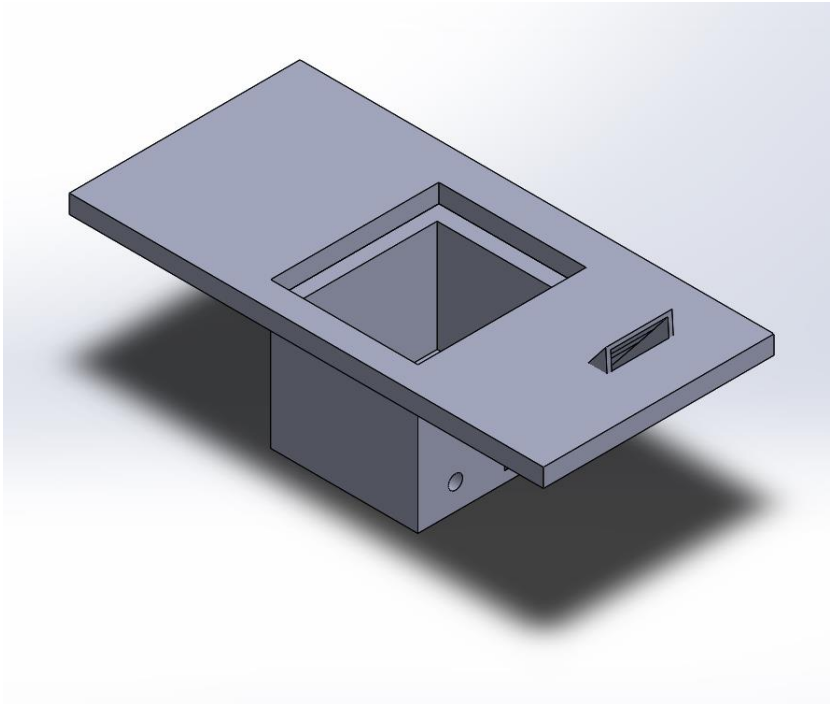


Design Suggestion 4

Underground furnace design

- The furnace is build under the floor surface. It is covered from all the four vertical faces. So, heat dissipation is minimum
- The coal is fed into the furnace from the tunnel inlet from the floor surface which will fall down into the furnace.
- 2 blowers are used on 2 opposite sides to provide uniform airflow for burning of coal.





Acknowledgement

The days at KHAMIR were delightful, there has been a lot of things to learn and unlearn. Experiencing kutch has been an amazing opportunity. Working with handicrafts were a new experience for both of us. Kutch was an entirely different way of learning design. We had to move out from what we had taught, had to get deep touch into the craft and its culture. Met a lot of interesting people at the organization and had so much interesting conversations and activities. We would like to thank every individual who made this project possible. We would like to thank,

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Ali Ibrahim luhar, Jura
Akbar Ibrahim luhar, Jura
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Amir hamja alibhai, jura
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Ali haji sidik, Nirona.

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Annexure - I

The lead content copper bells & brass powder alternatives

Lead content in metal alloys is a serious issue. It causes several health problems

Lead in brass helps the material to enhance the machinability and to remove its brittleness. It is an important constituent in brass. But there is a permissible limit that is, only lea than .06% is allowed in brass., according to FDA of the US. The brass powder that the copper bell artisans use to apply on their bells were tested by KHAMIR, and it was found that the lead content was 10 times higher that of the permissible limit of FDA standards.

This is a threat to the entire craft, and can put he entire sector in peril. Thus it is important that we should search and find alternative materials that has no lead content but could replace brass.

i. Lead free brass powder

Lead free brass is a recently developed material, this has very low lead content, with a minimum of .025%. The material is available at Ahmedabad and Rajkot in Gujarat.

ii. Bronze

Bronze is another alternative to brass. It has excellent acoustic properties.
The alloy has melting point which is nearer to brass which makes it usable in the current process. Bronze is one of the most common material to make bells. Unlike brass, bronze will have a reddish brown finish, which would add to its authentic vintage appearance. But still, it has to be tried out for once to check its feasibility.

Annexure – II

Experiments on Surface finishes

1. Coating the bells with tin along with brass:





Putting tin alloy wire along with brass to get silver colour bell

Causes of failure

Residual Brass left on the burnt clay

Flux residues stuck inside the bell

Tuned bell does not ring due to loose joints between its parts

2. Fusing tin on MS bell to make patterns

The material used here is tin alloy (soldering wire)

Causes of failure:

Under-fired bell

Flux residues stuck inside the bell

No fused joints

3. Piercing holes in clay cover

The experiment was done to see how the dark spots are appearing and to see whether they can be arranged in a pattern.

Findings

Holes were too small for the bell to burn at that place

Water went inside the clay cover while quenching resulting in white spots

Caused very Irregular spots

The experiments were not continued because of the time constraint. From our findings we understood that there are several ways we can manipulate the surface finish of the bell. There can be colour, texture and patterns that can be added

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