~Summer Internship Project~

Solar Agitator

SELCO Foundation,
Bangalore.

Quashif Qureshi | 156130001 | M.des , Industrial Design

Acknowl-edgment

Summer Internship is the one chance that we get after a year of learning the foundation courses to go and try our hand in the real world. I am grateful that I could use that time to try and create a product which is unique in terms of its function. I would really like to thank the entire team of Urban community Lab (UCL) of SELCO Foundation for the support that they extended during this period and special thanks to Ms. Khyati Shukla (Product Designer) for guiding me through the entire process.

It was a great opportunity for me to work with SELCO as I was always interested in working for people in resource constraint area. It's a great opportunity to work with a really passionate set of individuals and peers with vast knowledge, strong convictions and a really positive outlook towards life.

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Introduc-tion

India is a nation where the main occupation of the people in rural area is agriculture and animal husbandry, infact India ranks first in milk production, accounting for 18.5 percent of world population, even the urban areas are not left behind in fulfilling the local dairy needs of the people.

However, the availability of equipments to process the milk are very scarce and old schooled, which have not been changed for many years. People in villages still use muscular energy to make dairy products due to unavailability of versatile equipment which can be used with their vessels. The frequent power cuts in these areas make it difficult to use modern electric devices for their household use.

http://pib.nic.in/newsite/printrelease.aspx?relid=136849

Project Details

Project I Mid Term Internship

Project Name : Solar Agitator (Solar powered Butter Churner)

Company Name : SELCO Foundation, Bangalore, Karnataka

Department : Urban Community Lab (UCL),
Rural Community Lab (RCL)

Project Guide: Ms. Khyati Shukla
Product Designer
SELCO Foundation
Bangalore,Karnataka

Project Designer : Quashif Qureshi
156130001
M.Des Industrial Design
IDC School Of Design
IIT Bombay

Project Location : Hebbala & Kumta, Karnataka.

Internship Duration : 9th May 2016 - 9th June 2016 (5 weeks)

Project Brief

The aim was to design and develop a low-cost solar powered agitator for churning butter from milk, which can be versatile, easy to use and ergonomic for the rural as well and urban scenarios.

In SELCO Foundation, the local innovator tried experimenting with the remi fan motor to develop a low-cost butter churning but due to unavalaibility of proper design and materials, the project was closed. Since past few months, the need of a solar powered butter churner was increased in the rural area so Khyati Shukla alloted this project to me to take it further for its end to end to development.

The basic requirements for this device were that it should run on solar power, should be frugal, low cost, easy and safe to use and maintain.

About SELCO

The SELCO Foundation is an for profit social enterprise that plays a pivotal role in catalyzing holistic solutions and replicable processes that are an outcome of bottom up customized sustainable energy solutions.

SELCO Foundation is a company responsible for creating processes, models or concepts that can be replicated across segments, cultures and geographies. The strength of the Foundation is not only to implement processes or models but also to document it in a way that brings about the analogies that can help an individual, organization or an enterprise to copy it in any other part of the world that wants to bring in sustainable solutions to energy poor populations.

About SELCO

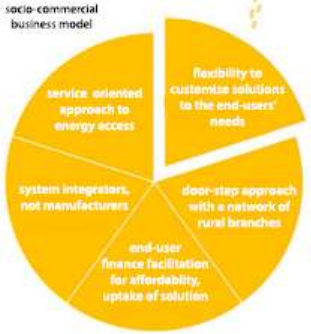
the structure of SELCO Family

SELCO India (1994)

For Profit, Social Enterprise

To enhance the quality of life of under-served households, institutes and livelihoods by providing customized sustainable energy solutions that become assets for the poor through a network of customer energy service centers.

SELCO'S socio-commercial business model



SELCO Foundation (2010)

Non Profit, Research and Development wing

To develop innovative sustainable - social, technical and financial - models that impact energy access, climate change and poverty alleviation. SELCO Foundation uses a holistic ecosystem approach to impact areas of wellbeing and livelihood.

Pillars of SELCO Foundation

SELCO Incubation (2012)

Entrepreneur Development

To achieve wider access and faster outreach of energy services, for the energy deprived, across India through entrepreneurship development and incubating potential energy enterprises.

Identifying Entrepreneurs
Identification through partner networks, entrepreneurial institutes, nominators

Providing Training
Transfer of knowledge on business model & processes in partnership with successful social enterprises

Business Support
Help establish operations & vendor linkages, and linkages for end- consumer financing

Investment
Help develop the strategy & business plan; identify and negotiate appropriate deal with investors

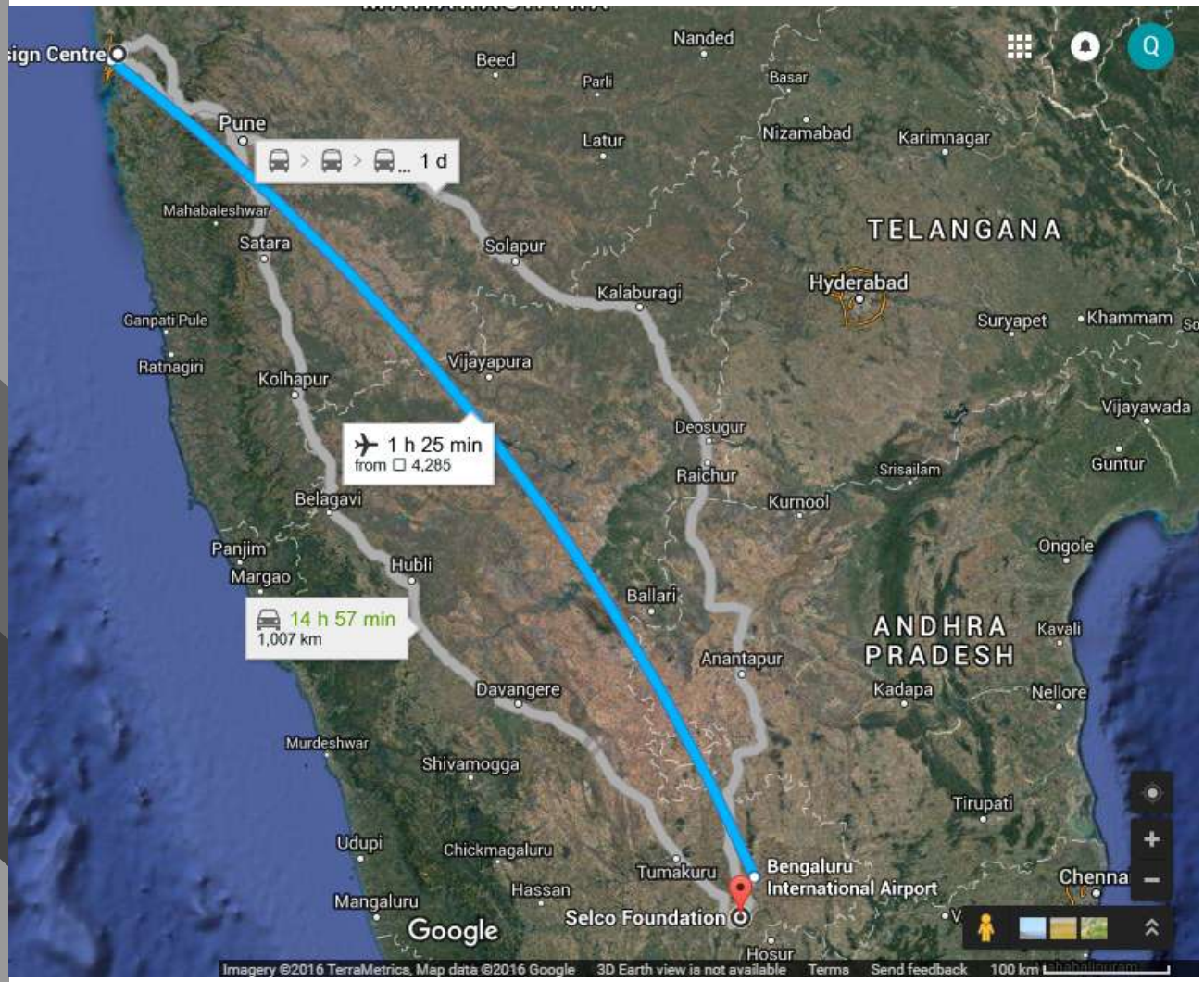
Investment for Entrepreneurs

To invest in small and medium size social enterprises and develop investment, debt and equity for sustainable energy entrepreneurs.

SELCO Fund (2015)

Location

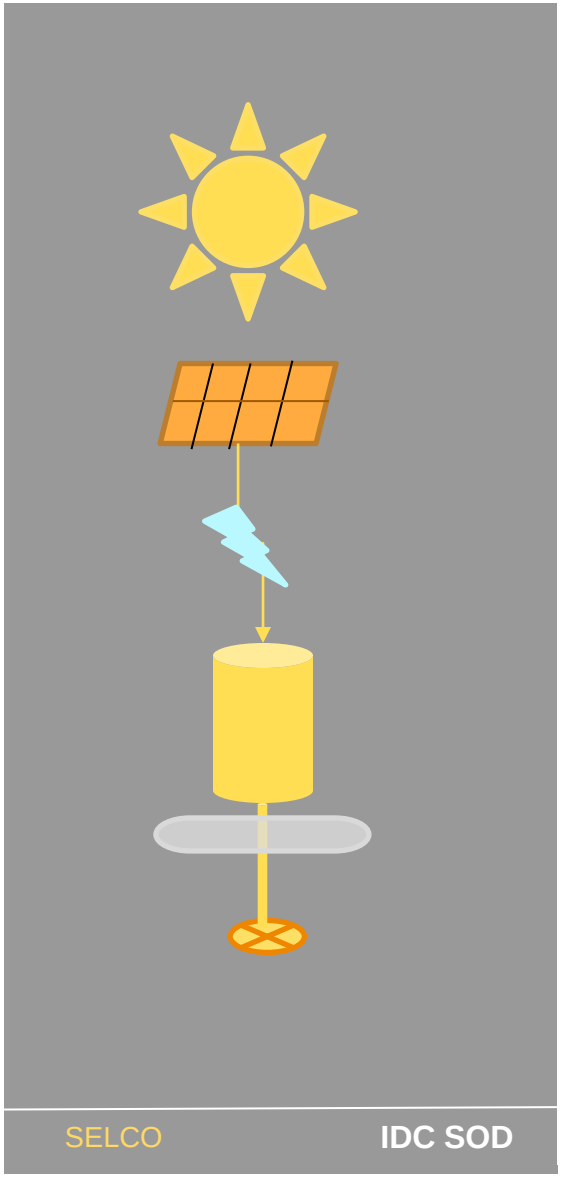
SELCO Foundation is situated at the heart of the Bangalore city , but its approach in providing holistic solar solutions are spread all over the country specially southern India, and now in north east of India, SELCO’s livelihood models are replicated in Africa, Pakistan and Bangladesh.



What is a Butter Churner?

A butter churner is a device used to convert cream into butter. This is done through a mechanical process, frequently via a pole inserted through the lid of the churn, or via a crank used to turn a rotating device inside the churn.

What is a Solar Agitator?



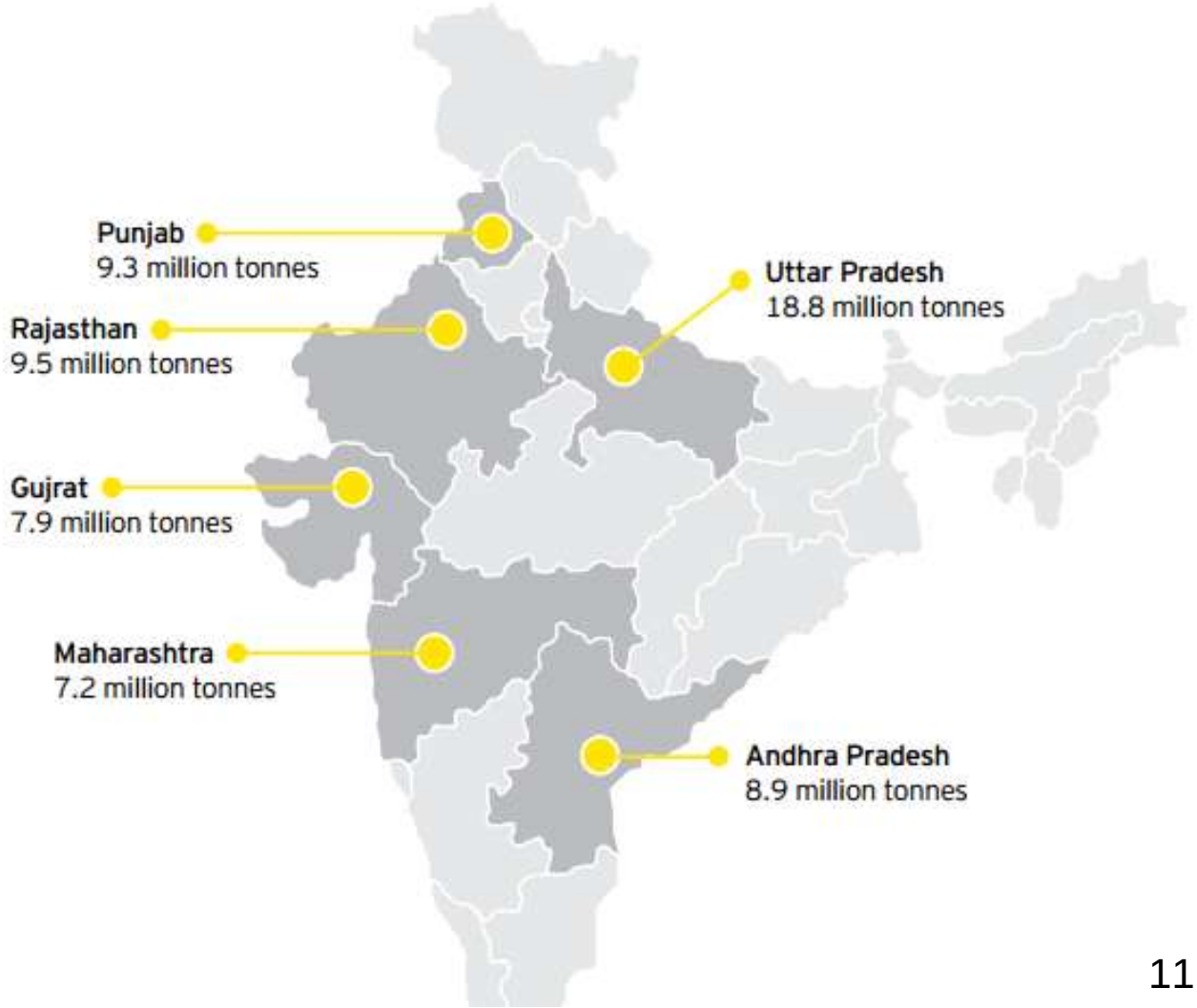
Solar Agitator is a solar powered churning/agitating device which incorporates the a DC motor which is used to rotate a churning blade at the end of the shaft by means of which milk gets churned and milk and fat gets separated from the milk resulting in butter and butter milk as a by product.
The whole device is made solar powered because after lot of study and testing it is designed in such a way that it can be used in the areas which has no electricity supply at all.
the device is made in such a way that it can be used with the available vessels what the people use in their day to day life cutting the extra accessories cost.

Design Criteria

- Low weight efficient blades and agitators for multiple applications such as mixing ,churning, beating, blending, low impact chopping/grinding
- Minimum/No vibration
- No spillage
- Local fabrication should be possible in small numbers
- Current features like height adjustability, easy to assemble and dismantle fixtures and easy serviceability should be maintained
- Planetary motion mechanism
- Simple and minimalistic design
- Serviceable
- Low cost
- DC powered
- Versatile and multifunctional

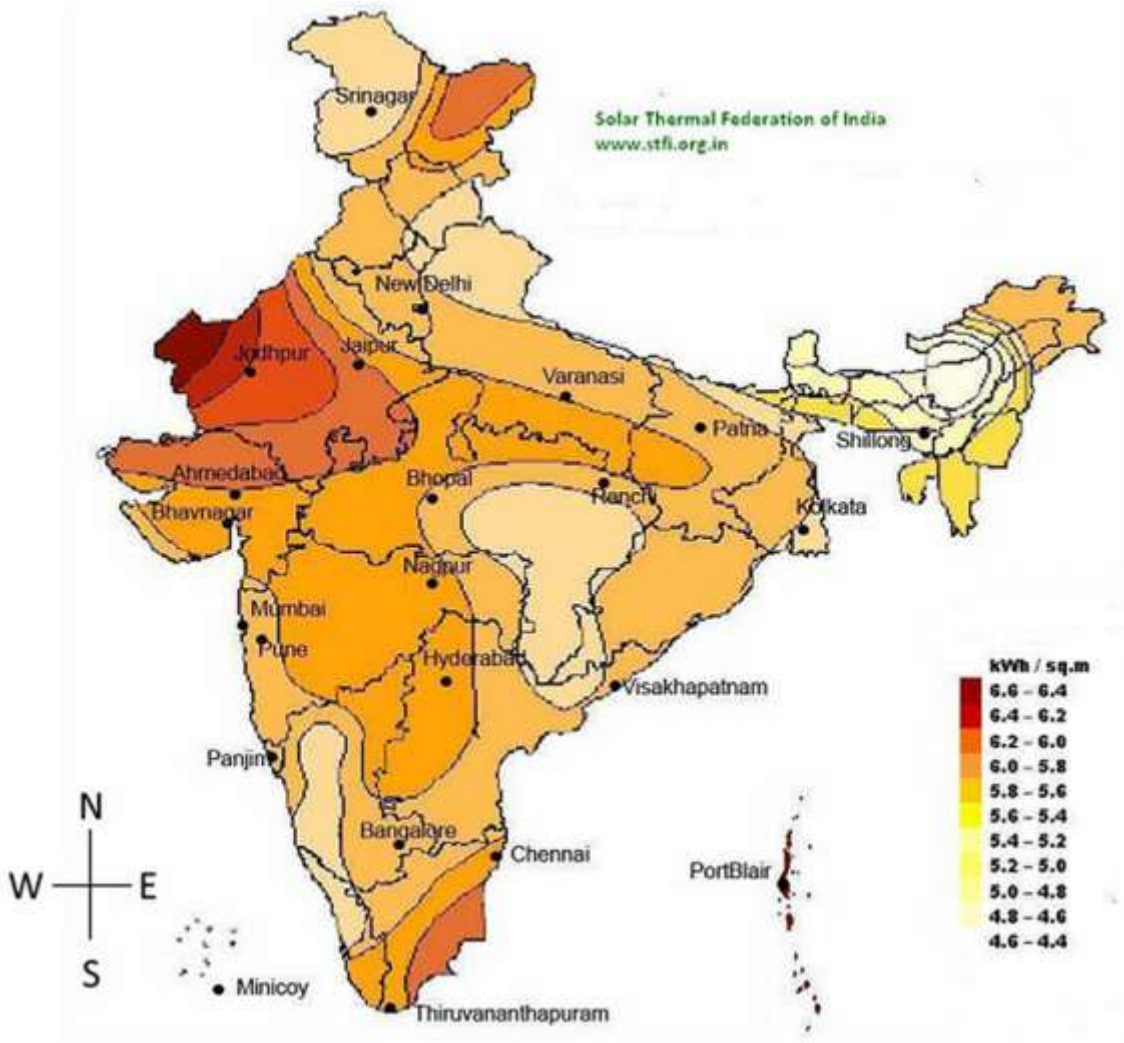
Scale of the problem addressed

These are the following states which are the highest milk producers of India. Apart from these small scale milk industry is booming in the other parts of India.



Solar Radiation concentrati-uon

By comparison of these two maps we can clearly see that the solar radiation concentration is more in the areas where the milk production is high.

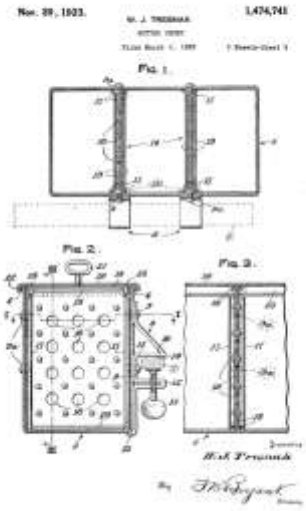


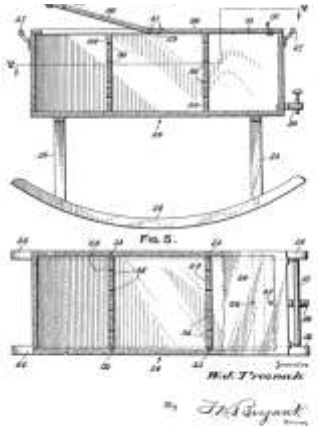
Literature Study

Patent : US 1474741

Butter churner

In brief the patent is about the butter is being made by using perforated sheets enclosed in a box.
When physical force is applied to the product, its starts oscillating hence, the milk inside the box starts flowing via perforated sheets making small eddys and it gets churned by which butter gets separated from butter milk





Link : http://www.google.com/patents/US1474741

Problems with current design

- No grip to hold the container
- No flat base to keep the container
- Lot of vibrations
- Blade not suitable for churning purpose
- Frame not rigid
- No cover to avoid spilling

User Study

User Study

The target user were basically the customers of the SELCO foundation who had already installed solar power panels at their homes.
As the designed brief was to design a versatile butter churner which runs on the solar power.

The primary focus on type of user was housewives in villages who use currently available AC powered kitchen appliances for butter churning or by physical actions.

The secondary user was the people using appliances for commercial use such as local milk producer, dairy shops , etc.

The tertiary user was the user who do not uses such appliances for their commercial and personal purpose but they are in a need of such appliance which can accommodate various functions and should not get affected by frequent power cuts.

Image Board

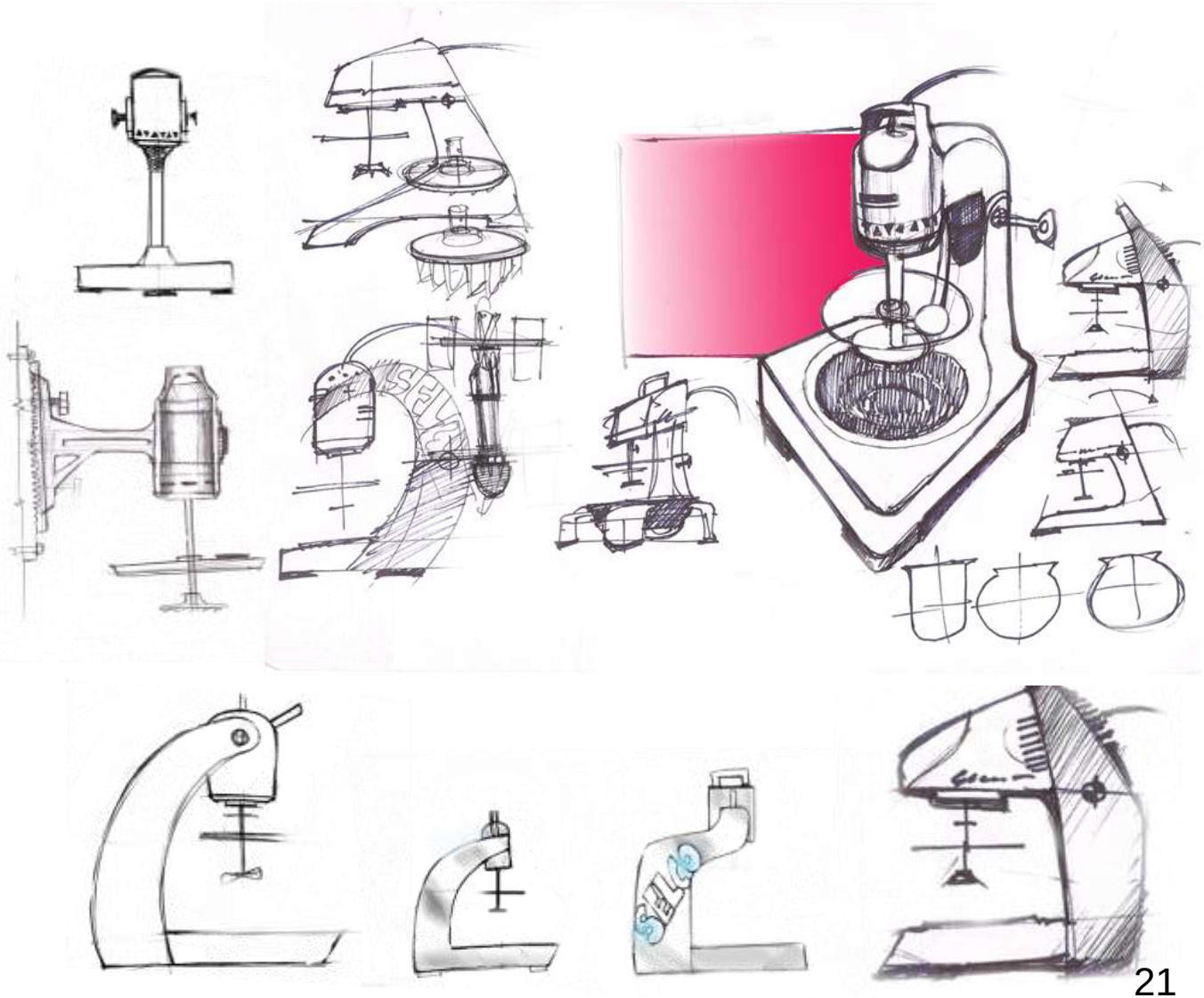
inspiration

Available Models

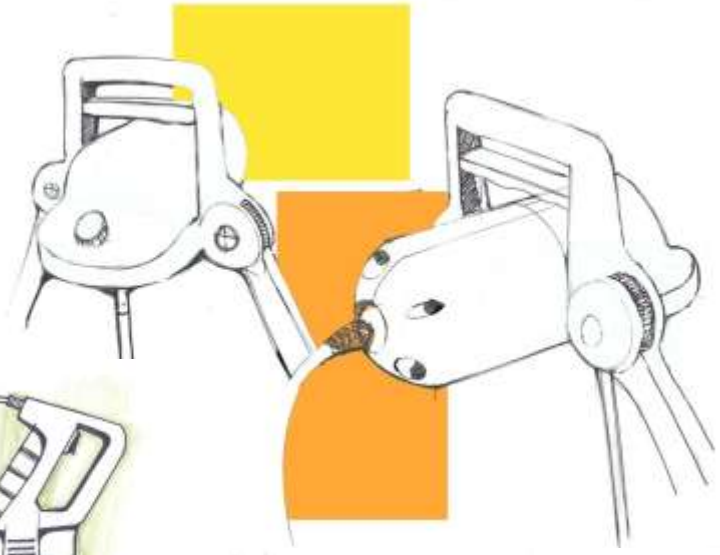
Available blades

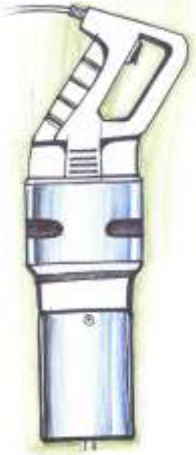
Blades play an important role in increasing or decreasing the efficiency of a agitator. The most suitable blade which was suggested was the blade with larger surface area and steep slope angle.
But to make the device easy to maintain and serviceable the existing blades where suggested to use which can help to make the device more versatile

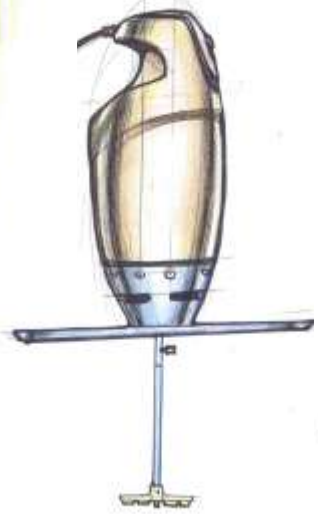
Ideation

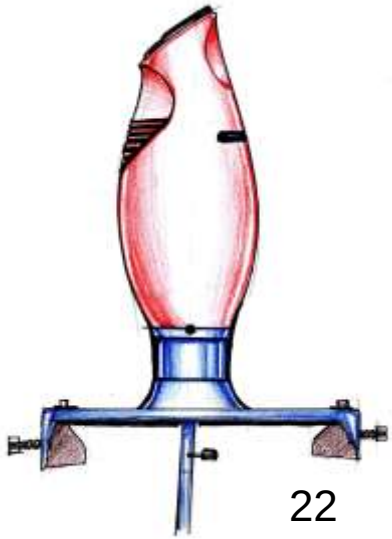


Ideation

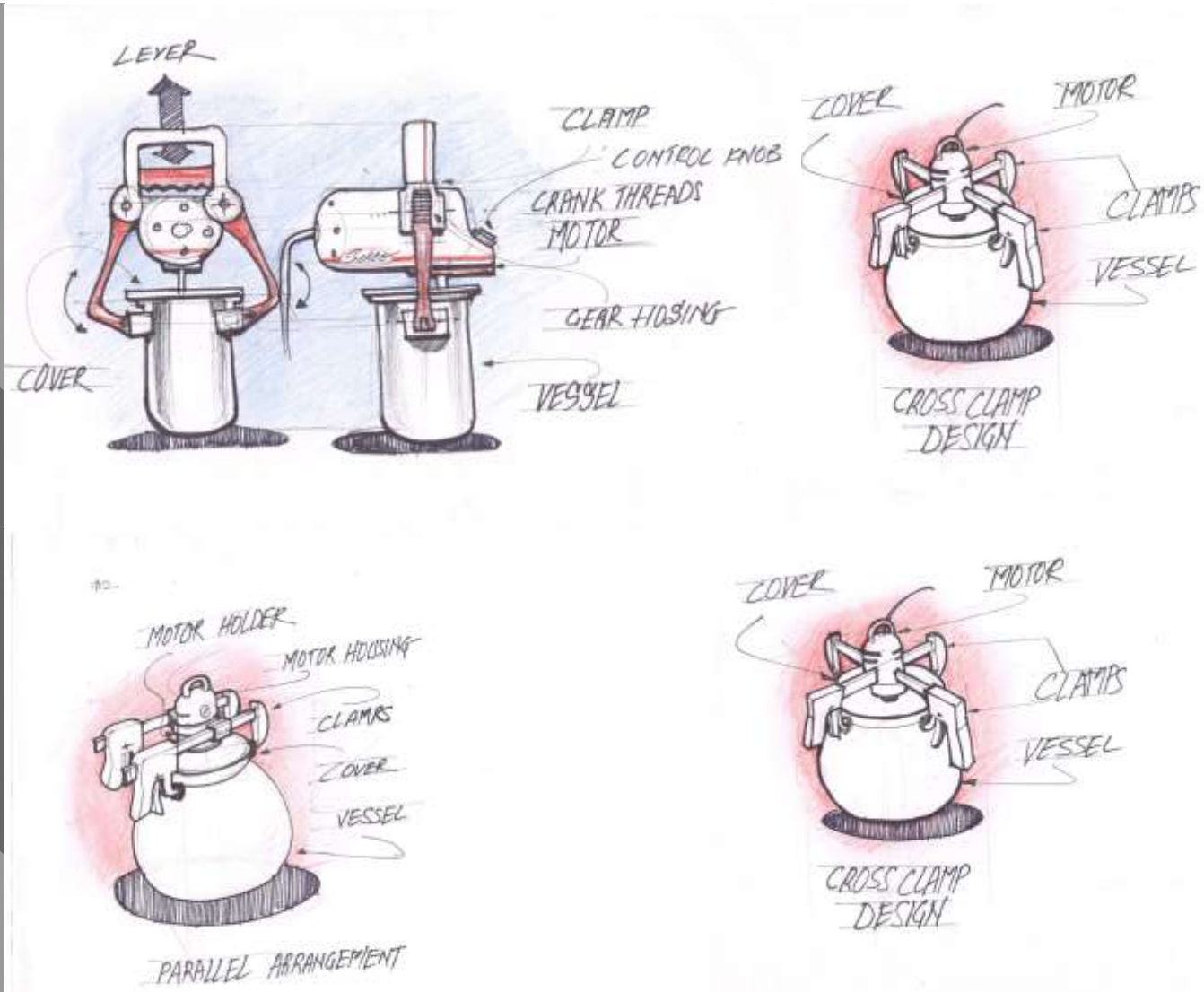








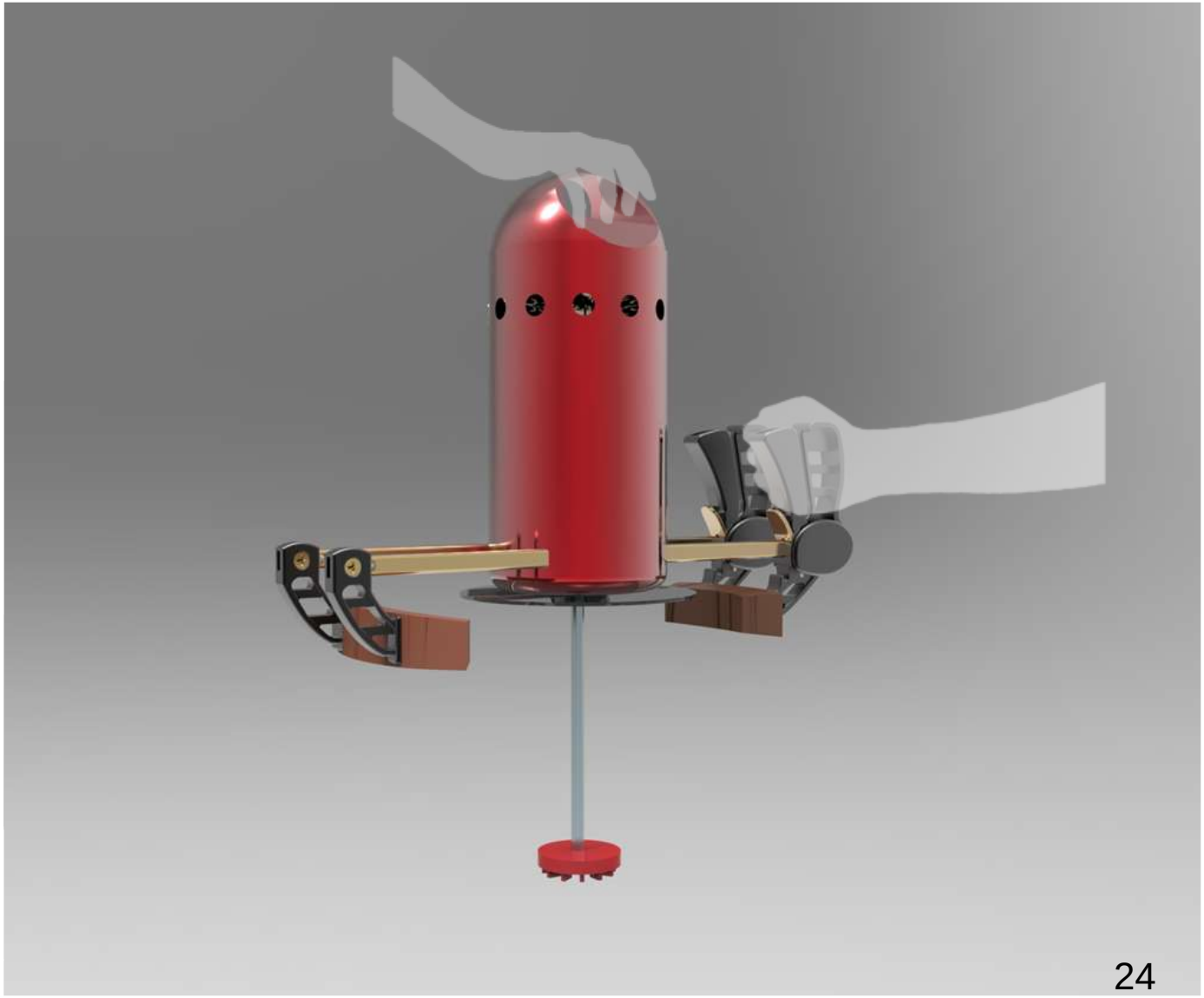
Ideation


LEVER
CLAMP
CONTROL KNOB
CRANK THREADS
MOTOR
GEAR HOUSING
COVER
VESSEL
COVER
MOTOR
CLAMPS
VESSEL
CROSS CLAMP DESIGN
MOTOR HOLDER
MOTOR HOUSING
CLAMPS
COVER
VESSEL
PARALLEL ARRANGEMENT
COVER
MOTOR
CLAMPS
VESSEL
CROSS CLAMP DESIGN

Form Exploration

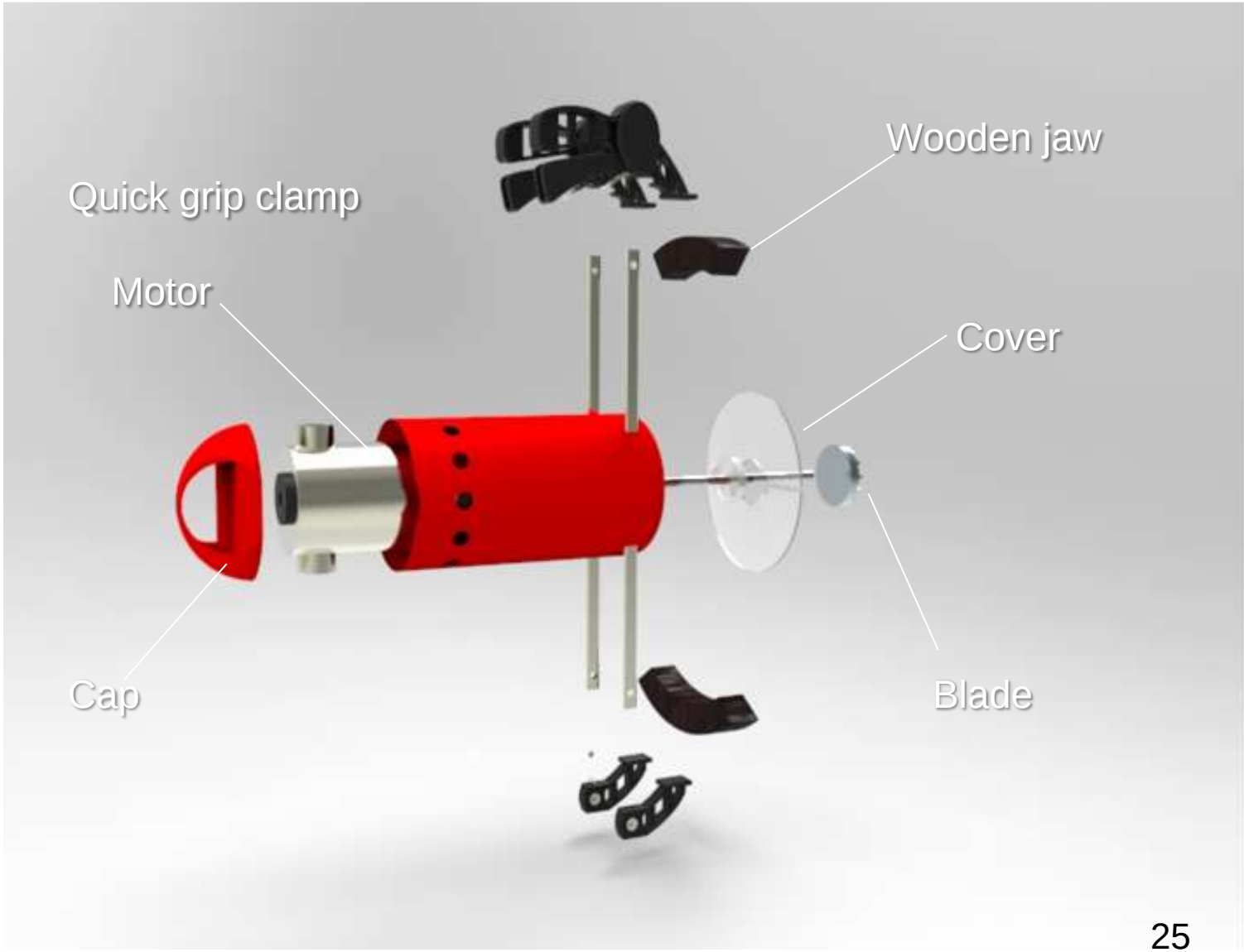
Concept A

First concept was based on the idea of using clamps as the most basic solution to hold vessels



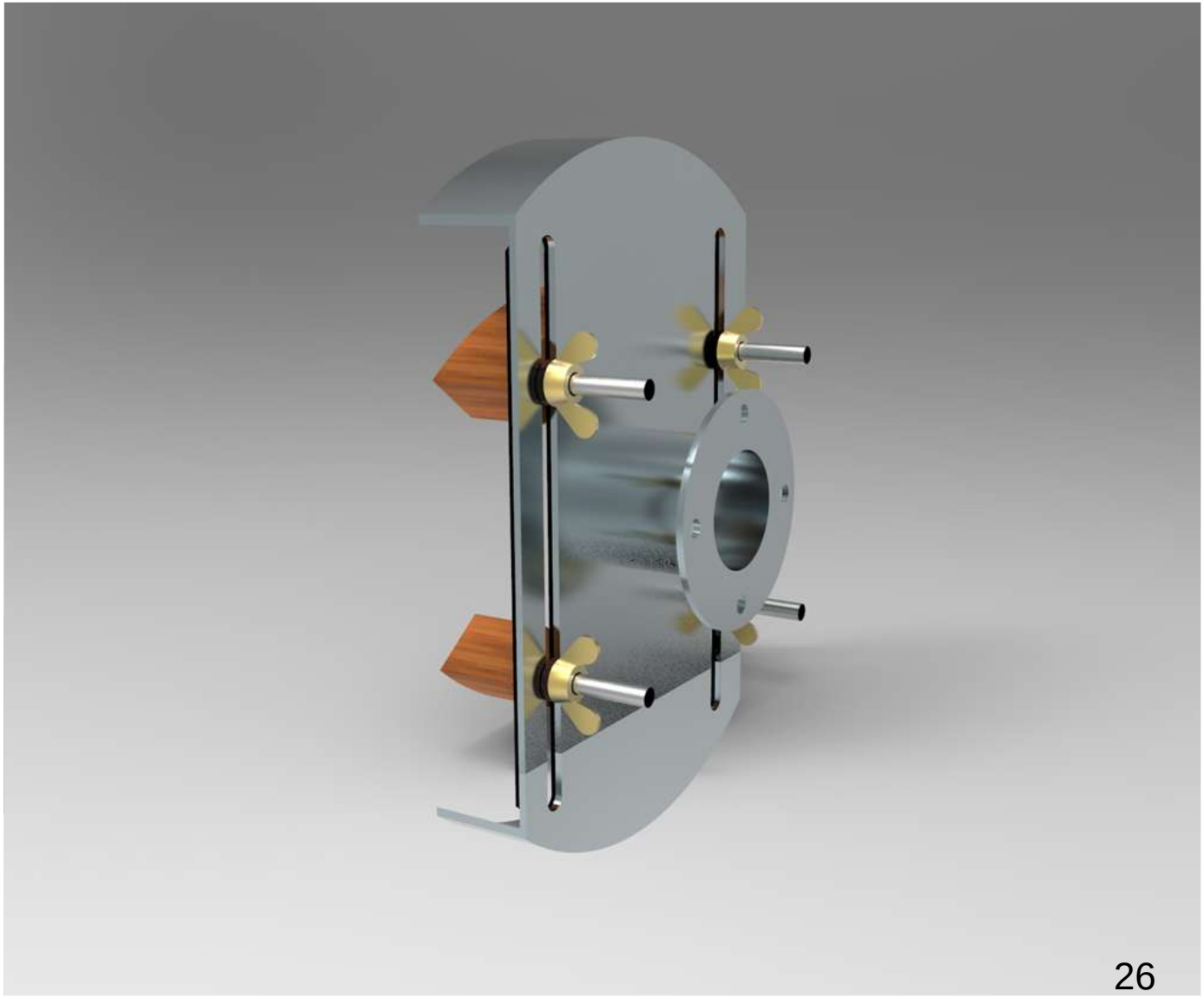
Concept A

Exploded View

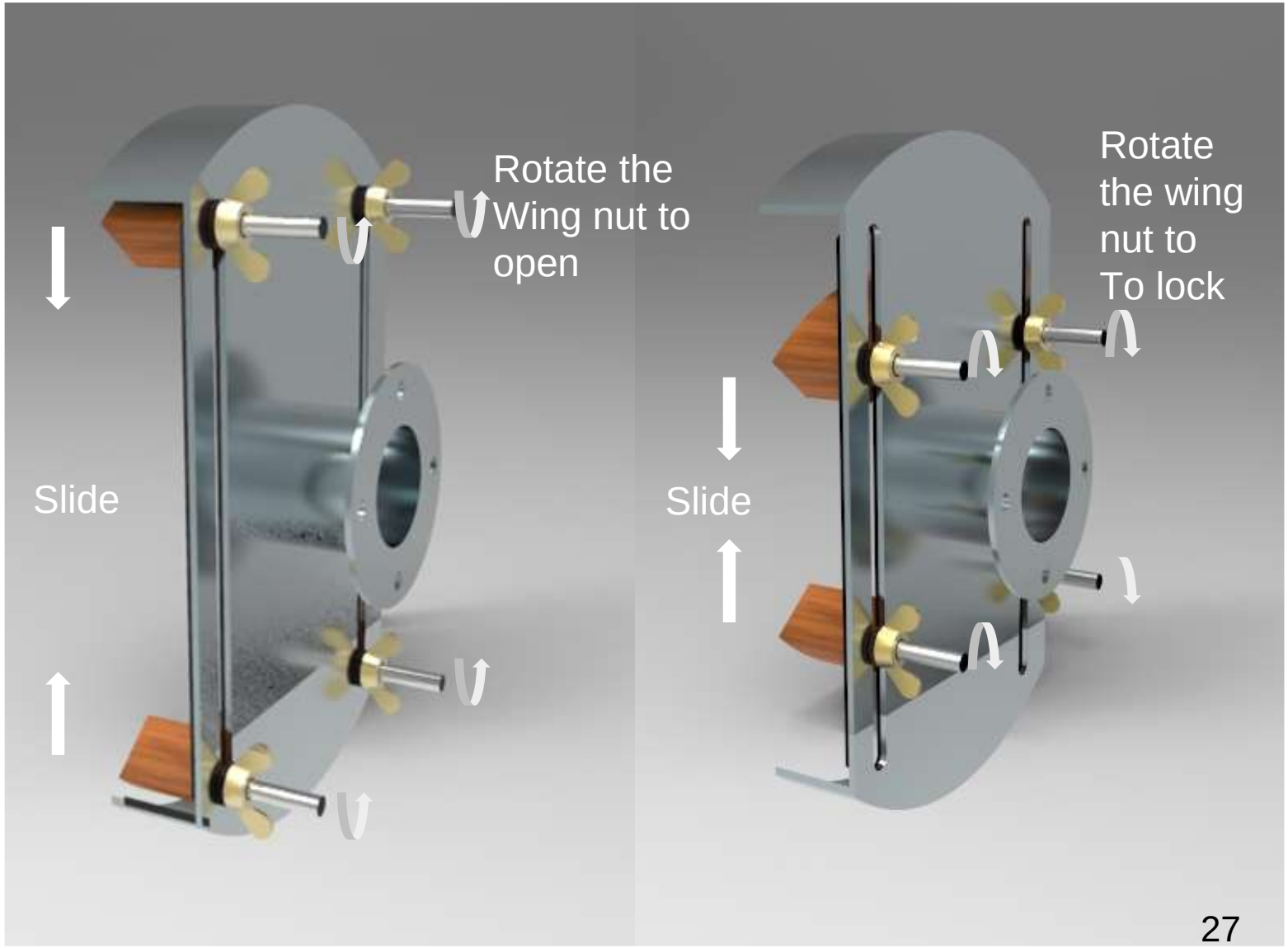


Concept B

The second concept was inspired from the available churners which had covers and caps to avoid spilling
The idea of clamping the vessel was inspired from the first concept.



Concept B


Rotate the Wing nut to open
Slide
Slide
Rotate the wing nut to To lock

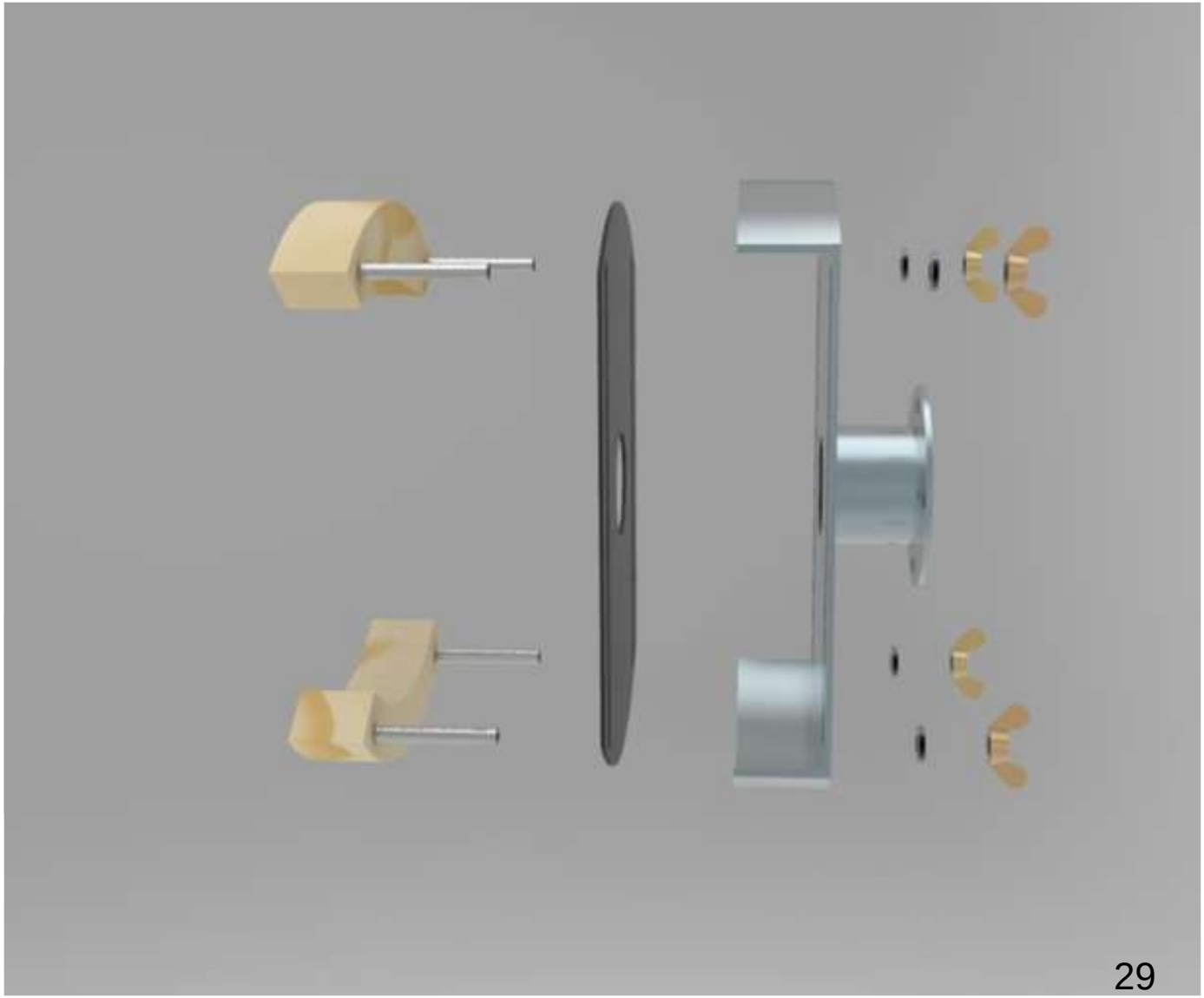
Concept B

Bottom view

Concept B

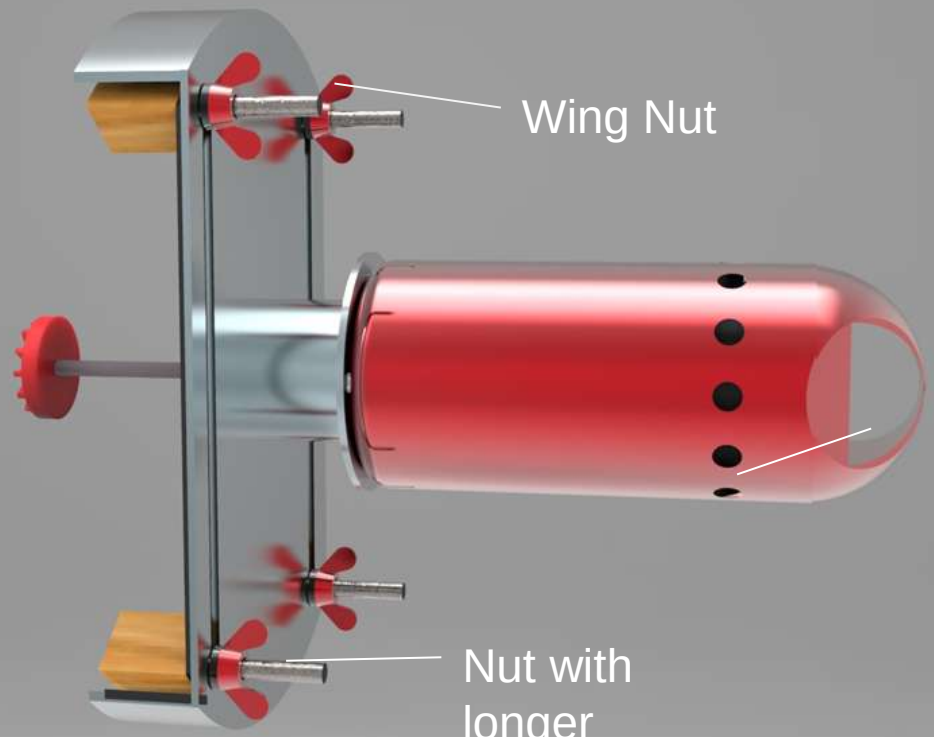
Materials Used:

Mild Steel: 2mm
Wood
Rubber gasket

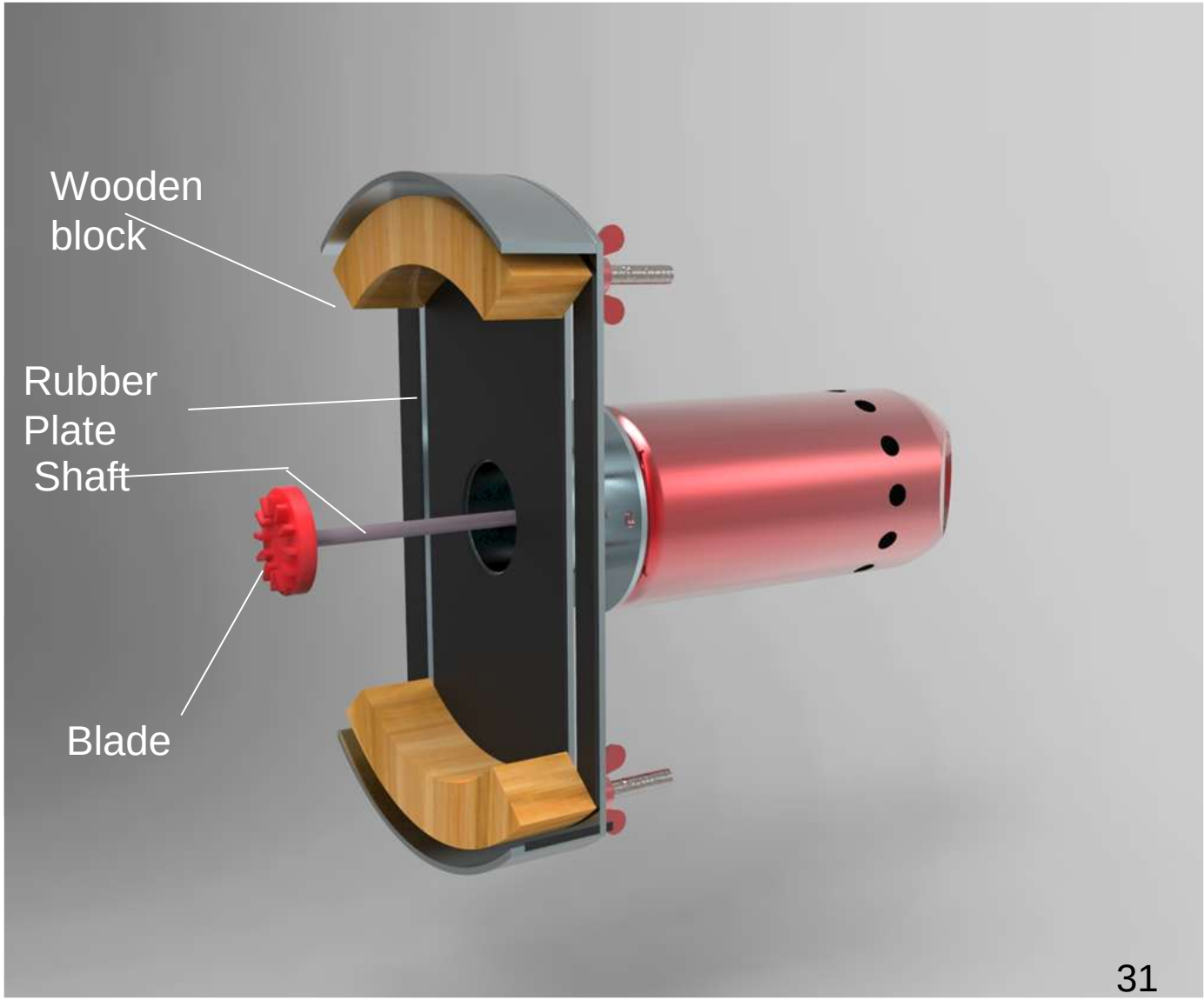


Concept B

Assembly

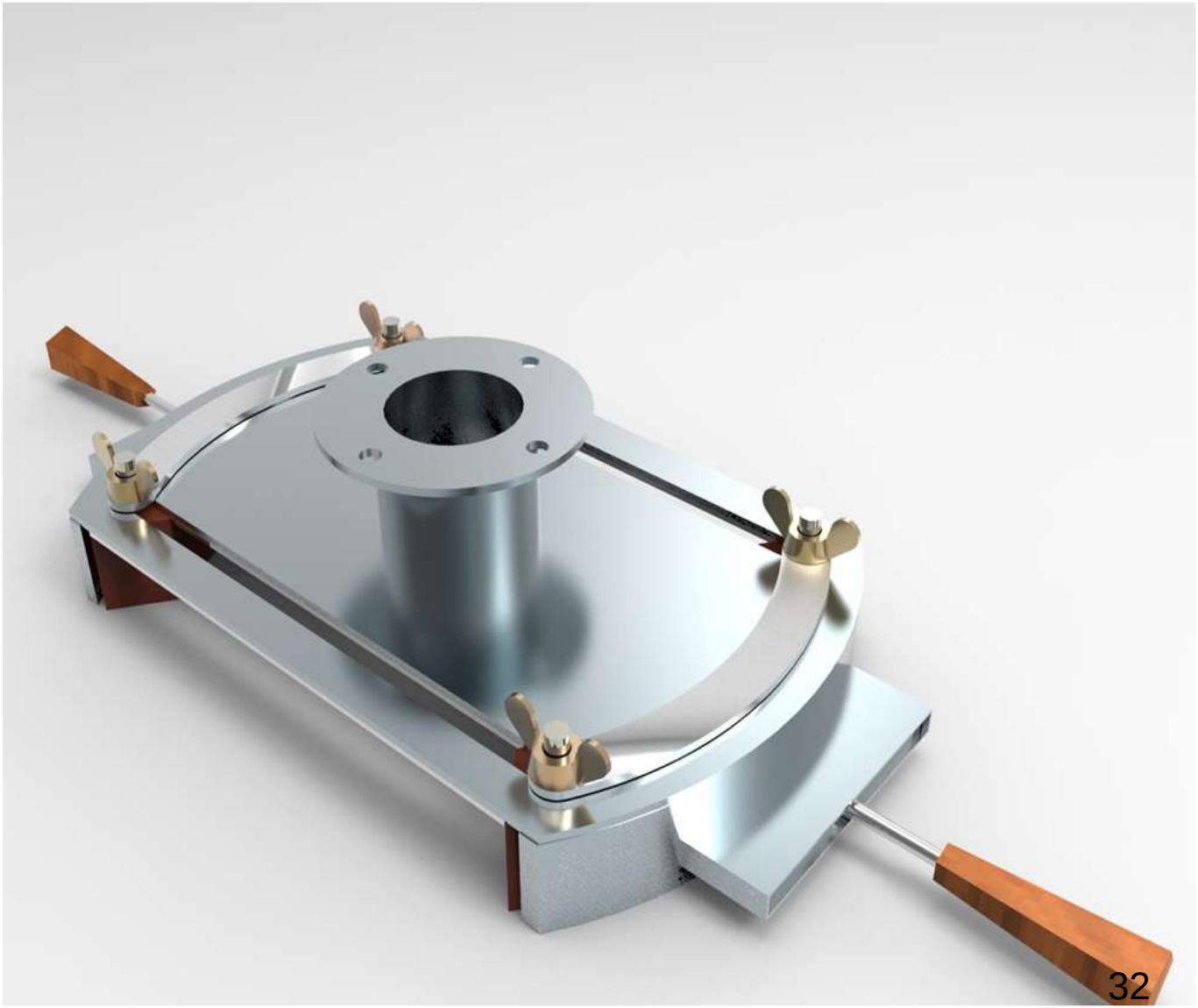


Concept B

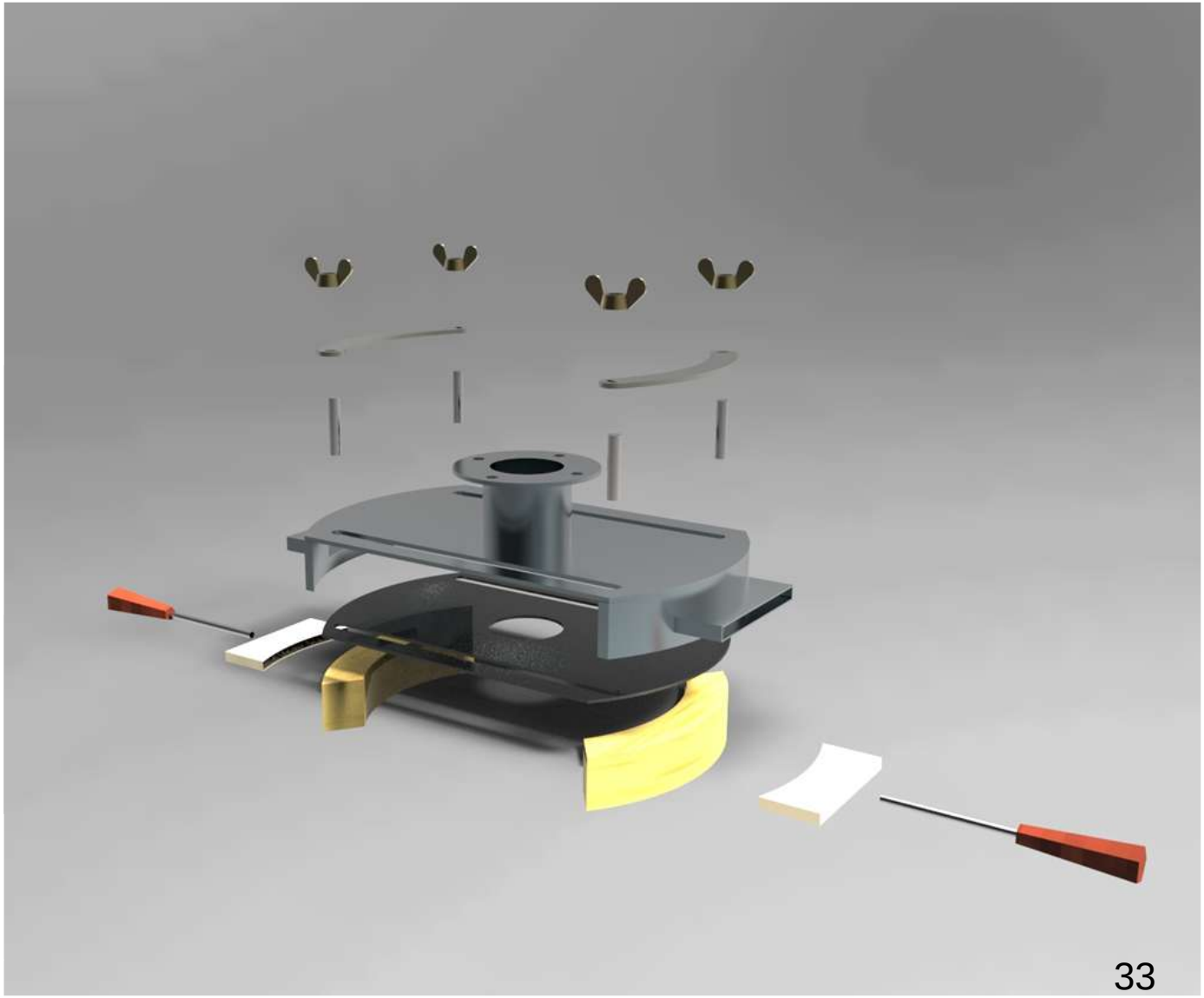


Third Concept

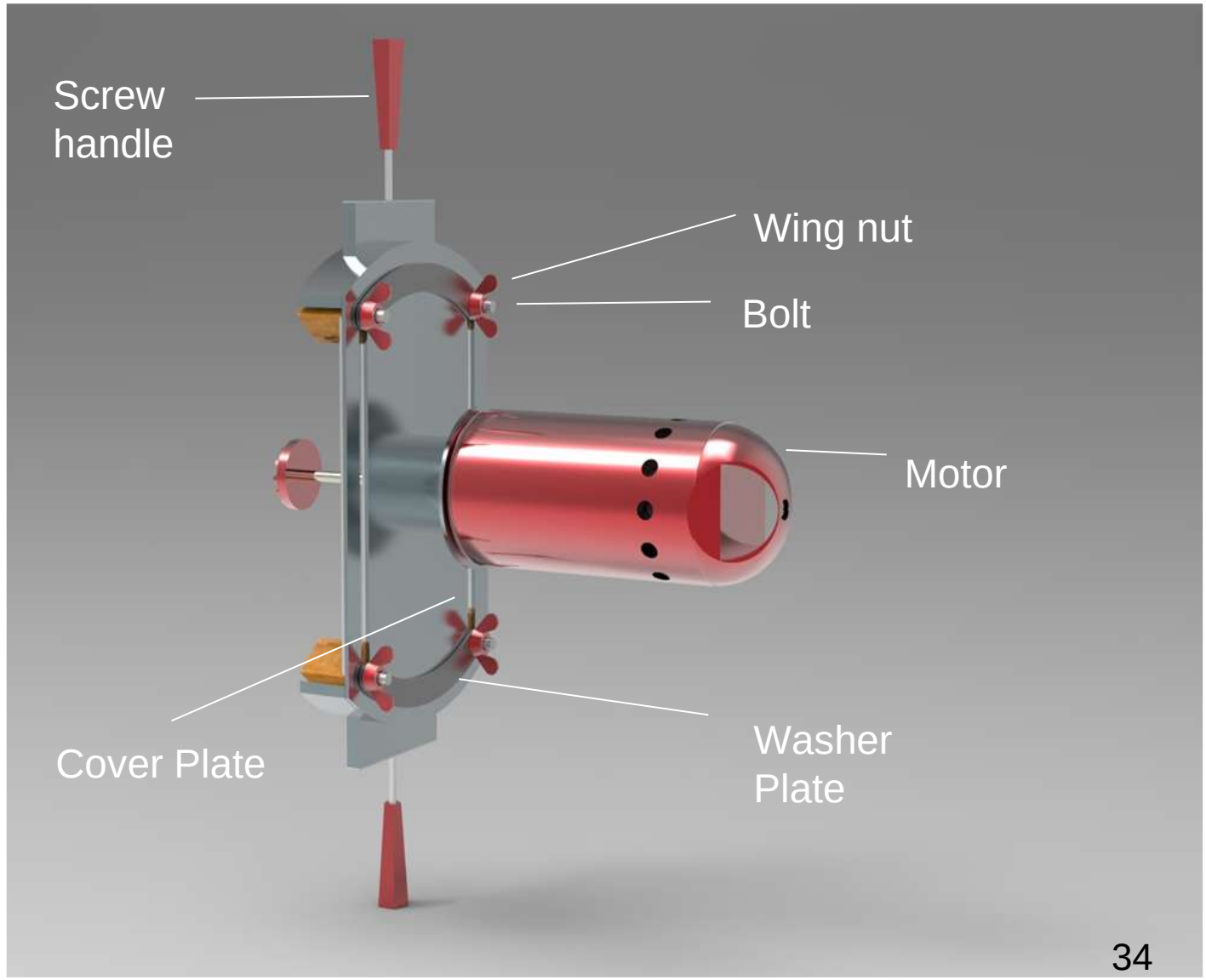
The third concept is an improved version of the second concept in which more emphasis was given on the stability of the motor.



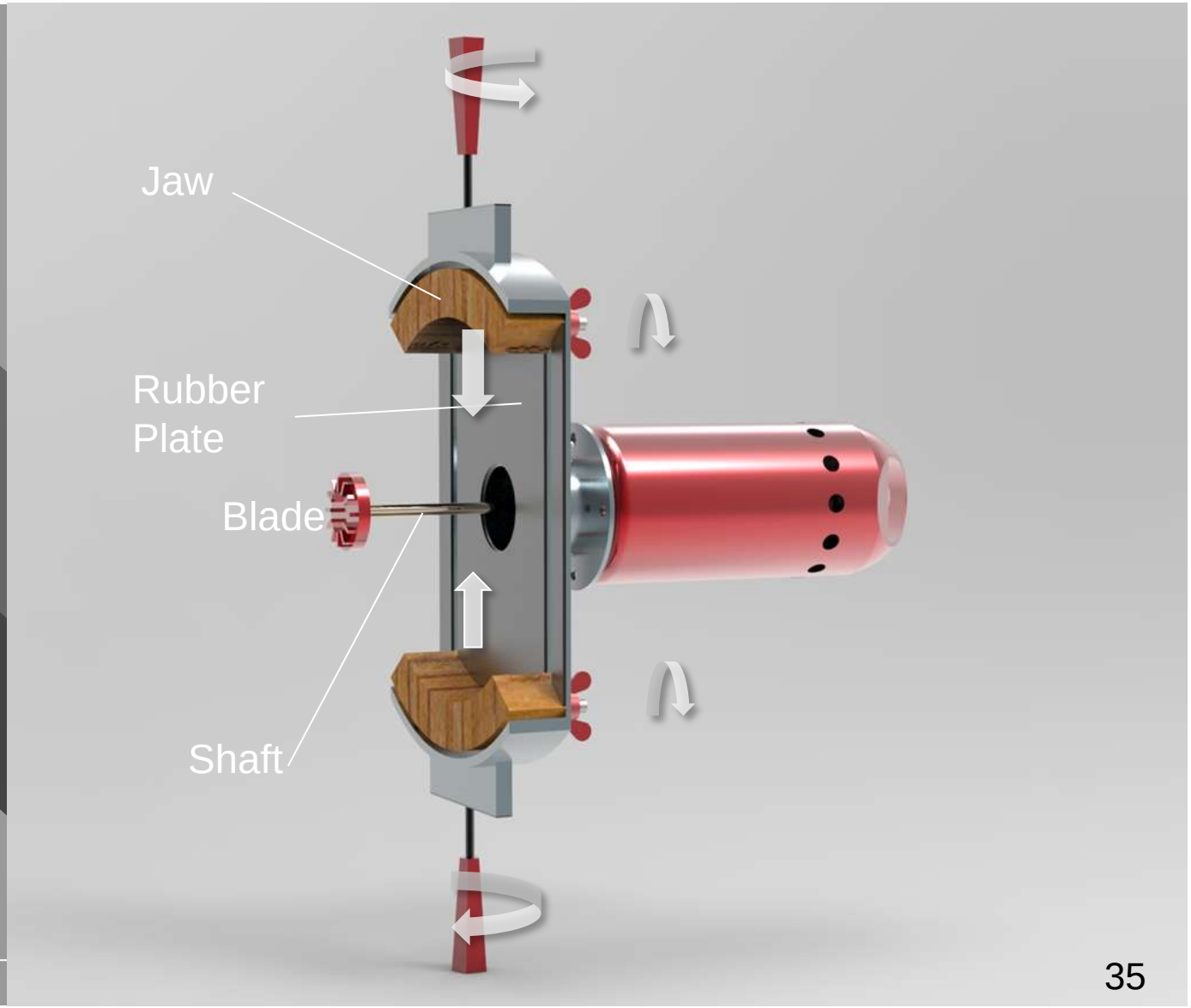
Concept C



Concept C

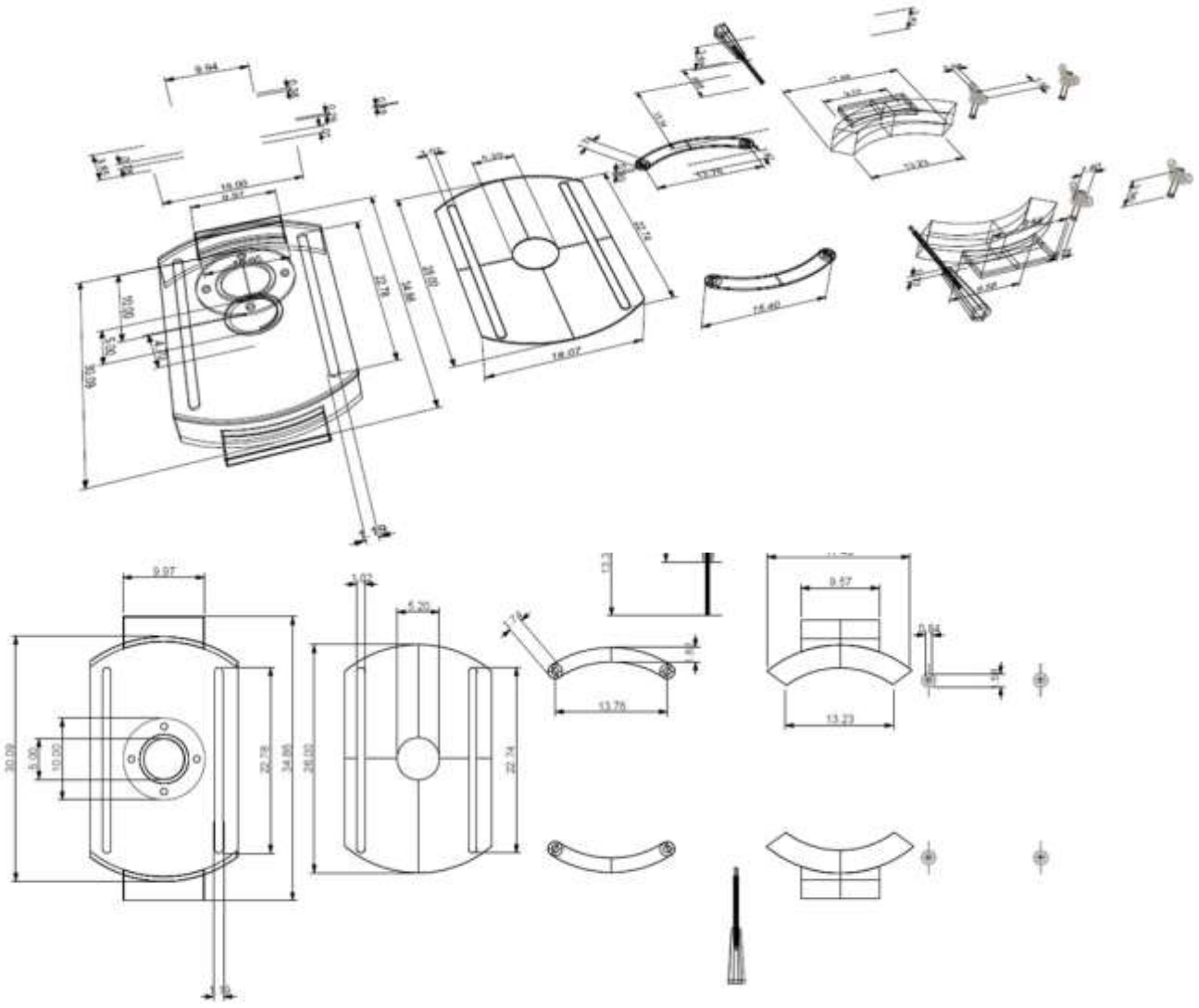


Concept C



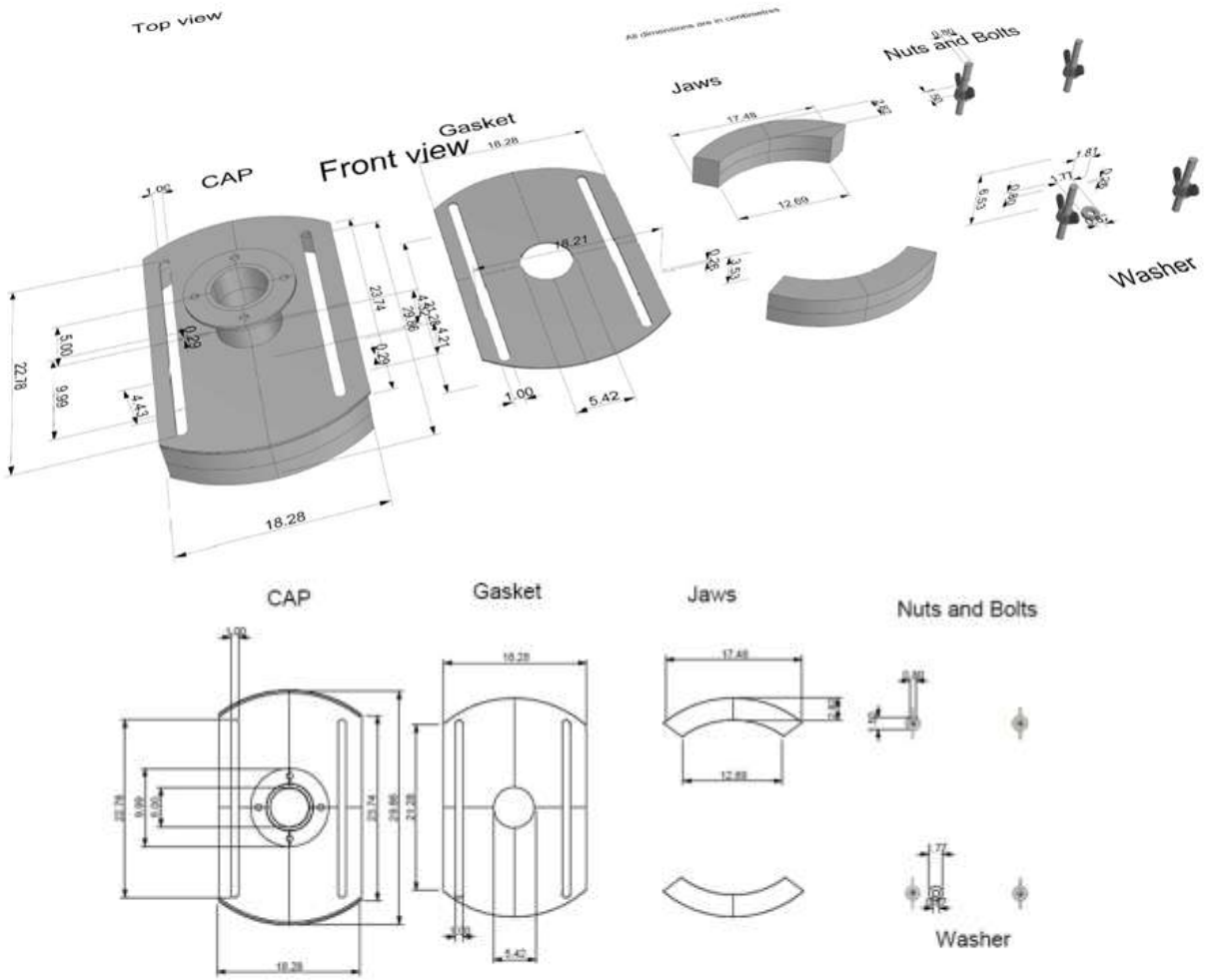
Prototype specifications

3D exploded view
And top exploded view
Of concept C



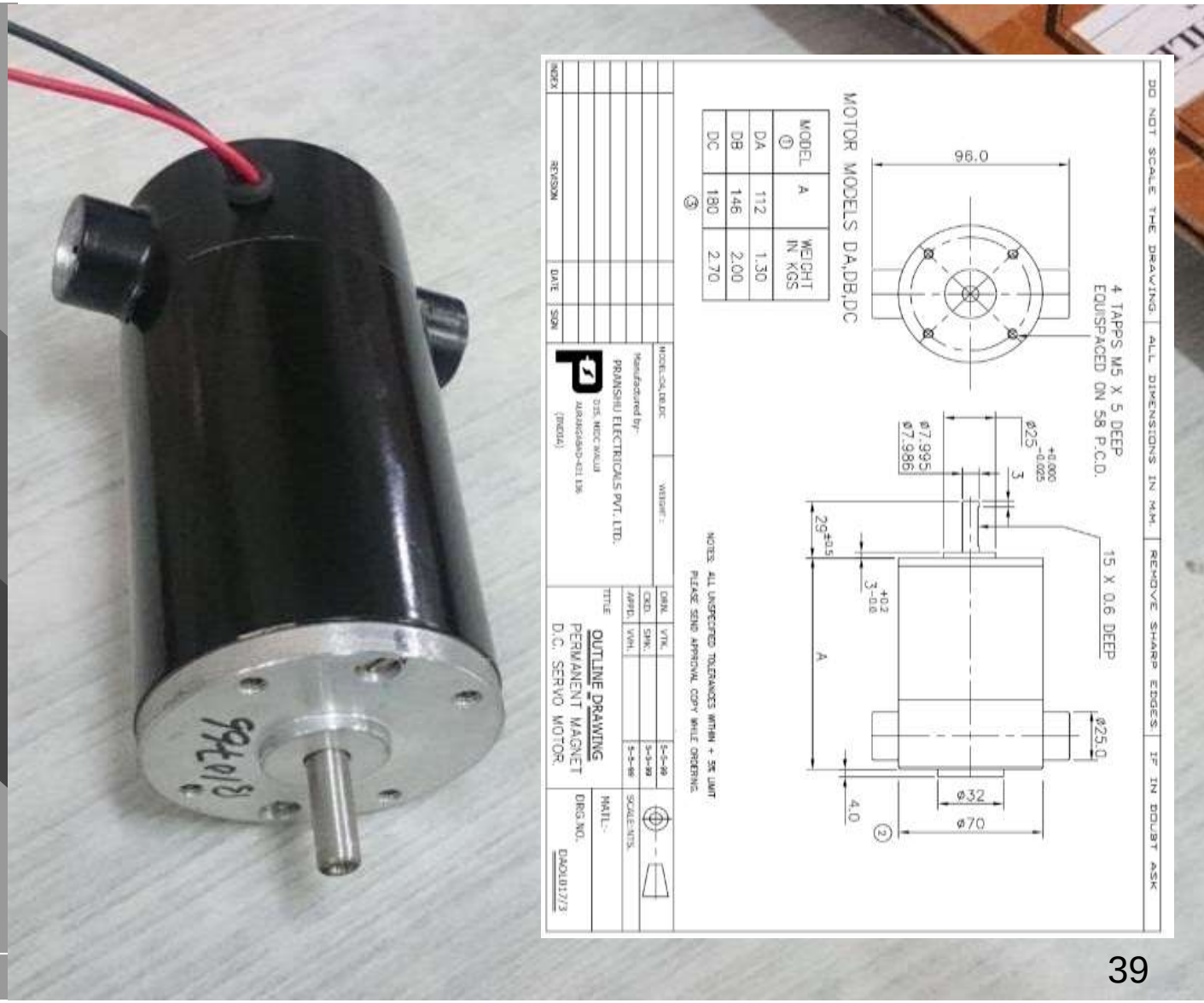
Prototype specifications

3D exploded view
And top exploded view
Of concept B



Motor specificat -ions

The motor is an half horse power DC powered motor
The motor has planetary gear transmission for high torque and better efficiency



Prototyping

Local fabrication was used to make the proof of concept.
This particular model was made in 2 mm mild steel
The currently model which is being developed is made in stainless steel.

Prototype

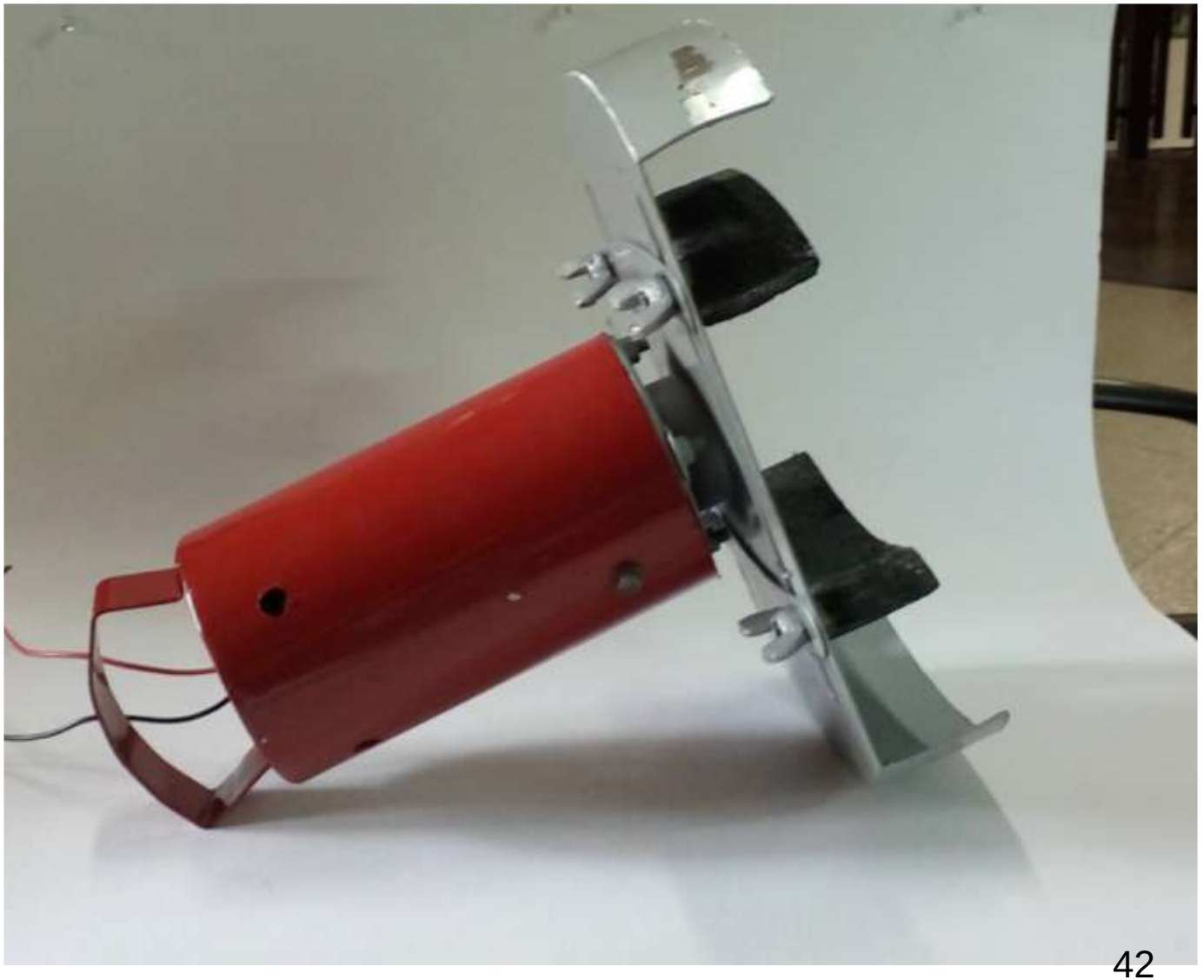
The overall manufacturing cost:

Material cost (MS):Rs.300
Machining cost : Rs.800
Painting cost : Rs.600
Labour cost : Rs.500
Total: Rs.2200

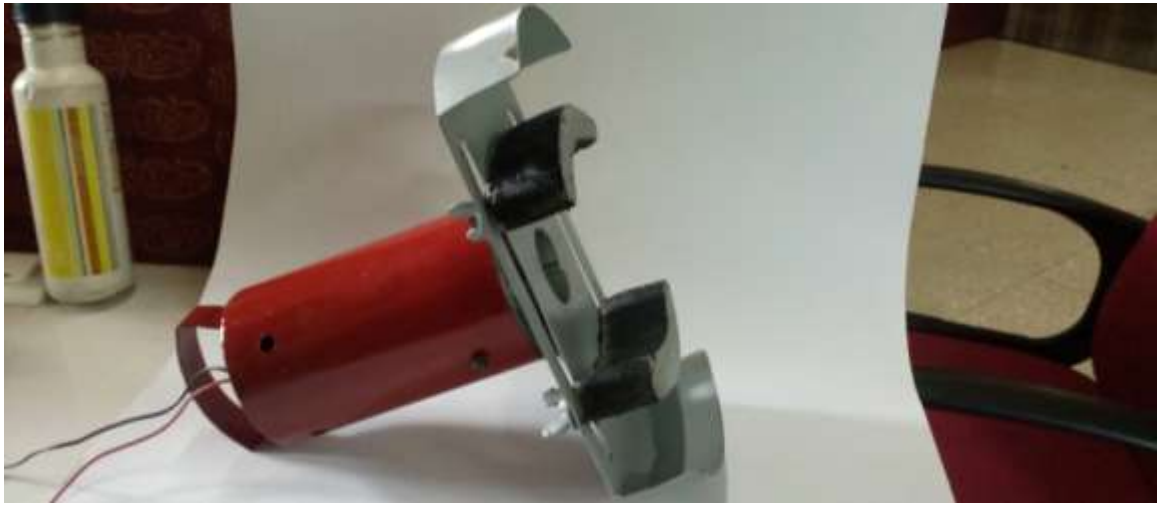
Prototype

Estimated cost for the prototype in SS:

Approx : Rs.2400



Prototype



Features

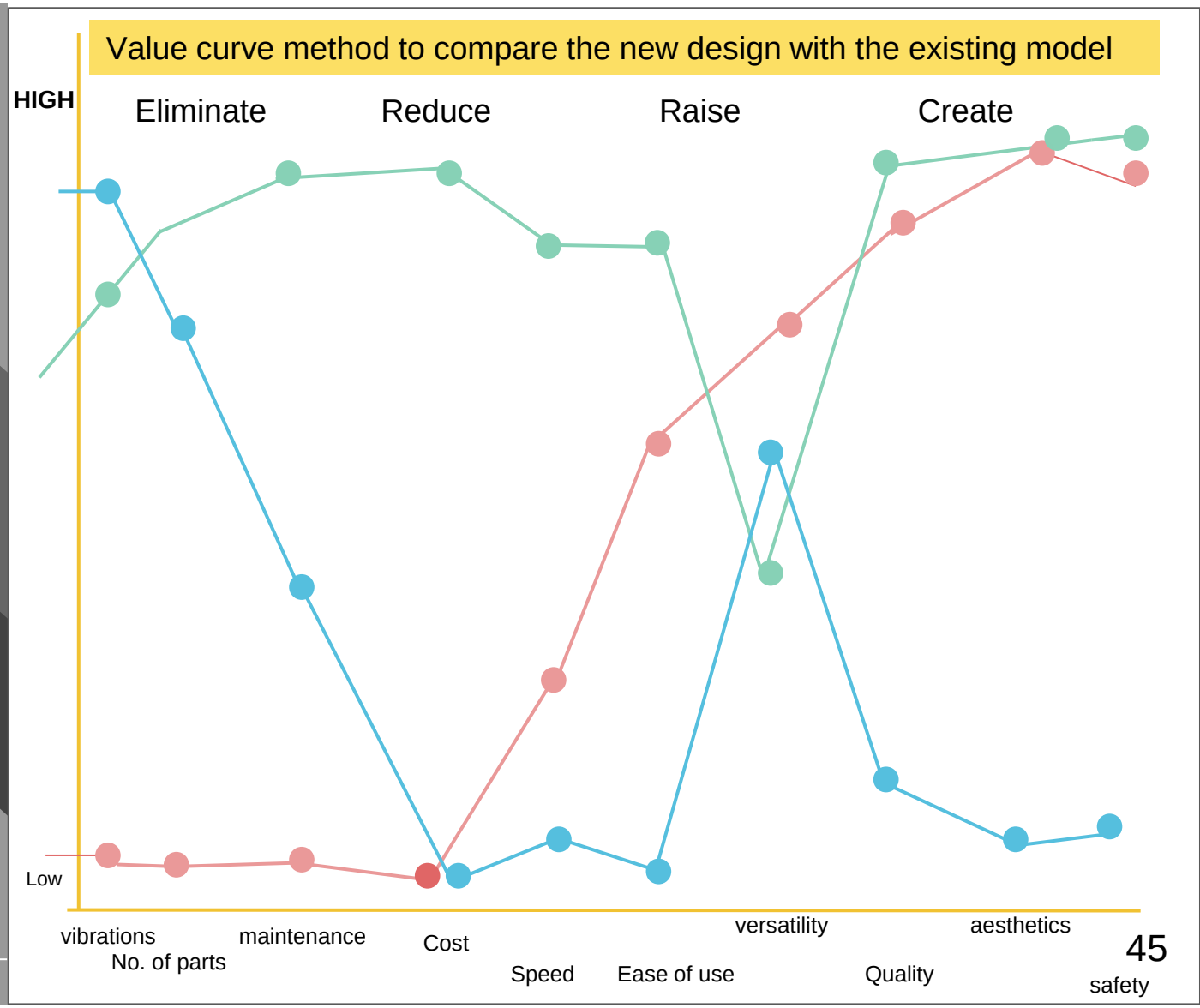
- Mild steel body, simple design and hence easy to operate and service.
- Width adjustment possible for small and large vessels
- Less number of parts
- It is designed to accommodate any type of vessel with any size, which makes its versatile for various purposes
- It can be used for personal as well as commercial use
- Low vibration because of proper weight distribution
- Easy to maintain and clean
- Almost zero spillage
- It can work on battery with DC supply, very useful incase of power cuts specially in rural area
- Simple and robust design

Value Curve

Existing model

First prototype

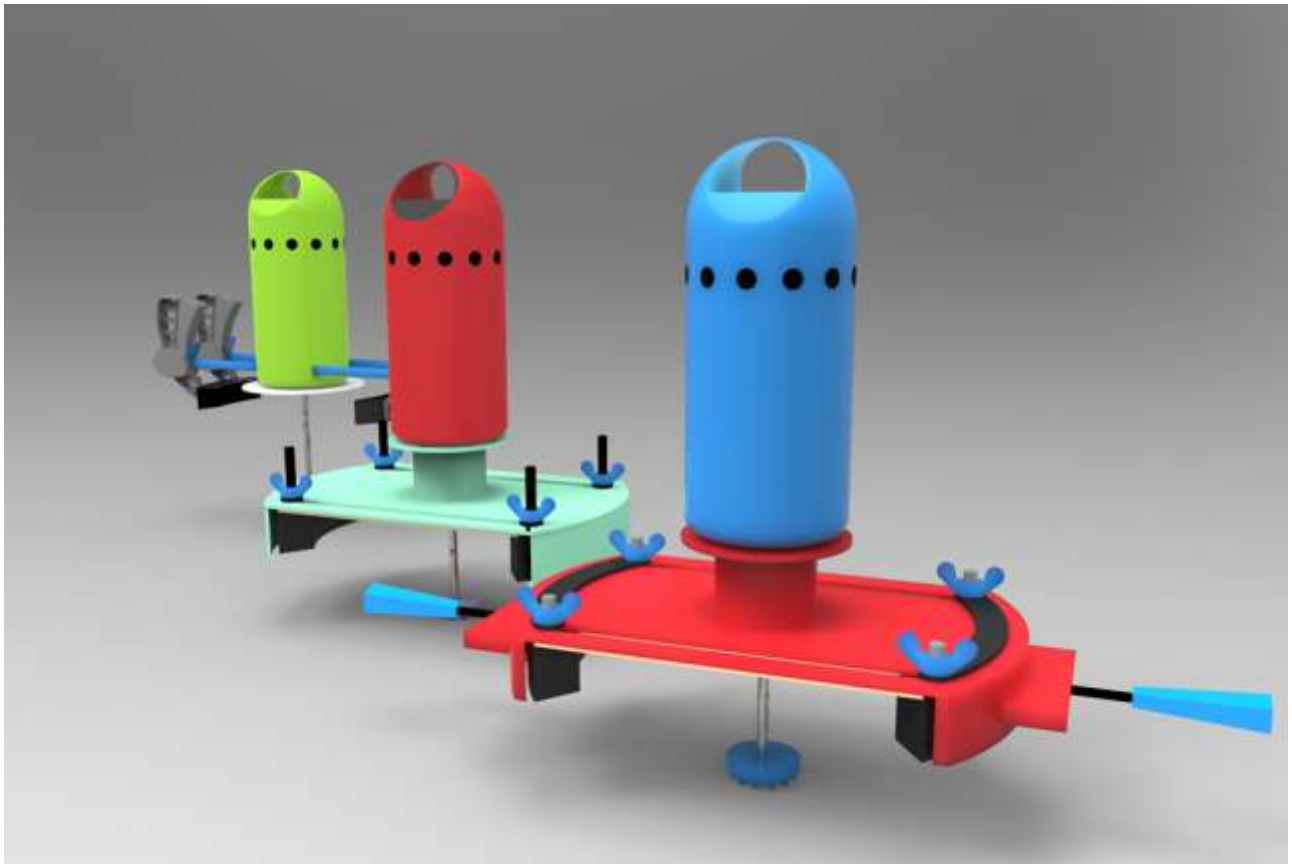
New Design



Product Placement

- Basically product was designed for household purpose, but the innovative design makes it useful for various purposes such as commercial purposes..
- Apart from that, the product can perform various functions such as chopping, cutting, grinding and blending which makes it versatile

Color options



Future Modifica-tions

1. Replacing the nuts and bolts screw thread to hold the motor cover to the clamp, making it easier to maintain and service (material suitable: Mild steel)
2. Reducing the groove length and making four smaller groover instead of two,for better load distribution of the body
3. Speed control knob for variable rotational speed of the churner
4. Replacing steel body with plastic body ,further reducing cost and making the device safer to use
5. Using battery kit in the device making it more portable to use
6. Designing different blades for the agitator for different uses
7. Making the design more ergonomical


Fin