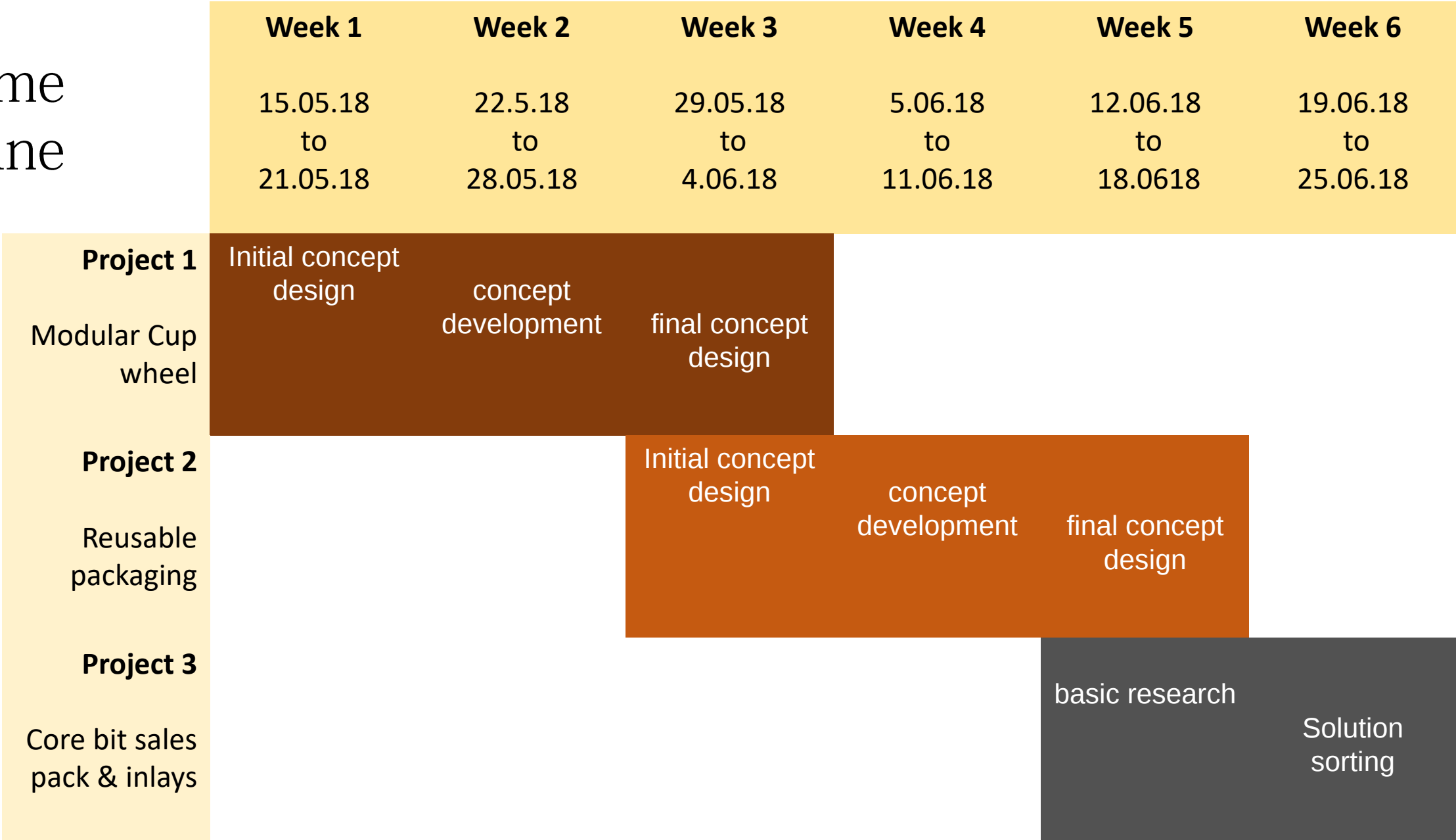


# SUMMER INTERNSHIP-2018

## P1

### REPORT

Time  
line



Project Title

“Modular cup wheel with quick change  
mechanism”



# Project Objective

To design **a cup wheel with change mechanism of the base body** from the insert.

It should be **quick change**.

The modular design should be **robust and stable** as cup wheel runs at rpm of 11000 which is close to 80 m/s.

The first and foremost requirement is regarding the **safety of the cup wheels**.

We also want to explore the possibility of different base material for the body such as carbon fiber, PEG with the objective of **weight reduction**.

From the customer perspective, it will **reduce the inventory** at his end and can use same base for multiple applications like grinding, finishing and abrasive cup wheel.

As a company we will be the first **one in market to offer modular cup wheels** which will give us a differentiation in the market and increased sales.

# Project scope

The project will be covering current 125 SPX wheels used on AG 125-13S.

All the dimensional constraints should be kept in consideration while designing any prototype.

## Deliverable

The deliverable of the project will be robust prototype design for the cup wheels and simulated POC and comparison of the same with regular 125 SPX.

# Design Brief

## User Specific

- ◆ Benefits to the user- Versatility of tool by changing of base plate having different grades of grinding quality
- ◆ Major concerns- The base plate should not disengage on its own
- ◆ USP of the product – Modularity of use
- ◆ Formal qualities based on basic function- Aggressive
- ◆ Confidence building measures- Manual fastening and provision of visual informative manual on performance

## Functional Aspects

- ◆ Broad Product Specifications- It should be robust in operation, light in weight to carry and should allow quick engage/disengage
- ◆ Identify major subsystems- Driving head, Base plate, Segments and Fasteners

Technical specifications for each module:

- A. Control- RPM (11000 rpm), fasteners (standardized), cooling holes & heat sink provision
- B. Dimensional constraints- Maximum height, maximum and minimum diameters, maximum and minimum thickness
- C. Consumables- Compressed air or water circulation

## Investment Specific

- ◆ Product variations/derivative products planned- Different grades of segment facilitates different operations
- ◆ Servicing issues- Cleaning with compressed air or water jet
- ◆ Standard parts, assemblies' etc. That are to be used in the product.

## Production Specific

- ◆ Target costs- possibly lower than the present cup wheel

# RESEARCH

## Insights

- A cavity necessarily hubs the cup wheel
- The suction is aided by the grooves on the cup wheel body
- The contact of brushes with the surface aids the vacuum cleaning of the dust
- The operator often try to lean over the tool to relax load coming on the arms
- Tool driven in random directions subjects lateral loads on the cup
- A specific spanner is designed to clamp/unclamp cup-wheel from the driving shaft
- The operator turns upside down the tool for changing the cup wheel

Reference to



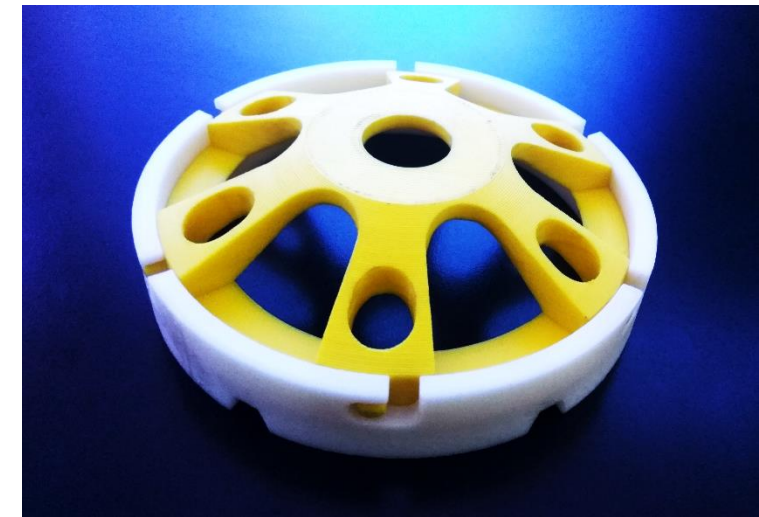
SPX 125 WHEEL



Concept B



Concept A



## Competitors

The product library had many samples of parallel products in market like **Bosch**, **Reca**, **CoreCut**, **Wruth**, **Samedia** majorly. These are mostly European brands.



The product library

# B R A I N S T O R M I N G

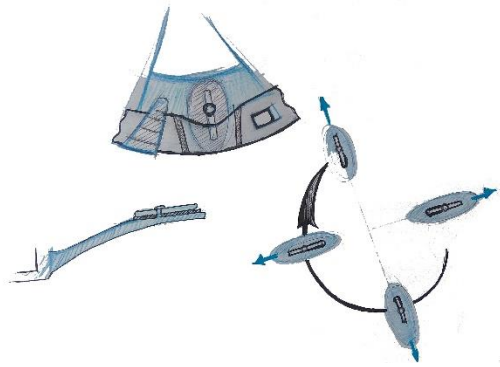
Catch  
Grip  
Snap  
Push-pull  
Click  
Discharge  
**Webs**  
**Pitch**  
Wrap  
Load  
**Magnet**  
**Spring**  
Elastic  
Bounce  
**Expand**  
**Skeleton**

Groove  
Launch  
**Flexible**  
Hug  
Bite  
Cling  
Weight  
Heavy  
Turbine  
Yo-yo  
**Beyblade**  
**Screw**  
Punch  
Chain  
Belt  
**Slide**

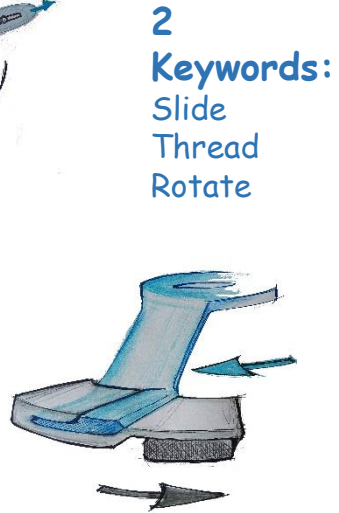
Ring  
Centrifugal  
force  
**Tighten**  
Rotate  
Clip  
**Thick**  
Suction  
Sweep  
Ring  
**Slide**

Clog  
**Fit**  
Latch  
Clamp  
Clutch  
Lock  
**Pins**  
**Cap**  
Tie  
Coil

# SKETCHING IDEATION



**1**  
**Keywords:**  
Centrifugal  
Weights  
Slots  
Slide



**2**  
**Keywords:**  
Slide  
Thread  
Rotate

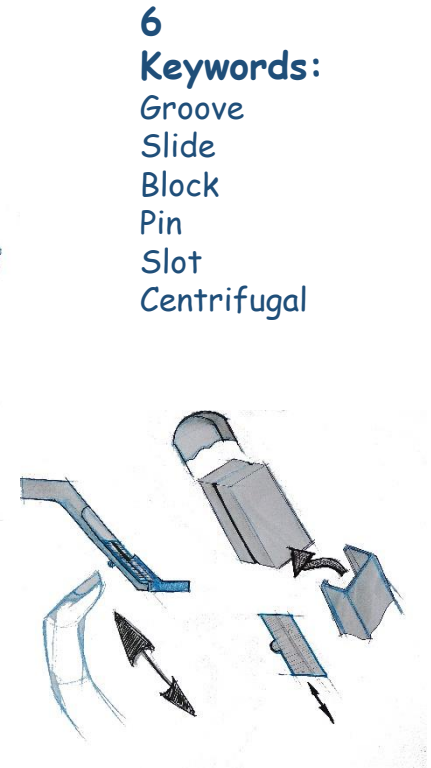


**3**  
**Keywords:**  
Nut  
Screw  
Spring  
Pins

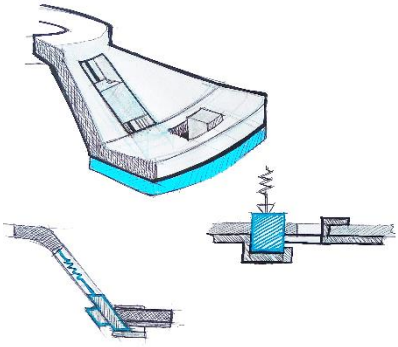
**4**  
**Keywords:**  
Nut  
Screw  
Thread  
Ring  
Fit  
Combine



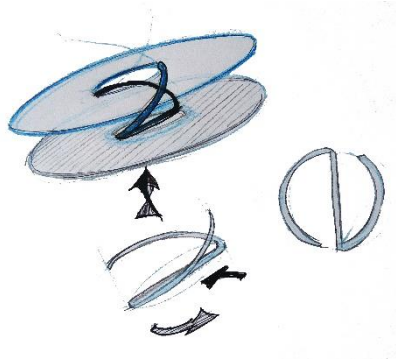
**5**  
**Keywords:**  
Skeleton  
Cap  
Fit



**6**  
**Keywords:**  
Groove  
Slide  
Block  
Pin  
Slot  
Centrifugal

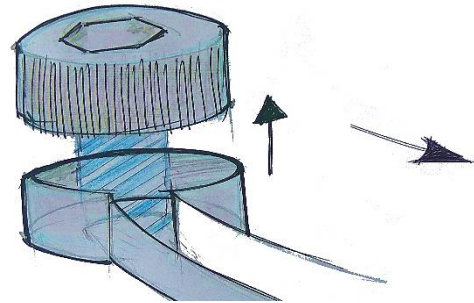


**7**  
**Keywords:**  
 Centrifugal  
 Weights  
 Slots  
 Slide  
 Groove

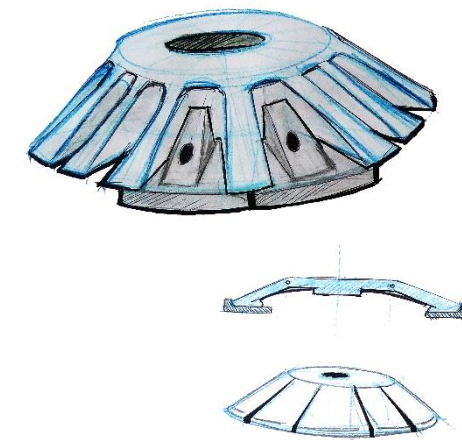


**8**  
**Keywords:**  
 Helical  
 Coil  
 Slide  
 Groove  
 Spring

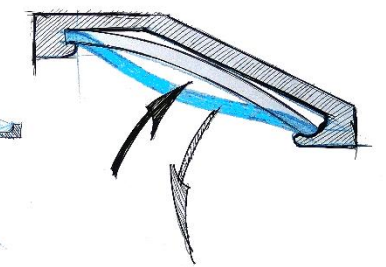
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 Pitch  
 Screw  
 Thread  
 Slots  
 Slide  
 Groove

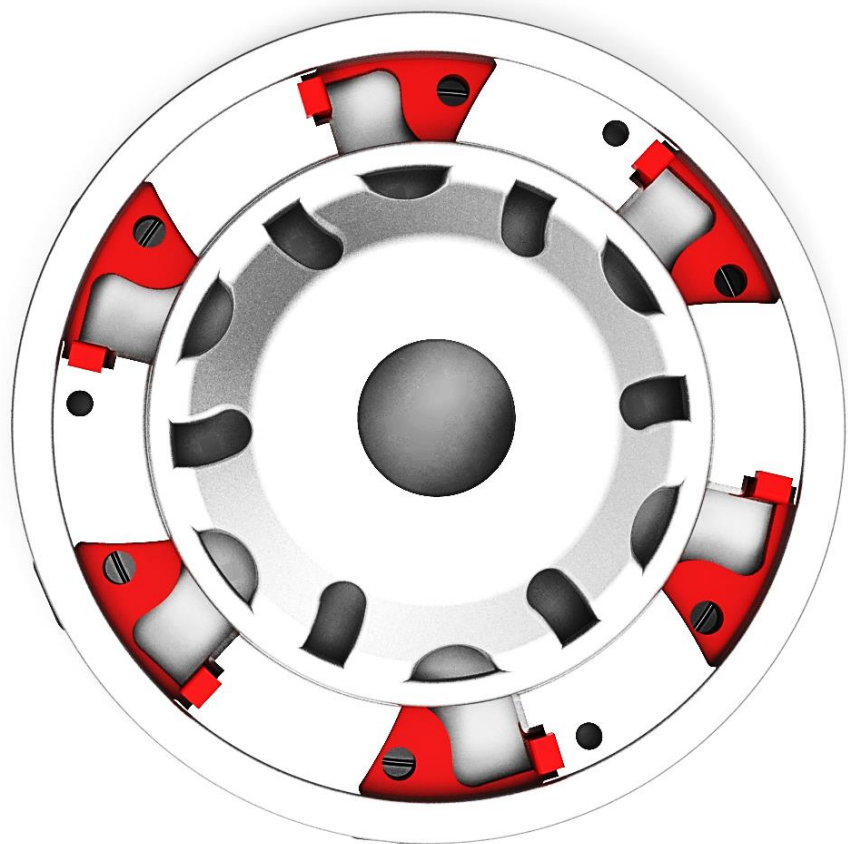
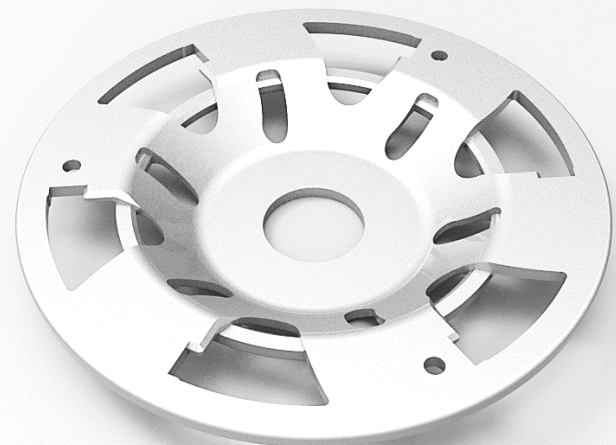


**10**  
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 Webs  
 Combine  
 Slots  
 Fit  
 Groove



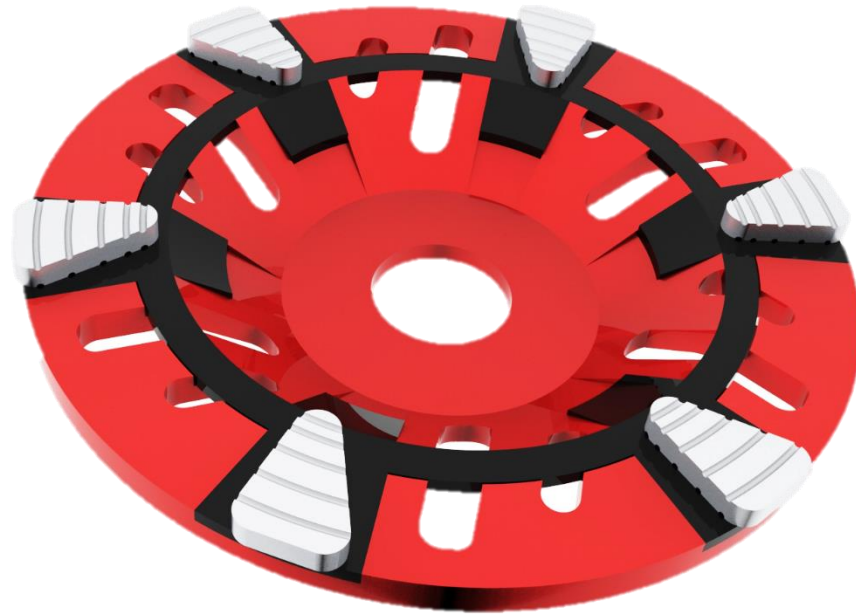
**11**  
**Keywords:**  
 Spring  
 Flexible  
 Coil  
 Elastic  
 Bounce  
 expand



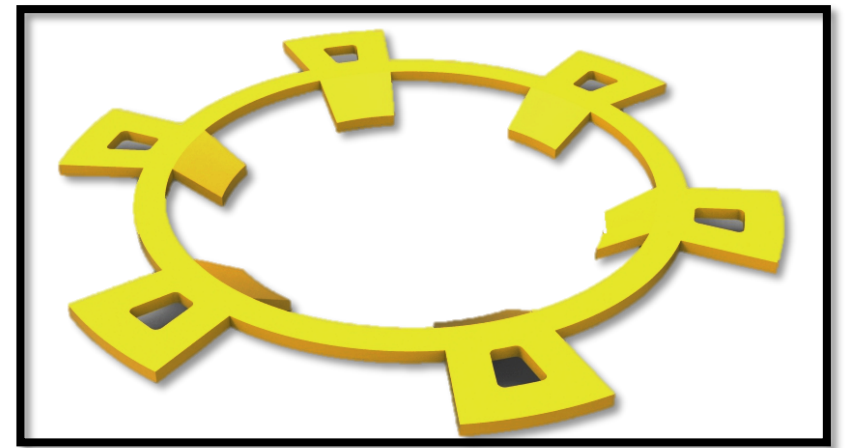


CONCEPT 1



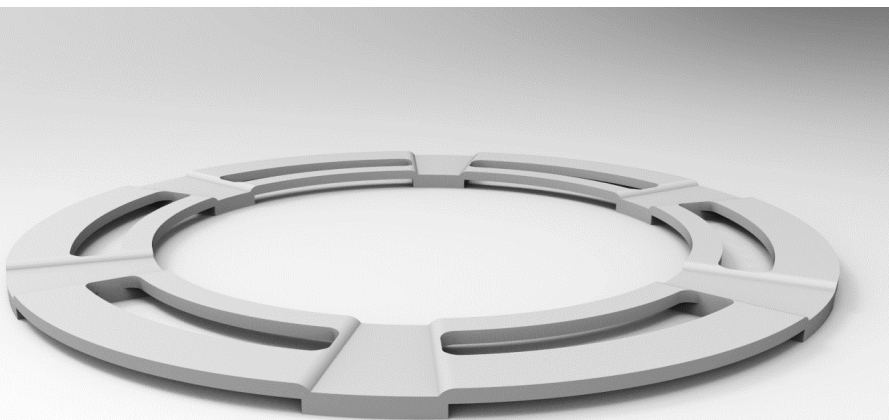
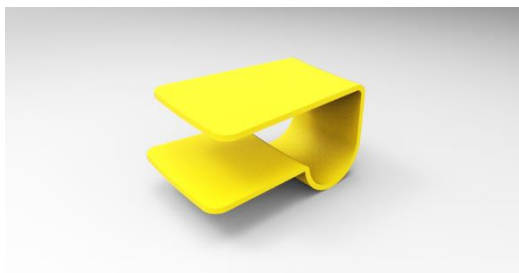


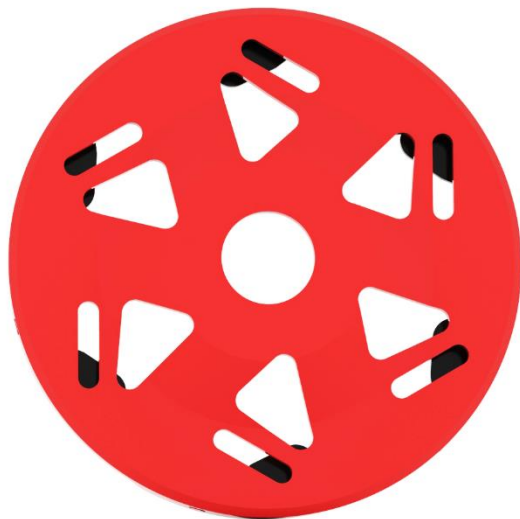
CONCEPT 2



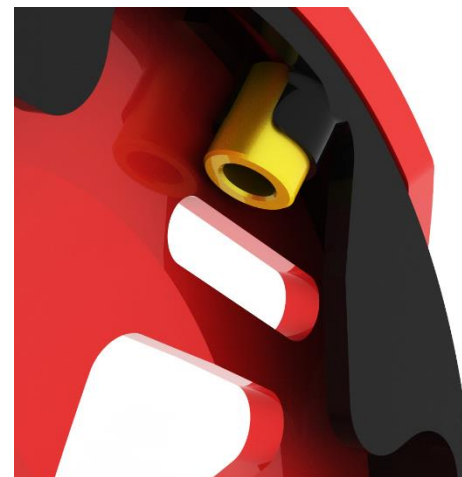


CONCEPT 3



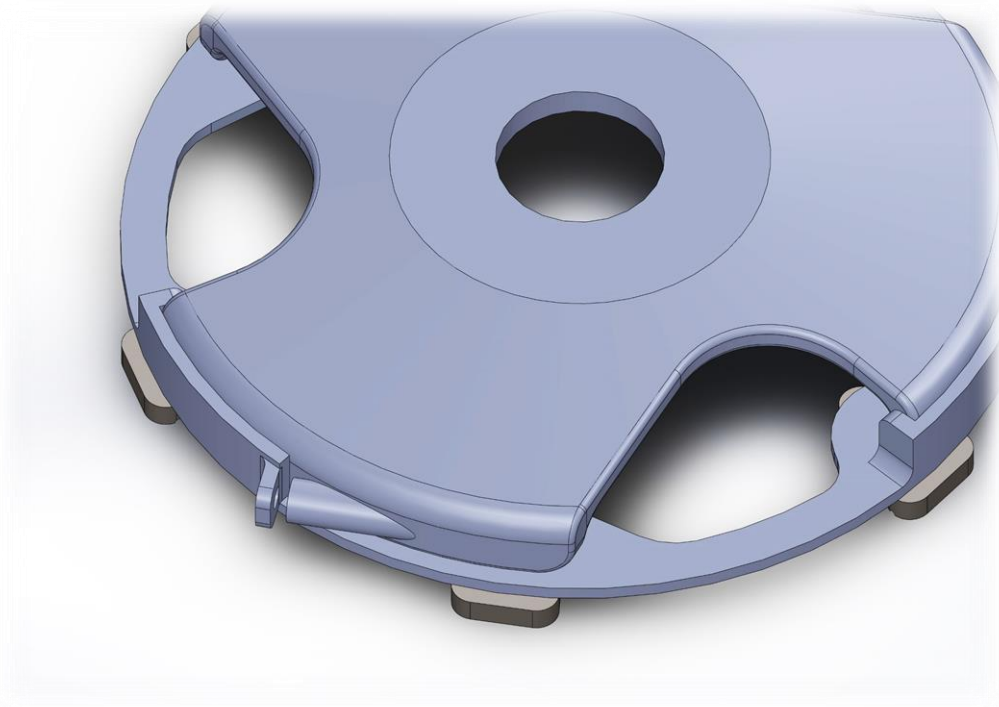


CONCEPT 4





CONCEPT 5



CONCEPT  
EVALUATION

| CRITERIA                    | CONCEPT VARIATIONS |           |           |           |           |
|-----------------------------|--------------------|-----------|-----------|-----------|-----------|
|                             | Concept 5          | Concept 2 | Concept 3 | Concept 4 | Concept 1 |
| Safety of cup wheel         | 0                  | -1        | -1        | 0         | 0         |
| Light weight                | 1                  | -1        | 0         | -1        | 0         |
| Robustness                  | 1                  | 0         | -1        | -1        | 0         |
| Suitability to present tool | -1                 | 0         | 0         | 0         | 0         |
| Quick disengage             | 1                  | 0         | 1         | 1         | 0         |
| NET                         | 2                  | -2        | -1        | -1        |           |
| RANK                        | 2                  | 5         | 4         | 3         |           |
| CONTINUE?                   | YES                |           |           |           |           |

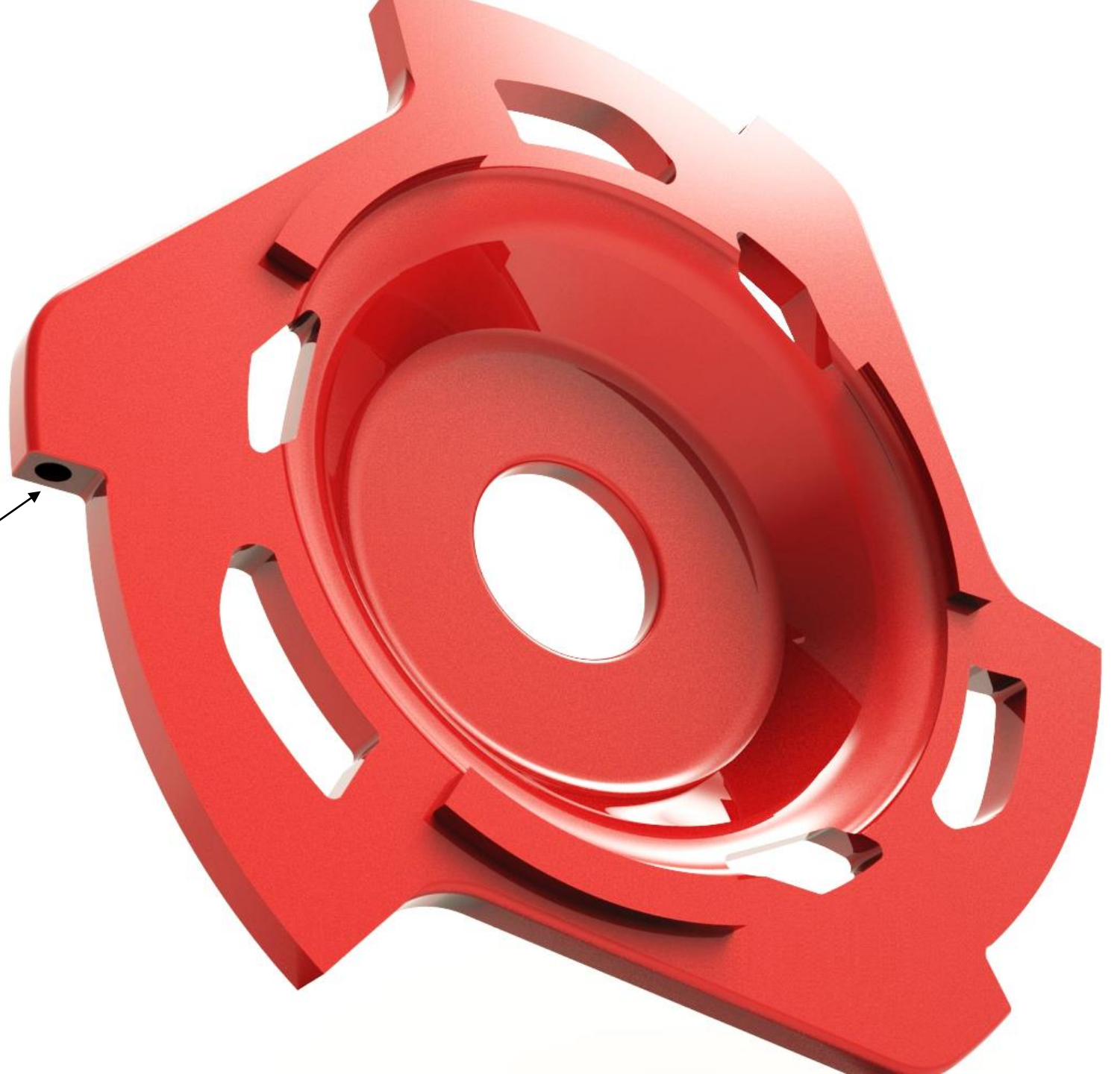
CONCEPT  
RATING

| CRITERIA                    | WEIGHTAGE | CONCEPT 1 |     | REFINED<br>CONCEPT |     |
|-----------------------------|-----------|-----------|-----|--------------------|-----|
|                             |           |           |     |                    |     |
| Safety of cup wheel         | 0.2       | 5         | 1   | 4                  | 0.8 |
| Light weight                | 0.2       | 4         | 0.8 | 5                  | 1   |
| Robustness                  | 0.2       | 5         | 1   | 4.5                | 0.8 |
| Suitability to present tool | 0.2       | 4         | 0.8 | 5                  | 1   |
| Quick disengage             | 0.2       | 3         | 0.6 | 5                  | 1   |
| TOTAL                       |           |           | 4.2 |                    | 4.6 |



FINAL  
CONCEPT

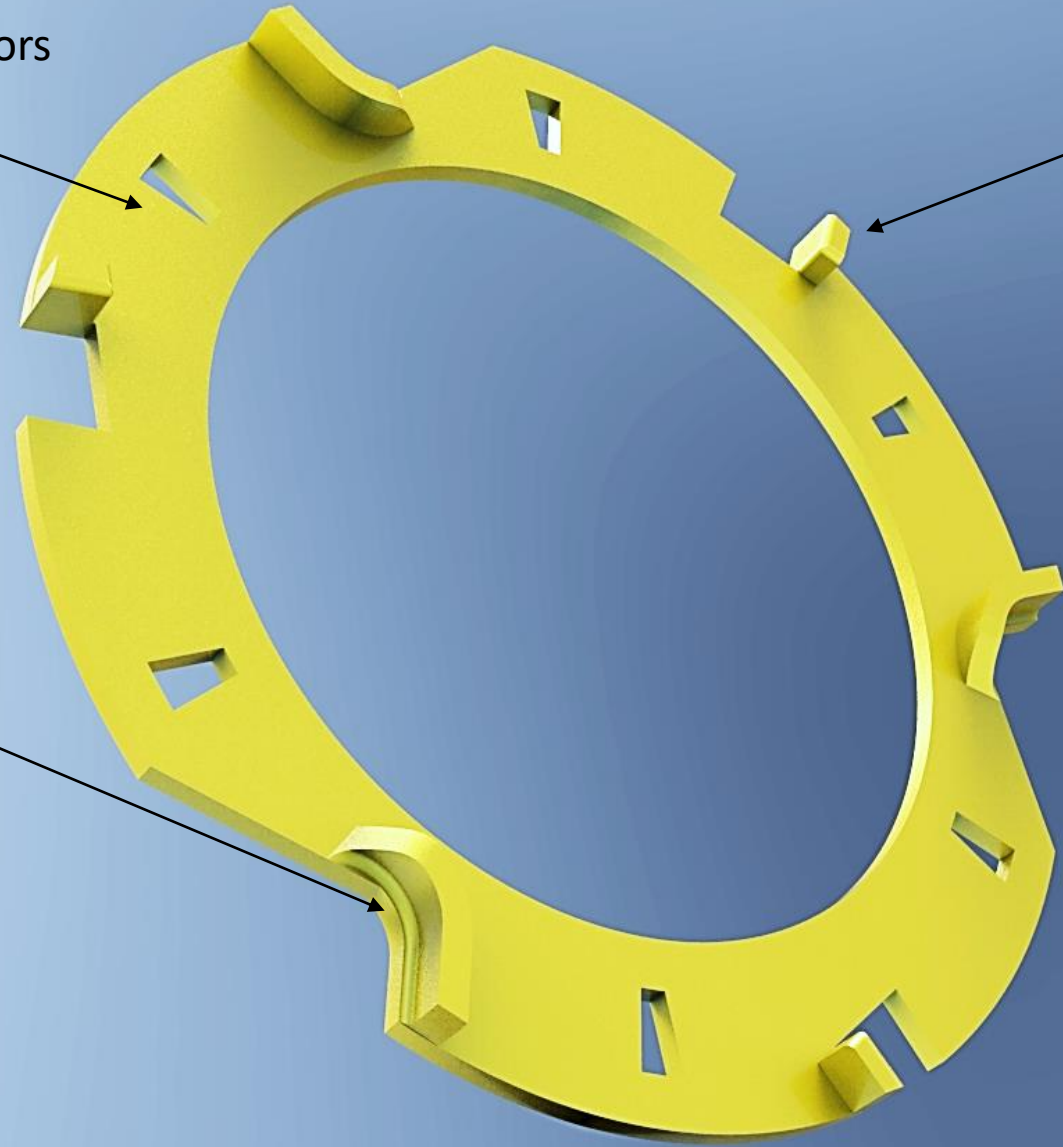
Hole for inserts

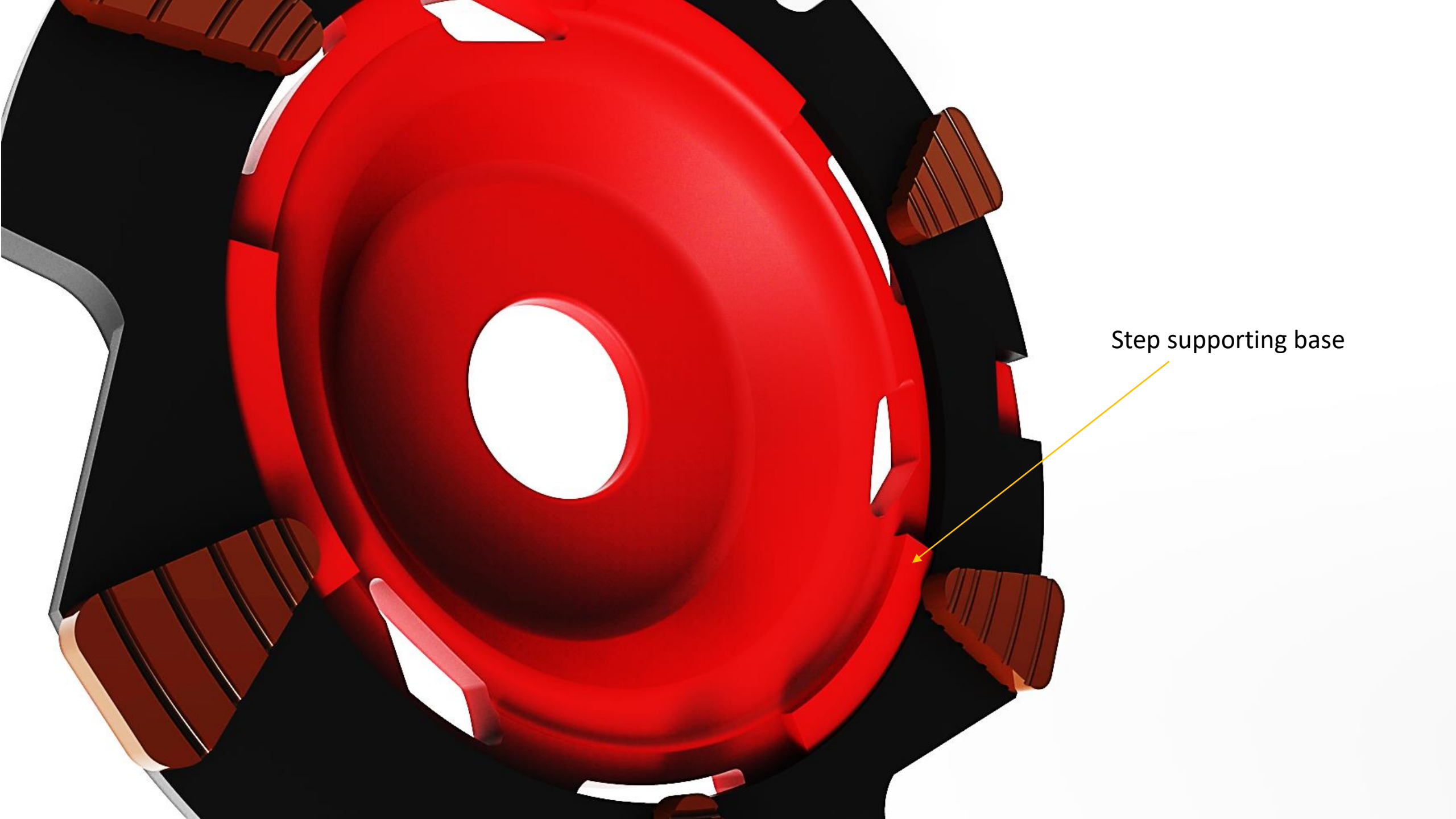


Heat vent and segment locators

Face for carrying fastener

Raised operating edge





Step supporting base



fastener



Form manipulation for function

FOLOWED BY

POC

Final design

Statement of limitation

# Project Title

Reusable packaging design concept  
for 130 SPX Cup wheel.



# Project Objective

The objective of the project is **to design reusable package** for 130 diameter SPX cup wheel.

The package design should have reusable features by which **customer can reuse the same** package after application of cup wheel.

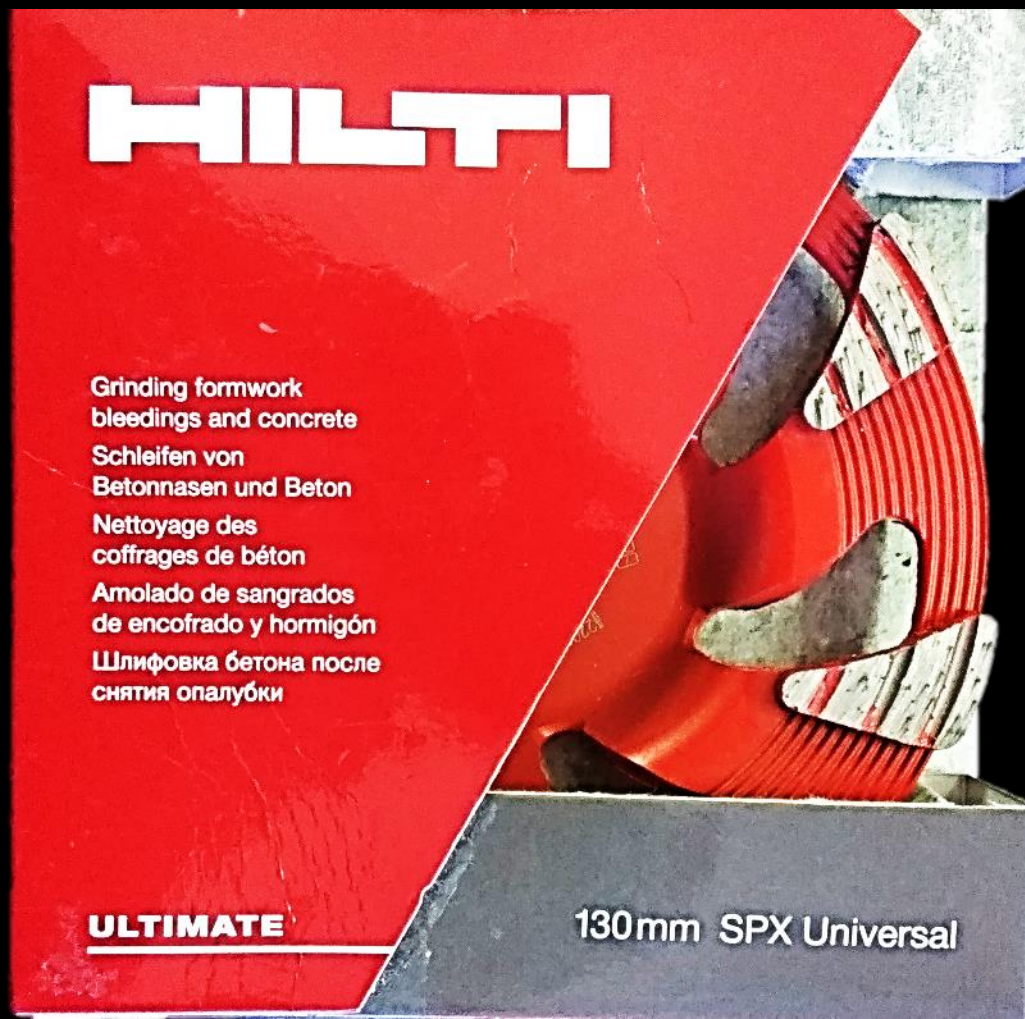
Reusable feature can be:

1. Pen/Mobile stand.
2. Tray/box to keep small things.
3. Convertible puzzle/game.
4. Display box.
5. Cup holder.

## Consideration

1. Package should have **euro hook for display** purpose in market.
2. Segment & blank portion should be **visible** to customer.
3. Package should be **printable or Sticker pasting applicable surface**.
4. **Manual/leaflet space** should be consider around 95mm (L) x 95mm (W) with 3mm thick.
5. Easy package **opening** to customer.
6. Easy package **assembly** for production.

# Referring to





1

A **ready to pack design** decreases the work space consumption and optimizes operators' movement.



2

**Pasting of stickers** with proper reference reduces manual effort for achieving precision and is time saving.



3

**Visible inner flaps** looks better without buckling.



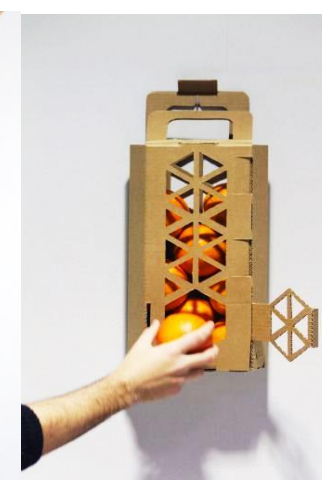
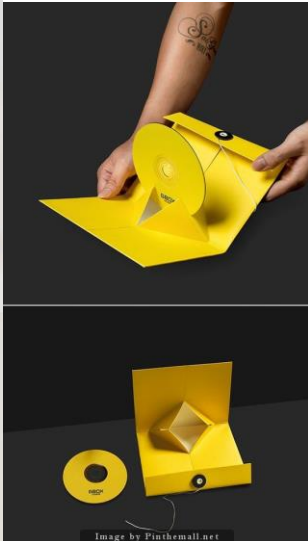
4

Certain **functional features** of packaging misleads operator.

# Insights



The Shopping Bag That Turns Into A Clothes Hanger



# Net search

# Parallel Products

BOSCH



2018-5-29 14:57

WRUTH



2018-5-29 14:57

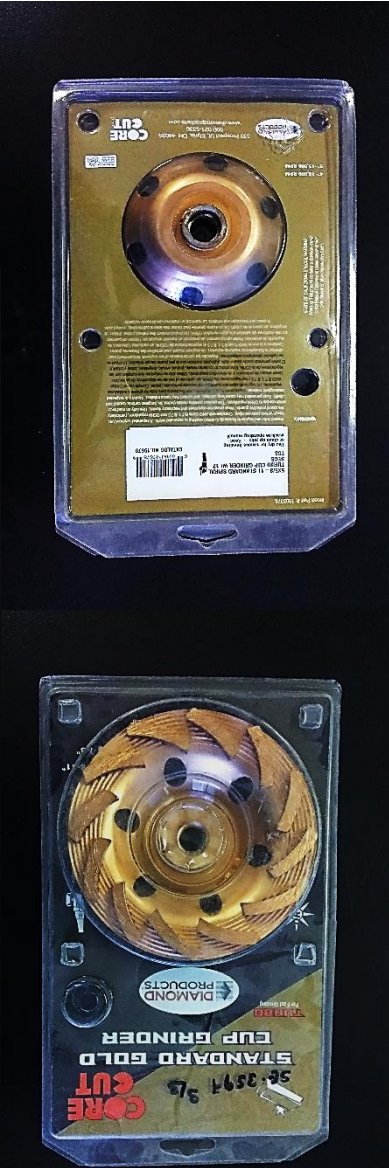
SAMEDIA



RECA



CORE CUT



# Design Brief

## USER SPECIFIC

- ♦ **Core benefits to the user**- added functionality to the packaging
- ♦ **Major concerns**- customers should not throw away the packaging or discard it
- ♦ **Micro environment**- may be office table, testing rig, field, and production line etc.
- ♦ **USP of the product**- reusable and ecofriendly packaging
- ♦ **User**- executive clients (**tertiary**), dealers (**secondary**), operator (**primary**)
- ♦ **Confidence building measures**- improving the moral of operator on assembly line by simplifying the packaging procedure.

## TECHNICAL SPECIFICATIONS

- ♦ **Consumables**- the product manual and the guidelines for how the packing turns useful.

## FUNCTIONAL ASPECTS

- ♦ **Identify major subsystems**- the packaging should have a dedicated space for given manual/leaflet.

## PACKAGING FEATURES RELATED TO

- ♦ **Safety**- the packaging should be recyclable if possible
- ♦ **Packaging transparency**- scope for displaying the product is must.
- ♦ **Functional**- the packaging should have added functionality which is going to be the USP of the packaging

## MARKETING SPECIFIC

- ♦ **What life is the packaging being designed for**- The product is being designed for 2-6 months of use
- ♦ **Transportation issues**- The packaging should easy to stack and should consume least possible volumetric space.
- ♦ **Product imagery and advertising**- majorly involve the base material indication, product specifications, logo, product serial code, instructions, barcode, and hologram

# BRAINSTORMING

Gamify  
Hobbies  
Popping  
Slide  
Inflate  
Swing  
Throw  
Colour  
Changing  
Magic

Portable  
Rotate  
Colourful  
Surprise  
Sound

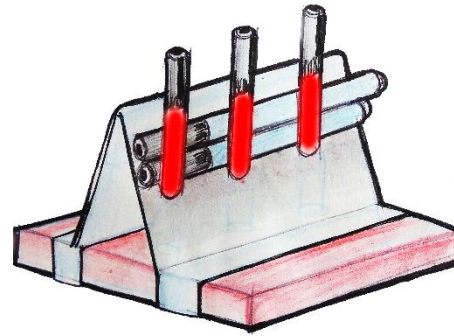
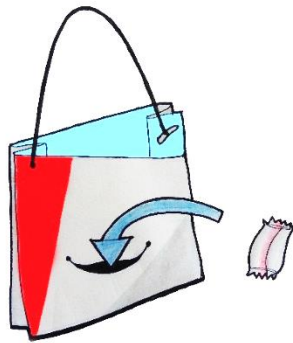
Graphic  
Fascination  
Curiosity  
Swing  
Share  
Storage

Wearable  
Association  
Transforming  
comfortable  
Button  
Routine

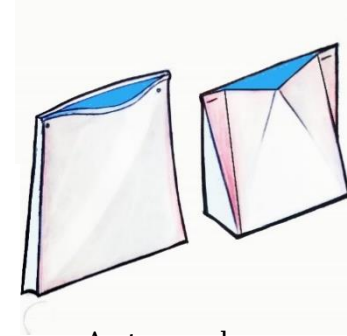
# SKETCHING IDEATION



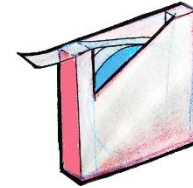
A collection bag



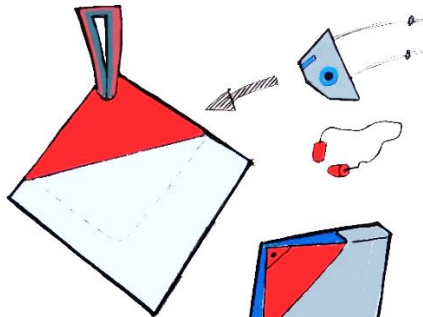
A pen stand



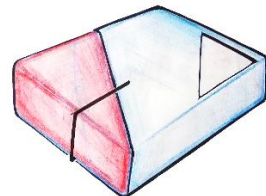
A storage box with self-closure



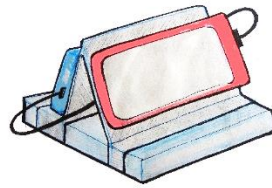
A tape dispenser



An accessory carrier



A travel storage box



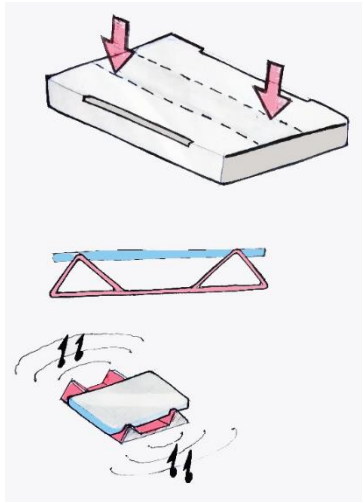
A mobile and power bank stand



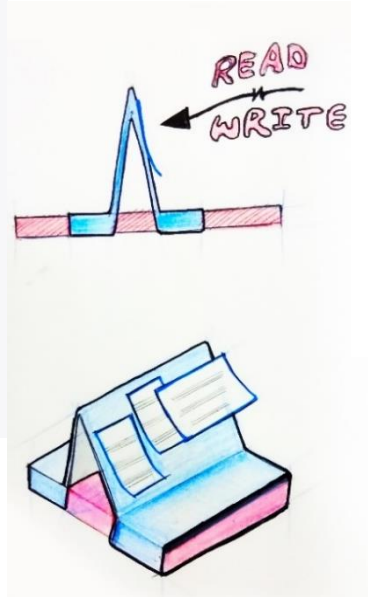
A calender



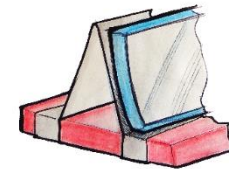
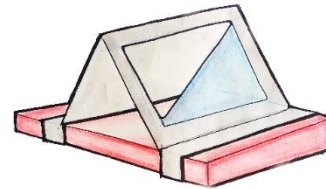
A Notice board



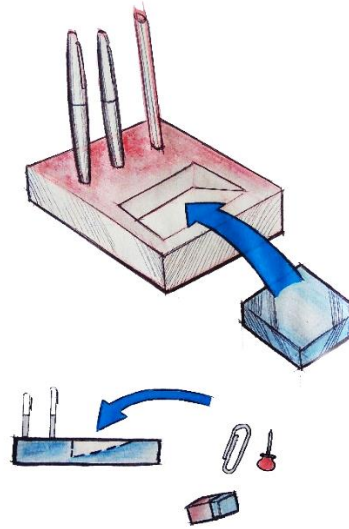
A sound amplifier



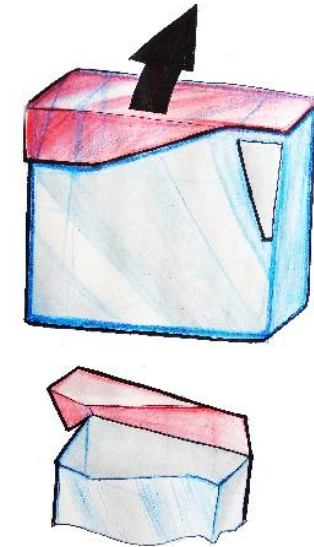
A posting board



A lamp cum mobile stand



A pen stand with accessible space for miscellaneous stuff



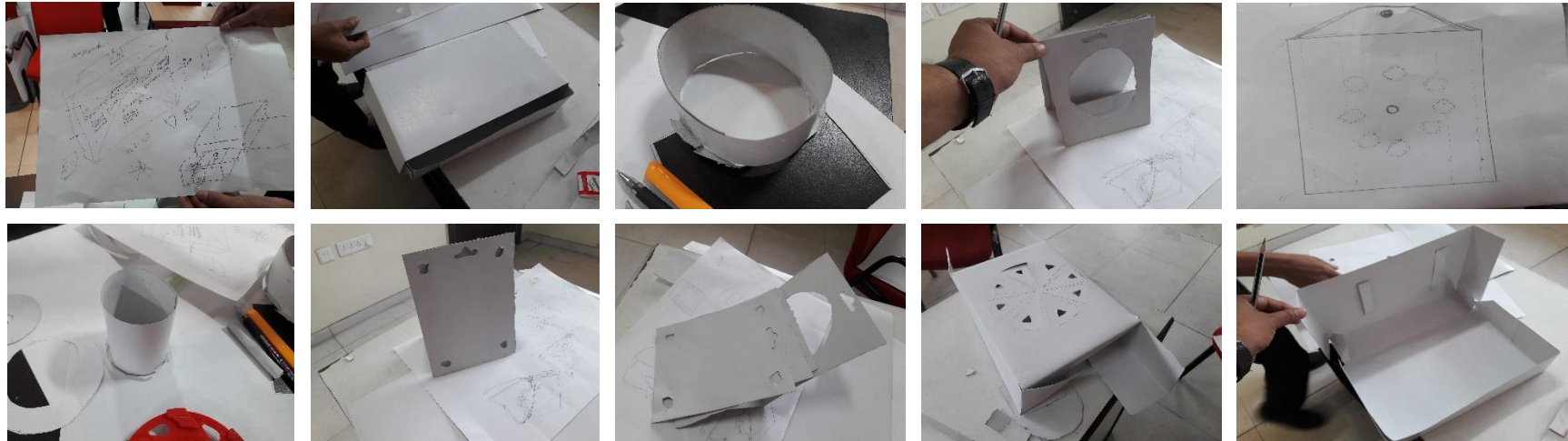
A storage for slender objects

# Concept evaluation

| CRITERIA                          | CONCEPTS                          |                                          |                                      |                               |                                            |                                           |
|-----------------------------------|-----------------------------------|------------------------------------------|--------------------------------------|-------------------------------|--------------------------------------------|-------------------------------------------|
|                                   | CONCEPT 1<br>An accessory carrier | CONCEPT 2<br>A calender cum notice-board | CONCEPT 3<br>A mobile-stand cum lamp | CONCEPT 4<br>A collection Bag | CONCEPT 5<br>A pen-stand cum accessory box | REFERENCE<br>CONCEPT<br>TAPE<br>DISPENSER |
| Simplicity of surface development | 0                                 | -1                                       | -1                                   | 0                             | 0                                          | 0                                         |
| Partial visibility                | 0                                 | 0                                        | 0                                    | 0                             | 0                                          | 0                                         |
| Ease of assembling                | 0                                 | -1                                       | -1                                   | 0                             | 0                                          | 0                                         |
| Ease of opening                   | 0                                 | 0                                        | 0                                    | 0                             | 0                                          | 0                                         |
| Simplicity of reuse               | +1                                | -1                                       | -1                                   | 0                             | -1                                         | 0                                         |
| No. Of folds involved             | 0                                 | -1                                       | -1                                   | 0                             | 0                                          | 0                                         |
| TOTAL                             | 1                                 | -4                                       | -4                                   | 0                             | -1                                         |                                           |
| RANK                              | 1                                 |                                          |                                      | 2                             | 3                                          |                                           |
| CONTINUE                          | YES                               |                                          |                                      | YES                           |                                            |                                           |

Concept  
rating

| CRITERIA                          | WEIGHTAGE | CONCEPTS          |      |                |      |                      |      |
|-----------------------------------|-----------|-------------------|------|----------------|------|----------------------|------|
|                                   |           | CONCEPT 1         |      | CONCEPT 4      |      | Reference Concept    |      |
|                                   |           | Accessory carrier |      | Collection bag |      | Cello tape dispenser |      |
| Simplicity of surface development | 0.2       | 5                 | 1    | 5              | 1    | 5                    | 1    |
| Partial visibility                | 0.2       | 5                 | 1    | 5              | 1    | 5                    | 1    |
| Ease of assembling                | 0.2       | 4                 | 0.8  | 4              | 0.8  | 5                    | 1    |
| Ease of opening                   | 0.15      | 5                 | 0.75 | 5              | 0.75 | 5                    | 0.75 |
| Simplicity of reuse               | 0.15      | 5                 | 0.75 | 5              | 0.75 | 5                    | 0.75 |
| No. Of folds involved             | 0.1       | 4                 | 0.4  | 4              | 0.4  | 5                    | 0.5  |
| TOTAL                             |           | 4.7               |      | 4.7            |      | 5                    |      |



## Rough model making

Small rough model were made to check the feasibility and various opportunities in ideated concept. Based on which further, some of the concepts were compiled and some were discarded.

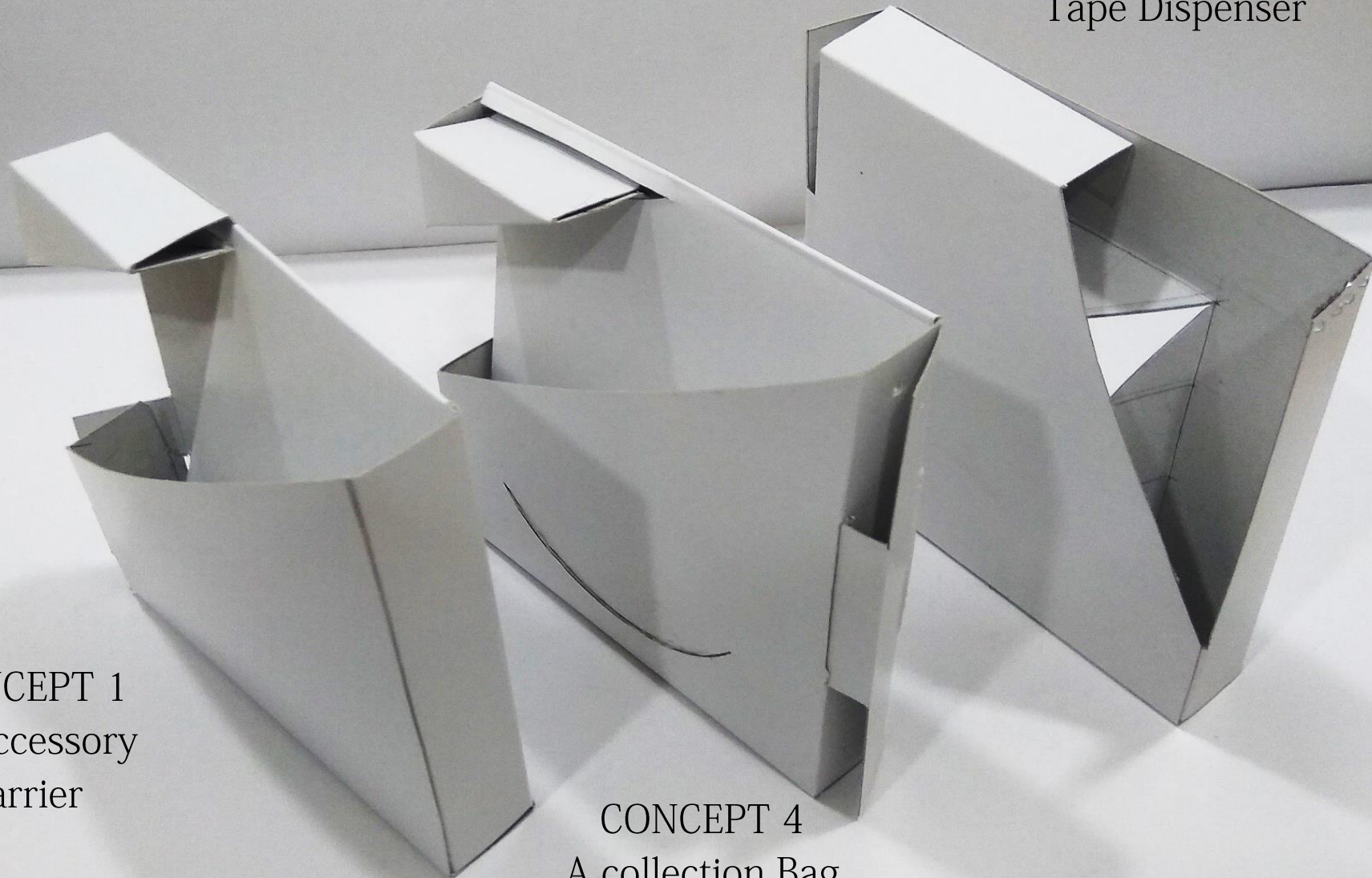


POC

REFERENCE CONCEPT  
Tape Dispenser

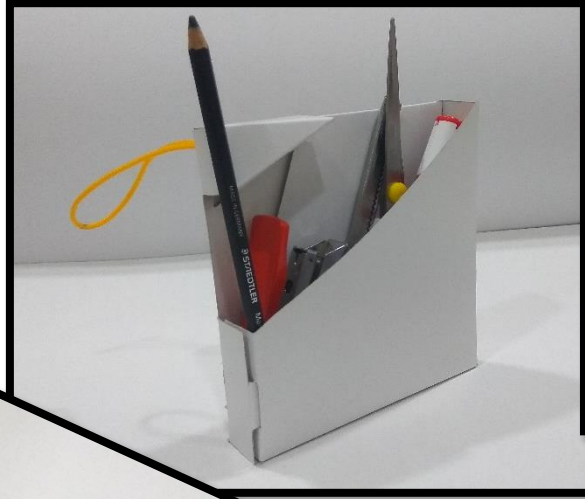
CONCEPT 1  
An accessory  
carrier

CONCEPT 4  
A collection Bag



# Final Concepts

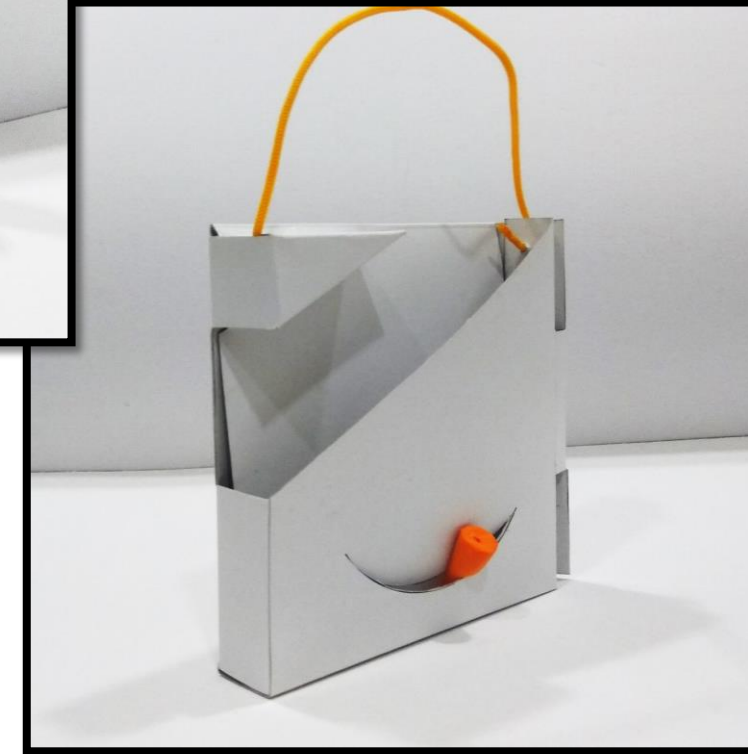
CONCEPT 1  
An accessory  
carrier



REFERENCE CONCEPT  
Tape Dispenser

## Feedback

Since there are many units of cup wheel consumed by the users one single transformation is not worth, so all three concepts were unanimously chosen as a solution for the given problem.



CONCEPT 4  
A collection Bag



# Project 3

## Project Title

To design UCL Sales pack with inlay for sizes  
35-52 & 300 of the core-bit diameter

# Project Objective

The objective of the project is to design packaging for 35-52mm & 300mm diameter core-bit sales pack with inlays.

The package design should have inlay feature within sales pack to get rid of separate inlay packing assembly & production.



# Background of problem



Too much of floor space consumption

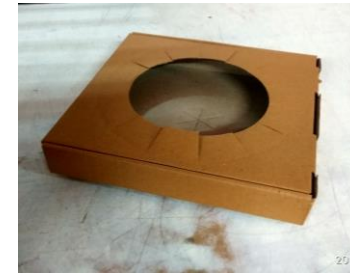


Too much of waiting inventory



Extra man powers and man hours required for inlay assembly

Inlays need to be assembled earlier



Inlays after assembly needs storage



Stack of bigger boxes are waiting for longer



## Project Considerations

- ◆ Package should be **printable or Sticker pasting** applicable surface/material.
- ◆ Easy package **opening** to customer.
- ◆ Easy package **assembly** for production
- ◆ Europe & USA **sales pack length** is different

# Design Brief

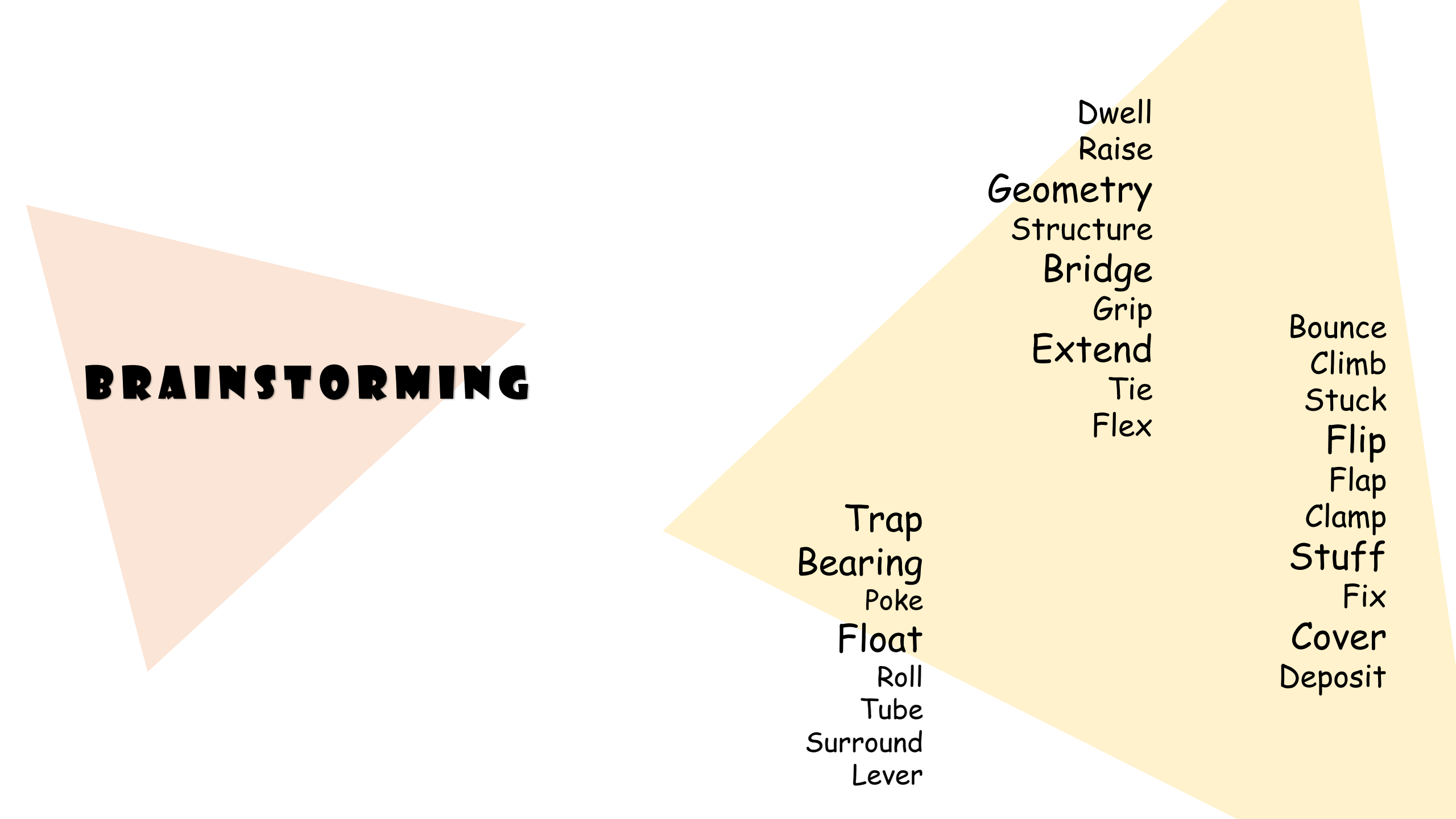
## Packaging features related to

- ◆ **Safety**- The packaging should be recyclable if possible and should be robust enough to protect the product
- ◆ **Functional**- To support and protect the product
- ◆ **Transportation issues**- The packaging should be easy to stack and should consume least possible volumetric space
- ◆ **Product imagery and advertising**- One information label is to be pasted on top
- ◆ **Confidence building measures**- Improving the morale of operator on assembly line by simplifying the packaging procedure
- ◆ **USP of the product**- No inlays required

## Operator specific

- ◆ Core benefits to the operator- no extra preparations for packaging

Major concerns- Packaging should not be tedious



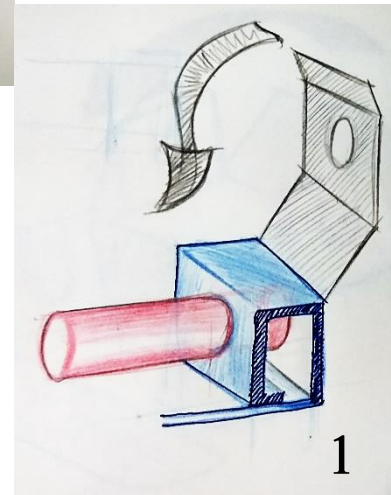
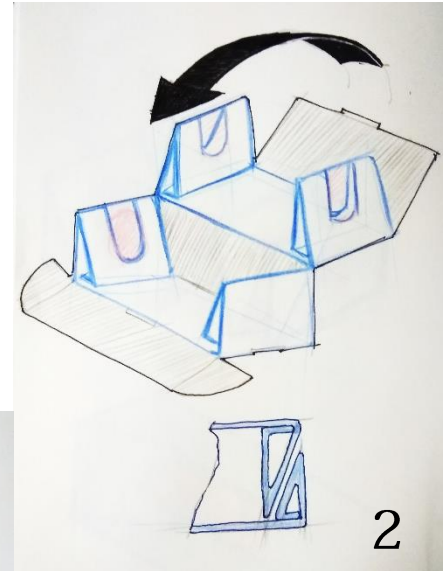
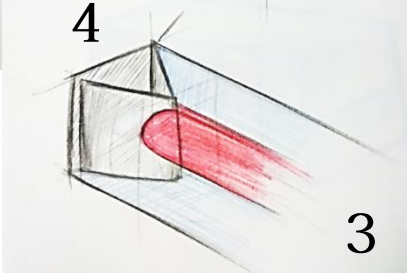
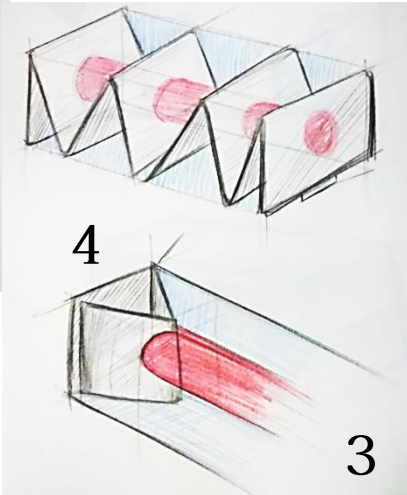
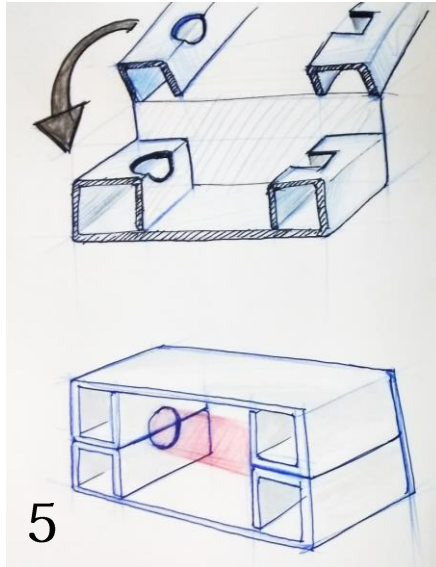
# **BRAINSTORMING**

Dwell  
Raise  
Geometry  
Structure  
Bridge  
Grip  
Extend  
Tie  
Flex

Trap  
Bearing  
Poke  
Float  
Roll  
Tube  
Surround  
Lever

Bounce  
Climb  
Stuck  
Flip  
Flap  
Clamp  
Stuff  
Fix  
Cover  
Deposit

# SKETCHING IDEATION



# Concept Refining

| CRITERIA                            | CONCEPTS  |           |           |           |                          |
|-------------------------------------|-----------|-----------|-----------|-----------|--------------------------|
|                                     | CONCEPT 1 | CONCEPT 3 | CONCEPT 4 | CONCEPT 5 | REFERENCE<br>[CONCEPT 2] |
| Simplicity of surface development   | 0         | -1        | 0         | 0         | 0                        |
| Robust                              | -1        | 0         | 0         | 0         | 0                        |
| Ease of assembling                  | 1         | -1        | -1        | 0         | 0                        |
| Ease of opening                     | -1        | 0         | 0         | 0         | 0                        |
| Suitable to Europe & USA sales pack | 0         | 1         | 0         | 0         | 0                        |
| Time required for assembly          | 1         | -1        | 0         | 1         | 0                        |
| TOTAL                               | 0         | -2        | -1        | 1         |                          |
| RANK                                | 2         | 4         | 3         | 1         |                          |
| CONTINUE?                           | YES       |           |           |           |                          |

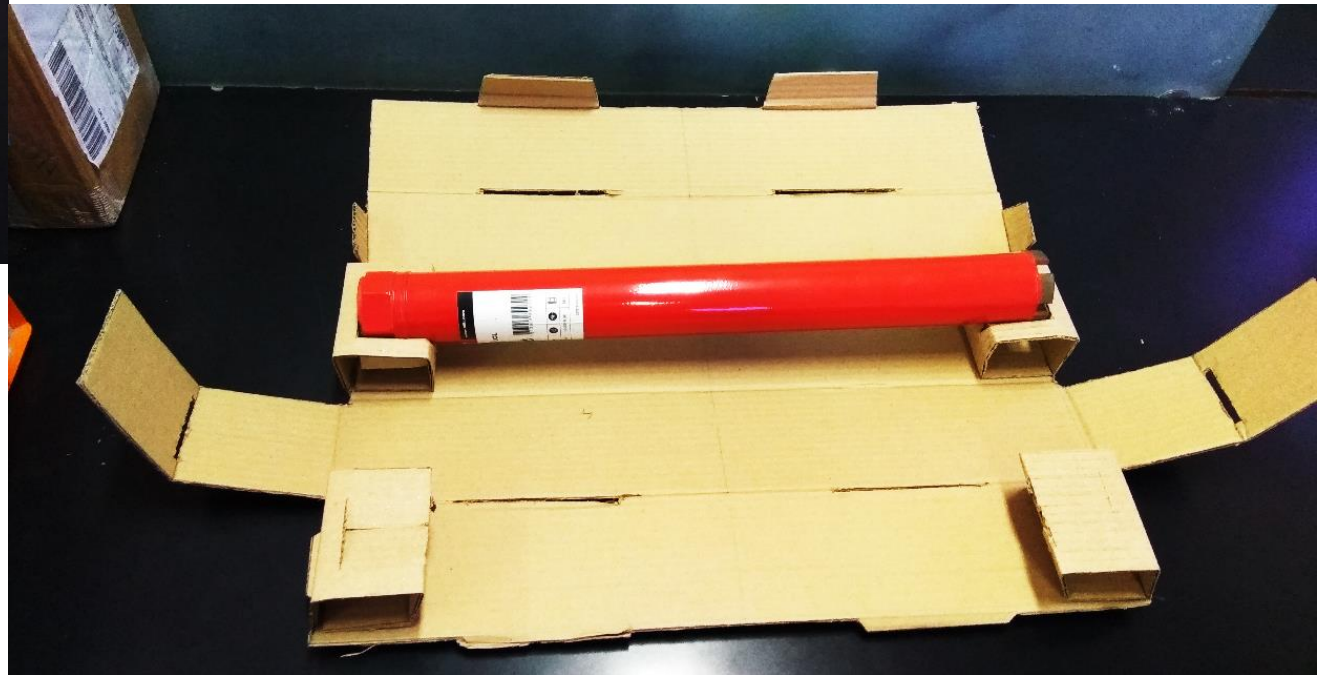
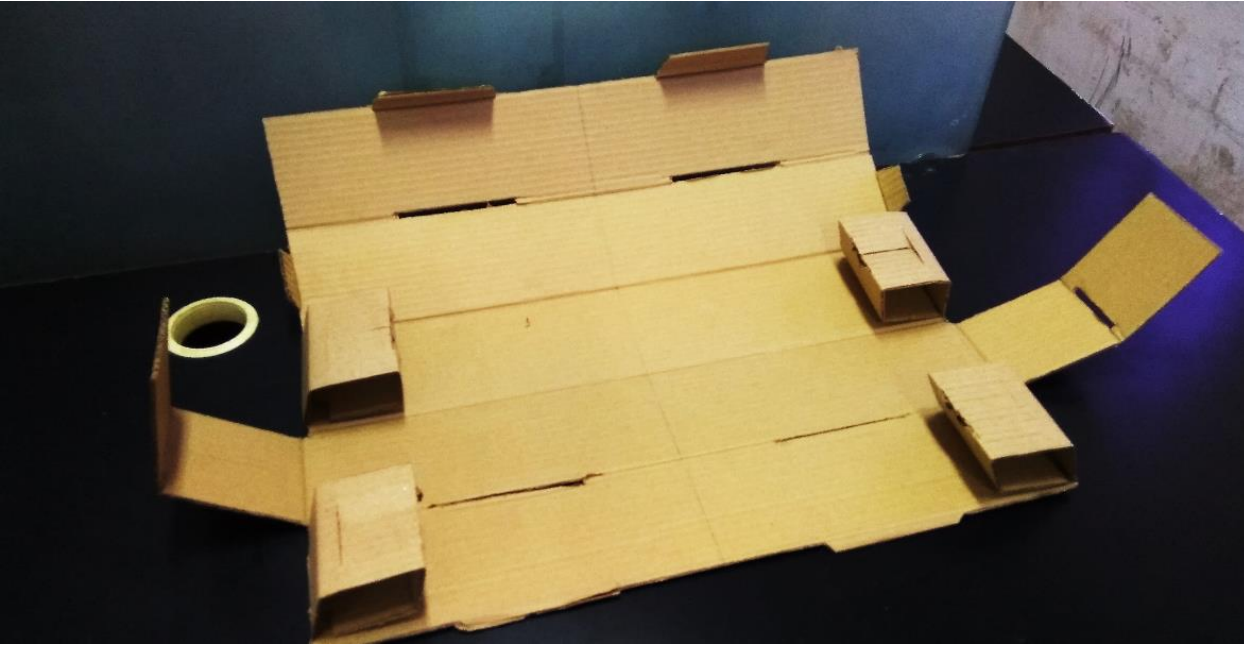
# Concept rating

| CRITERIA                            | WEIGHTAGE | CONCEPTS           |      |           |      |
|-------------------------------------|-----------|--------------------|------|-----------|------|
|                                     |           | REFINED<br>CONCEPT |      | CONCEPT 2 |      |
| Simplicity of surface development   | 0.2       | 5                  | 1    | 4         | 0.8  |
| Robust                              | 0.2       | 5                  | 1    | 4         | 0.8  |
| Ease of assembling                  | 0.2       | 5                  | 1    | 4         | 0.8  |
| Ease of opening                     | 0.15      | 5                  | 0.75 | 4         | 0.6  |
| Suitable to Europe & USA sales pack | 0.15      | 5                  | 0.75 | 5         | 0.75 |
| Time required for assembly          | 0.1       | 5                  | 0.5  | 4         | 0.4  |
| TOTAL                               |           | 5                  |      | 4.15      |      |

POC



# Final Concept



## Outcome of the project

- ◆ A more **feasible** design.
- ◆ No. of steps to pack are **6**.
- ◆ Bursting **strength 13.9 kg/cm sq.**( greater than required value of 10.6 ).
- ◆ Cost cutting **Rs. 10 to Rs. 22 per unit of core bit.**
- ◆ **Concept Suitability** to Europe and USA export.
- ◆ Net **cost** of packaging **increased** by Rs. 2 and conversion cost **reduced** by Rs. 4 approximately
- ◆ **Visibility** of segments after opening the box.
- ◆ **Simpler** sheet **conversion**

## REFERENCES

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5. <https://www.hilti.in/cutting%2C-sawing-and-grinding/diamond-cup-wheels/2/06/2018>

Thank you