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# DESIGN AND FABRICATION OF MULTI OPERATIONAL DEHUSKING MACHINE

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**Abstract-** *Comfort coupled with safety and simplicity is what man strives for. Our project has been to bring about both .The culmination of our effort has resulted in development of a new multi dehusking machine. The project present a basic as well as very professional treatment of the subject in a very comprehensive, based on learning effort and understanding capability of today as per their levels. The device is simple and comfortable. Basic calculation, drawing, designing is included in the project the salient features of our machine can be listed as the mechanism used is very simple, easy for operation no skill is required to operate the machine.*

**Keywords**: Multipurposemachine, Dehusking groundnut, Corn dehusking, Sugar cane.

## 1.INTRODUCTION

In today's industrial world man's innovative ideas has taken him towards all directions concerning about the production and safety in industrial establishments. Some instruments are of shear excellence where as others are the result of long research and persistent work, but it is not the amount of time and money spend in the invention of device or the sophistication of it operation is important, but its convenience, utility and operational efficiency that are important in considering the device. The existing methods of corn husking in agriculture industry consist of breaking the grains by hand the pieces , both of which are not effective and time consuming expose. Safety being a prime consideration, an innovative idea such as this would go long way in solving this simple but serious problem. Here is a device which is based on scientific principles of machines. It is simple, cheap and maintenance free that is produced as a result of this project work. The corn husking machine can be used in areas like mills etc, where human labor is required used at present. This device can cut the grains and separates the cub. As far as cost aspect is concerned it works much cheaper as compared to human labor, since the major component is only a teethed shaft. The size of machine is important feature in considering the capacity of the device. The operating cost of the device is low as it requires only a single person to operate as compare to manual method. Its maintenance cost is almost negligible as it requires only lubrication periodically.

## 2. OBJECTIVES OF THE PROJECT

1. To make a complete mechanical device.
2. To make a device which is suitable economically for husking processing taking into consideration the cost factor this device is suitable for husking processing for common people.
3. Taking safety as prime consideration: This device is safer in all respects.
4. To built a machine which can be easily operated by all the people.
5. The main purpose of the machine is to eliminate the human efforts
6. This device is multi operation which can conduct various operation and this machine can be used whole year
7. Taking safety as prime consideration: This device is safer in all respects.
8. To make a complete mechanical device: The idea is to make a device which does not uses any electrical power so that it is wholly independent of its own.
9. To utilization the force or the energy which is useless or unknown.
10. To develop a device this can make work simple.
11. To develop a device which can run cost efficient.
12. To develop a device which can serve the farmers.

## 3. Raw materials and Methodology

**Table 1: Materials used**

| Sl. no | Material | Specificatons | Quantity |
|---|---|---|---|
| 1 | Belt | d1=175mm, d2=50mm | 2 |
| 2 | Pulley | 50mm,175mm | 4 |
| 3 | Motor | 3phase, 144rpm | 1 |
| 4 | Shaft | 25mm length,600mm D=16mm | 5 |
| 5 | wood | 30*30*300mm | 4 |
| 6 | Bearings | ms plating | 4 |
| 7 | Hopper | 300*300*90 | 1 |
| 8 | Sheet metal | 1000*1000 | 1 |
| 9 | Fastener s | Pitch1.5mm,lengt h80mm | 1 |
| 10 | Blades | Length120mm,t= 3mm,w=25mm | 6 |
| 11 | Grinding wheel | L=120mm,t=3m, w=25mm | 1 |
| 12 | Hinges | 600mm | 2 |

### 3.1Fabricated assembled parts

**Fig 1.1:** Fabricated assembled parts

### 3.2WORKING

This machine completely works on one motor in this machine we can conduct various operations as mention in the application below we have prepared this machine in order that farmer can use this machine for whole year and no season wise the specialty of this machine is that it can conduct various operation in this machine the motor is the main unit and when the motor starts the pulley on the motor shaft rotates then with the help of belt the power is transmitted to the other pulley by maintain the speed required for different operation different mechanism is used the mechanism is shown in block diagram below. As this machine works on single motor as all the 5 application are attached on the single frame which is drives with the help of belt drive and with the help of AC motor as the different application requires different rpm so we have used different pulleys to reduce the speed and increase in order that to obtain the requires output.

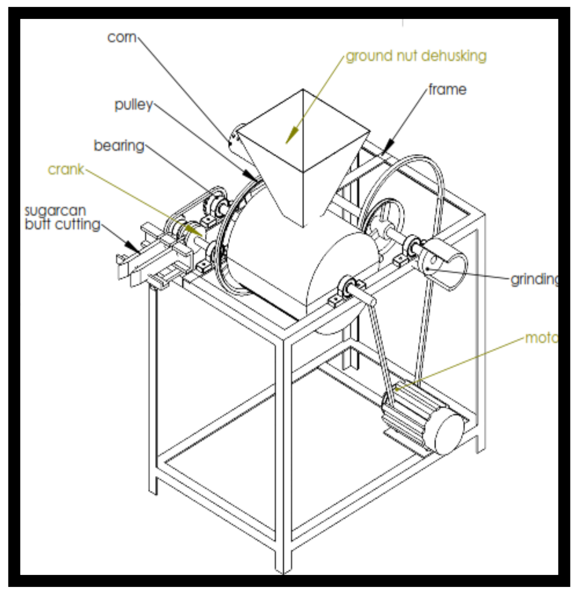


**Fig-1.2**: Assembly of the equipment

### 3.3 MANUFACTURING

The process of conversion of raw material in to finished products using the three resources as Man, machine and finished sub-components. Manufacturing is the term by which we transform resource inputs to create Useful goods and services as outputs. Manufacturing can also be said as an intentional act of producing something useful . It s the phase after the design. Hence referring to the those values we will plan The various processes using the following machines:-

i) Universal lathe
ii) Milling machine
iii) Grinding machine
iv) Power saw

v) Drill machine
vi) Electric arc welding machine

## 3.4 STRUCTURALDESIGN METHODS

This chapter describes some of the mathematical technique used by designers of complex structures. Mathematical models and analysis are briefly describe and detail description is given of the finite – element method of structural analysis. Solution techniques are presented for static, dynamic & model analysis problems. As part of the design procedure the designer must be analyses the entire structure and some of its components. To perform this analysis the designer will develop mathematical models of structure that are approximation of the real structure, these models are used to determine the important parameters in the design. The type of structural model the designer uses depends on the information that is needed and the type of analysis the designer can perform. Three types of structural models are

1. **Rigid Members:** The entire structure or parts of the structure are considered to be rigid, hence no deformation can occur in these members.
2. **Flexible members** : The entire structure or parts of the structure are modeled by members that can deform, but in limited ways. Examples of this members trusses, beams and plates.
3. **Continuum** : A continuum model of structure is the most general, since few if any mathematical assumptions about the behavior of the structure need to be made prior to making a continuum model. A continuum member is based on the full three-dimensional equations of continuum models. In selecting a model of the structure, the designer also must consider type of analysis to be performed. Four typical analysis that designers perform are

1. **Static equilibrium** : In this analysis the designer is trying to the determine the overall forces and moments that the design will undergo. The analysis is usually done with a rigid members of model of structure and is the simplest analysis to perform.
2. **Deformation** : This analysis is concerned with how much the structure will move when operating under the design loads. This analysis is usually done with flexible members.
3. **Stress** : In this analysis the designers wants a very detailed picture of where and at what level the stresses are in the design. This analysis usually done with continuum members.
4. **Frequency** : This analysis is concerned with determining the natural frequencies and made shape of a structure. This analysis can be done with either flexible members of a structure. This analysis can be done with either flexible members or continuum members but now the mass of the members is included in the analysis.

The subject of machine design deals with the art of designing machine of structure. A machine is a combination of resistance bodies with successfully constrained relative motions which is used for transforming other forms of energy into mechanical energy or transmitting and modifying available design is to create new and better machines or structures and improving the existing ones such that it will convert and control motions either with or without transmitting power. It is the practical application of machinery to the design and construction of machine and structure. In order to design simple component satisfactorily, a sound knowledge of applied science is essential. In addition, strength and properties of materials including some metrological are of prime importance. Knowledge of theory of machine and other branch of applied mechanics is also required in order to know the velocity. Acceleration and inertia force of the various links in motion, mechanics of machinery involve the design.

## 4 CALCULATION AND SPECIFICATION

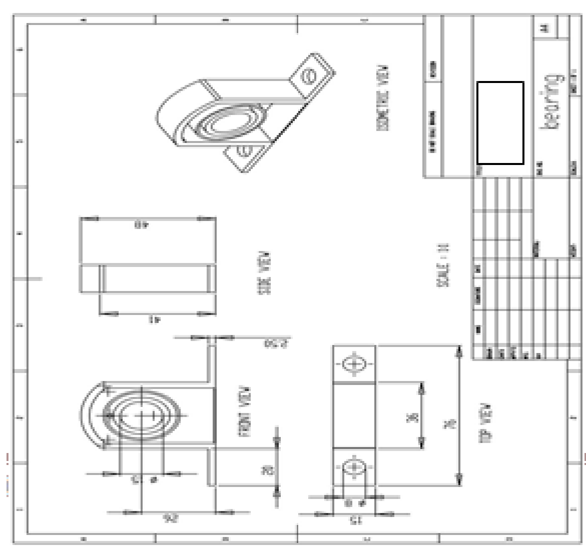


**Fig1.3**: Design of bearing

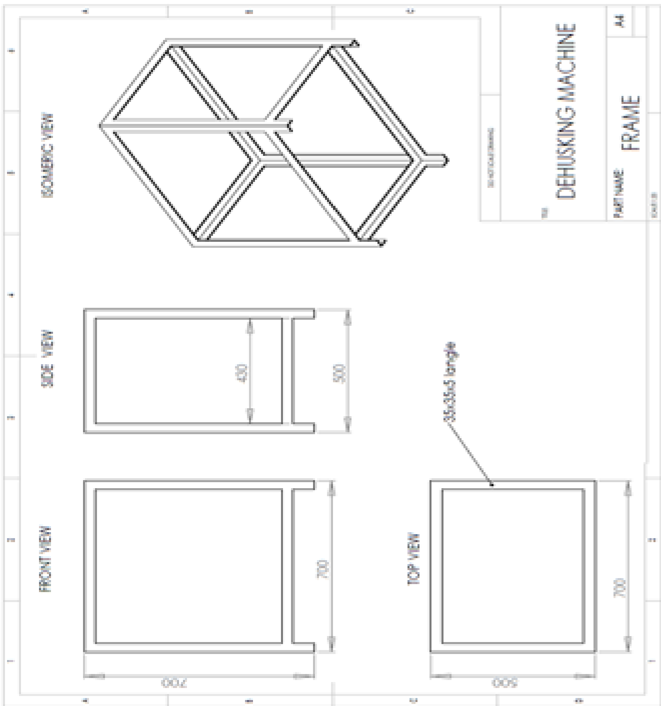


**Fig1.4**: Design of dehusking machine frame

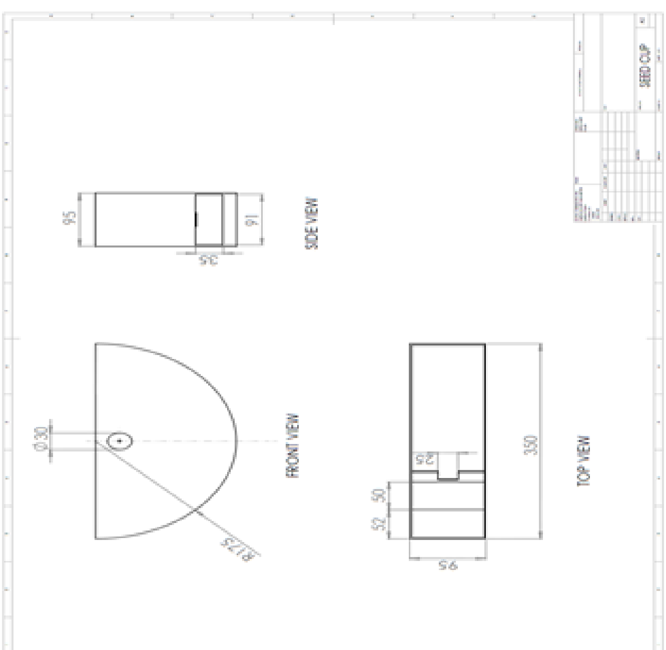


**Fig1.5**: Design of seed cap

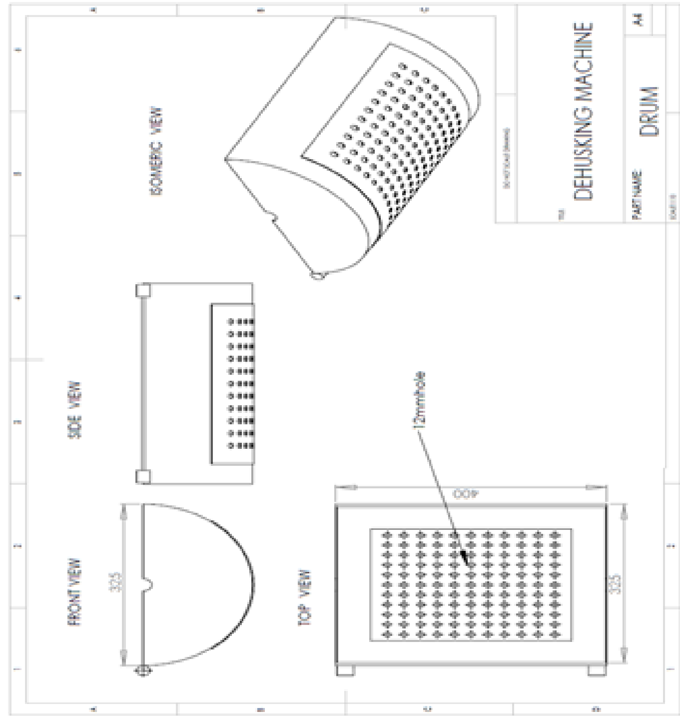


**Fig1.6**: Design of dehusking machine drum

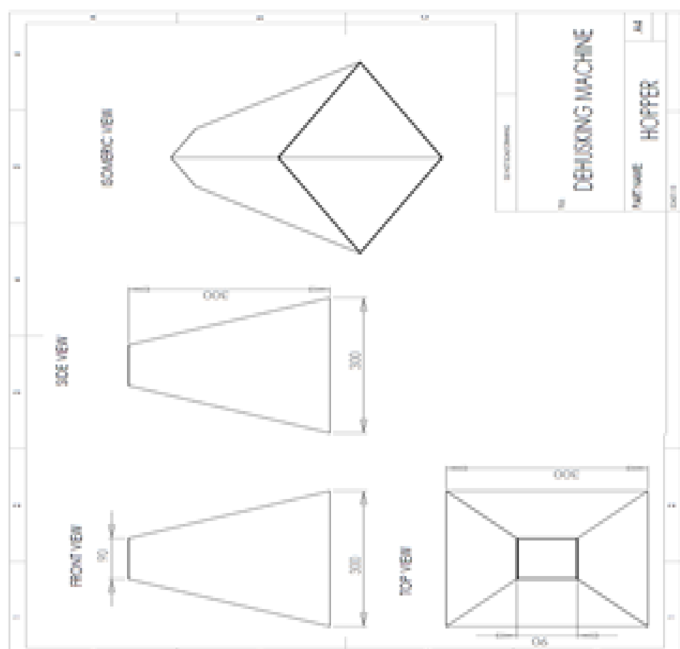


**Fig1.7**: Design of dehusking machine hopper

### 4.1.Design of Bolt

The bolts are used for fixing the connections which can be used as temporary joints. Bolts are been used as they can be removed and properly adjusted as per the requirements. Bolt is to be fastened tightly also it will take load due to rotation.

Stress for C-25 steel $f_t$ =120 N /mm$^2$. Std nominal diameter of bolt is 8 mm.
Let us check the strength: -
Also initial tension in the bolt when belt is fully tightened
P = 1420 d N
P = 1420 x 8 N
P = 1420 d N
P = 11360 N
Therefore the total load on bolts
P = 11360 + 500 N
P = 11860 N
Being the four bolts the load is shared as
P= 11860/4
=2965 N.
Also,
$2965 = (\Pi /4\ dxc^{2)}) \times f_t$
$2965 = (\Pi /4)\ (8x\ (0.84)^{2)}) x\ f_t$
$f_t = 83.59$ N / mm$^2$

The induced $f_t$ 83.59 N / mm$^2$ is less than the maximum ft 120 N /mm$^2$ hence our design is safe.

### 4.2.Design of Angles

Here, The maximum load due to all factors = 450 kg (including friction)

F= 450kg = 450 x 9.81 = 4414.5 N.
We know that he load on each link,
F1 = 4414.5/4 = 1103.63N.
Assuming a factor of safety as 3, the links must be designed for a buckling load of
$W_{cr}$ = 1103.63 x 3 = 3310.9 N
Let $t_1$= Thickness of the link
$b_1$= width of the link
So, cross sectional area of the link = A = $t_1 x\ b_1$
Assuming the width of the link is three times the thickness of the link, i.e.$b_1$= 3 x t1
Therefore
$A= t_1 x\ 3\ t_1 = 3\ t_1^2$
And moment of inertia of the cross section of the link,
$I = 1/12\ t_1 b_1^3$
$= 2.25\ t_1^4$
we know that I = AK$^2$, where k = radius of gyration.

$K^2 = I/A = 2.25\ t_1^4 / 3\ t_1^2 = 0.75\ t_1^2$
Since for the buckling of the link in the vertical plane, the ends are considered as hinged, therefore, the equivalent length of the link

L = l = 600 mm.
And Rankin's constant, a = 1/ 7500
Now using the relation,

$$Wcr = \frac{f\ x\ A}{1 + a\ (L / K)^2}$$

with usual notation,
Here f = 100 N / mm$^2$

$$3310.9 = \frac{100\ x\ 3\ x\ t_1^2}{1 + (1 / 7500)\ \ (600^2/0.75t_1^2)}$$

$$3310.9 = \frac{300\ t_1^2}{1 + 64 / t_1^2}$$

$300\ t_1^4 - 3310.9\ t_1^2 - 64 \times 3310.9 = 0$
$t_1^2 = 41.2$
$t_1 = 6.418$ mm
$b_1 = 3 x\ t_1 = 3 x\ 6.418 = 19.25$ mm.
But the standard angle available of 35x 35 x 3 hence for safer side we have
Selected it. Which can bear the impact loading. Hence our design is safe.

### 4.3.Design of Shaft

A solid shaft rotating at 75 rpm is assumed to be made of mild steel. The shaft here is subjected to both bending moment and torsional stresses. The yield strength of a mild steel shaft material (C50) from design data is 380Mpa.(380/(2x 2)) The safe load is 300N (Approx 30Kg).The shaft o length 430mm is subjected to bending and torsional stresses.

Maximum Bending moment about bearing
BM = 300 x 430
= 129000 N-mm
Taking power generated to be as 0.25HP = 0.18375 kw
And torque T = (P x 60) / (2 x π x N)
= (183.75 x 60) / (2 x 3.14x75)
= 23.397 N-m
= 23.397 x 1000 Nmm
Equivalent Twisting Moment
$Te = (M^2 + T^2)$ ½
$= (M^2 + T^2)$ ½
= 131104.3949 N-mm
Take safe stress fs = 95 N/mm$^2$, for factor of safety=2
$d^3$ = (T x 16) / (3.14 x fs)
= 7028.51

d = 19.15mm or 20 mm

The diameter of shaft taken is 25 mm which is safe .

### 4.4.Design of Motor

The device is incorporated with 1 HP motor, then

1HP = 0.735KW

= 0.735 X$10^3$ w

= 735 w

The belt is mounted on the motor shaft on one end and pulley on the other end.

Motor shaft has v groove on which the belt is mounted. The size of the motor shaft as per the specifications

Using Hindustan motors catalog for 1 HP motor, N =1440rpm

P = 2ΠNT / 60

0.735X$10^3$ = (2Π x 1440 x T) / 60

T = (0.735 x$10^3$ x 60) / (2Π x1440)

T = 4.874 N-m

T = 4.874 X$10^3$ N-mm

T = 4874 .120132 N-mm

### 5.To calculate the belt length

The belt is inserted on a V groove on the motor running at 1440 rpm.

The motor shaft dia is 16 mm

d =16mm.

$N_1$ =1440 rpm

Motor pulley Dia $d_1$ = 50 mm

Where as the pulley Dia on the other side

$d_2$ =175 mm

The Belt having dimensions

Centre Distance = 220mm

$N_2$ = Speed of the pulley

$d_1$ =50 mm $d_2$ =175 mm

$N_1$= 1440 rpm $N_2$ =?

Using velocity ratio

$d_1$/ $d_2$ = N2 / $N_1$

(50 / 175) = (N2 / 1440)

$N_2$ = (50 x 1440) / 175

= 411.42485 rpm.

To calculate the length of the belt, this is considered as open belt drive

L =2X +1.57($d_2$+$d_1$) + ($d_2$-$d_1$)$^2$ / 4x

X=centre distance = 220mm

$d_2$ =175

$d_1$ = 50mm

L = 2 x 220+1.57(175+50) + (175+50)$^2$/ (4x 220)

= 440+353.25+17.75568

L = 811.00568mm

= 0.8m

The length of the belt is approximately taken as 1 m

### 4.6.Design of Welded Joint

Checking the strength of the welded joints for safety .The transverse fillet weld welds the side plate and the edge stiffness plates, The maximum load which the plate can carry for transverse fillet welded is

P = 0.707 x S x L x ft

Where, S = factor of safety, L = contact length = 35mm

The load of shear along with the friction is 50 kg = 500N

Hence, 500 = 0.707 x 3 x 35 x ft

Hence let us find the safe value of 'ft'

Therefore ft = $\frac{500}{0.707 \times 3 \times 35}$

ft = 6.73536 N/mm$^2$

Since the calculated value of the tensile load is very smaller than The permissible value as ft=56 N/mm$^2$. Hence welded joint is safe.

### 4.7.Design of Bearing

Depending upon the nature of contact the bearing lies in I contact bearing .here contact is rolling one .the advantage of bearing here is that it has low starting friction due to this , we also call it an antifriction bearing.

| | |
|---|---|
| D | =25mm |
| Fa | =100 N |
| Fr | = 250 N |
| Nd | =150 rpm |

Proposed bearing SKF

Required life =1000 hours

From table 24.60 for SKF 6204

Basic static load rating capacity $C_{or}$ =7800 N

Basic load rating capacity $C_r$= 14000 N

Fa/$C_{or}$= 100/7800=0.01282

Assume minor shock & bearing works at normal temperature

Kt=1 from table 24.29. For minor shock load application factor Ka=1.5

Therefore Fe=Fr*Ka*Kt

=250*1*1.5

=375

Dynamic load rating $C_r$=Fe{(Ld/Lr) (Nd/Nr)}$^{1/m}$

Lr = Rated life =500 hours

Nr = Rated speed =33.33 rpm

$C_r$ = 14000 N; m=exponent = 3 for ball bearing

14000 =375{(Ld/500)(150/33.33)}$^{1/3}$

$(14000/375)^3 = (Ld/500) *(150/33.33)\}^{1/3}$
Therefore Ld = 1605.98 hours

Since designed life is more than the require life, the selected bearing is suitable. Hence the proposed P205 is suitable for the expected life of 1000 hours.

## 5. FABRICATION

1. Shaft
   Material: Mild steel
   Operation: cutting, facing, turning, threading.

2. L angle
   Material: Mild steel
   Operation: Bending. Fitting.
3. Bearing
   Material: assembly
   Operation: Fitting.
4. Fasteners
   Material:
   Operation: Fitting.
5. Drum
   Material: -mild steel
   Operation: machining, Fitting.
6. Pulley
   Material: CI
   Operation: Boring, fitting.
7. Drum plate
   Material: mild steel
   Operation: facing, turning, Fitting.
8. Motor
   Material: assembly
   Operation: Fitting.
9. V- Belt
   Material: Rubber
   Operation: Fitting.
10. bearings
    Material: assembly
    Operation: fitting
11. Bush
    Material: mild steel
    Operation: facing, planning, boring, tapping & fitting

## 5.1 APPLICATIONS

1) Corn husking
2) Ground Nut Dehusking
3) Sugarcane butt cutting
4) Grinding

## 5.2 ADVANTAGES

1) Compact in size
2) Less power consumption
3) Ease in manufacturing
4) Initial low investment cost
5) Multipurpose work
6) Less effort required
7) Easy to operate
8) Ease of maintenance

## 6.RESULT

In this project consist of four operations as describes above first we go through a ground nut dehusk in it will dehusk 35-40 kg of ground nut per hour with the cost of 5-6 Rs. It will produce good quality ground nut pods. In the corn dehusking the corns are separated from the stalk without much more effort. In the agriculture usage of the equipments has to be sharpened for smooth work so we attached grinding wheel for sharpening the tools. Another operation is a sugar cane scooping in that butt will be cut according to the seeding dimension so to perform these operations two men are sufficient since it reduces labour problem. And also operations are done by electric motor which has capacity of 3 hours. Hence it has major application in agriculture field.of scope if the device is to show different type of seeds.

## 7.CONCLUSION

We have taken up this project as real challenge, as we were not experience in the hydraulics field. We started our work on this project facing new hurdles initially. After the completion of the project work we tried its working in our college machine shop and we were pleased to note that it does meet the requirements for what it is meant.The maneuverability of the device is quite good and the handling is quite simple. For commercial purpose one can improve the efficiency of the device effectively by increasing the size of the device.

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