



## DESIGN AND CONSTRUCTION OF A CORN SHELLING MACHINE WITH A CAPACITY OF 80KG/HOUR USING A COMBO ENGINE

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### Abstract

*This study discusses the design and construction of a corn sheller with a capacity of 80 kg/hour using an internal combustion engine . A corn sheller is a machine that functions to shell corn to separate the corn kernels from the corn cobs. In Indonesia, corn is available in abundance in rural areas, especially during the harvest season. In the production process, generally, during the shelling process, many farmers still use the shelling method by hand or using simple tools, which takes quite a long time. The reason people still use the shelling method by hand or using tools is because the price of the machine is too expensive and they are not even aware of the existence of a corn shelling machine. This corn shelling machine with a 5.5 HP internal combustion engine is a tool designed to speed up and simplify the corn shelling process efficiently and produce a fairly large production capacity of 80 kg / hour. To extend the service life of this corn shelling machine, maintenance and cleanliness should be carried out so that the machine can operate optimally without problems. Safety also needs to be considered to avoid unexpected work accidents.*

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## 1. INTRODUCTION

developments are currently growing rapidly, particularly in the engineering field. This is because technology is significantly helping humans complete various tasks and create a wide variety of products to meet the needs of society (consumers).

Indonesia is an agricultural country. Corn is the second most important food crop after rice. Apart from being a staple food for the community, corn can be processed into a variety of industrial food products, including corn which can be processed into snacks, and so on. Corn can also be processed into a mixed ingredient in animal feed, especially for poultry.

Farmers still use traditional methods in post-harvest handling. Especially handling during corn shelling. Shelling corn using manual labor is inherently time-consuming and labor-intensive, slowing productivity. Therefore, using a corn sheller machine is very helpful because it is more efficient, saves time , and saves energy . Corn shelling is easier when the corn is dry and has minimal moisture content, as this allows the corn to easily detach from the cob, minimizing kernel damage.



Corn shellers using machines that have been on the market, in addition to the price and high operational costs, the space required must be large, considering its size is quite large, therefore this model of sheller is more widely used in medium to large industries. Corn shellers in household industries and small industries are mostly carried out in traditional and semi-traditional ways, where the time used is quite long and the energy used is quite large. Based on this description, the designer tried to design a machine with appropriate technology to develop a semi-traditional sheller tool, which is able to increase capacity, work efficiency in corn shellers.

## **2. LITERATURE REVIEW**

### **2.1 Corn Cultivation**

Corn is an annual plant with a planting age of around 80-150 days (around 3-5 months) so that in a year the corn plant can be harvested two to three times and is a type of grass or *graminea* that has a single stem, although there is the possibility of the emergence of branches in some *genotypes* and certain environments. Corn stalks consist of nodes and segments, corn leaves grow on each node opposite each other.

Corn plants can be cultivated in lowlands or highlands, in rice fields or dry fields. Optimal temperatures are between 21-34°C, with a soil pH between 5.6-7.5, and an altitude of 1,000-1,800 m above sea level. Optimal altitudes are between 50-600 m above sea level. Corn plants require approximately 100-140 mm of water per month. Therefore, planting time must take into account rainfall and its distribution. Planting begins when rainfall reaches 100 mm/month. To find out this, it is necessary to observe rainfall and its distribution patterns over the past 10 years so that planting times can be determined properly and precisely. Corn requires fertile soil to produce well. This is because corn plants require large amounts of nutrients, especially nitrogen (N), phosphorus (P), and potassium (K). Corn cultivation techniques include the following:

- 2.1.1 Superior Varieties
- 2.1.2 Quality Seeds
- 2.1.3 Land Preparation
- 2.1.4 Planting
- 2.1.5 Fertilization
- 2.1.6 Weeding
- 2.1.7 Pest and Disease Control
- 2.1.8 Irrigation (During the Dry Season)

### **2.2 Main Components of the Machine**

The main components of the machine are crucial for supporting its function and operation. The main components of this corn huller machine include:

#### **2.2.1 Combustion Engine Power**

A combustion engine is a prime mover which in principle is a tool that converts chemical energy into heat energy and is converted into mechanical energy.

To calculate engine power (P), first calculate the torque (T) and angular velocity, namely:

$$T = F \times R$$
$$\omega = \frac{2\pi n}{60}$$

After knowing the magnitude of the torque and angular velocity, the next step is to calculate the engine power. Engine power (P) is calculated using

$$P = T \cdot \omega$$

Table 1. General Steel Classification

| Group                   | C content (%) |
|-------------------------|---------------|
| mild steel              | 0 – 0.15      |
| Clay steel              | 0.2 – 0.3     |
| The steel is quite hard | 0.3 – 0.5     |
| hard steel              | 0.5 – 0.8     |
| Very hard steel         | 0.8 – 1.2     |

So the planning power needed,

$$Pd = f_c \times P$$

### 2.2.2 Axis

A shaft is a solid steel bar that functions to support rotating moments, rotating stress, torsional stress and bending stress. The shaft is one of the most important parts of every machine, which functions to transmit power and rotation. The shaft plays the most important role in a transmission system. Shafts are typically circular and hold elements such as clutches, gears, pulleys, flywheels, crank sprockets, and so on. Theoretically, the various types of shafts used in machines include:

1. Transmission Shaft
2. Spindle Axle
3. Axle Shaft

To plan an axis, things that need to be considered:

1. Axis Strength .
2. Shaft stiffness.
3. Critical turn.
4. Corrosion
5. Shaft Material

Design torsional moment (T),

$$T = 9.74 \times 10 \frac{5Pd}{n1}$$

Shear stress ( $\tau$ ),

If the design moment T (kg.mm) is applied to a shaft diameter  $d_s$  (mm), then the shear stress  $\tau$  (kg/mm<sup>2</sup>) that occurs is

$$\tau = \frac{5.1 T}{d_s^3}$$

Allowable shear stress,

In addition, the safety factor for the fatigue limit of the puncher  $S_f1$  with a value of 5.6 is taken for the  $S_f$  material with guaranteed strength, and 6.0 for the  $S_c$  material with the influence of the mass with alloy steel. If the shaft and the influence of surface hardness are also taken into account, which is expressed by  $S_f2$  which has a value of 1.3 – 3.0.

$$\tau_a = \frac{\sigma_b}{(sf1 \times sf2)}$$

Determine the shaft diameter,

$$d_s = \left[ \frac{5.1}{\tau_a} Kt Cb T \right]^{1/3}$$

### 2.2.3 Pulley

Pulleys are a vital component of machinery, so when manufacturing them, consideration must be given to their strength, manufacturing process, and the economic value of the material.

The groove and belt mounting locations on the pulleys are tailored to the cross-sectional shape of the belt being used.

The rotation of the drive pulley and the one to be driven are respectively  $n_1$  (rpm) and  $n_2$  (rpm), and the nominal diameters are  $d_p$  (mm) and  $D_p$  (rpm), respectively. V-belts are usually used to reduce rotation, so the commonly used ratio is the reduction ratio  $i$  ( $i > 1$ ), where

$$\frac{n_1 \cdot D_p}{n_2 \cdot d_p}$$

#### 2.2.4 V-belt

A V-belt is an endless belt reinforced with braided reinforcement and straps. V-belts are made of rubber and have a trapezoidal cross-sectional shape. The material used to make the core of the belt itself is made of tetoron weave.

Calculations used in V-belt planning include:

##### 1. Belt Circumference Length

$$L = 2C + \frac{\pi}{2}(d_p + D_p) + \frac{1}{4C}(D_p - d_p)^2$$

There are a variety of belts available in the trade. However, finding a belt that matches the calculated length is generally difficult.

The axis distance of the axle  $C$  can be expressed as:

$$C = \frac{b + \sqrt{b^2 - 8(D_p - d_p)^2}}{8}$$

For the value of  $b$ ,

$$b = 2L - 3.14(D_p + d_p)$$

##### 2. Belt Linear Velocity

$$V = \frac{D_p \cdot n_1}{60 \times 1000}$$

##### 3. Contact angle ( $\theta$ )

$$\theta = 180^\circ - \frac{57(D_p - d_p)}{C}$$

##### 4. Tangential Force

$$F_e = \frac{p_0 \cdot 102}{v}$$

#### 2.2.5 Bearings

Bearings are machine elements that support a loaded shaft, allowing rotation or reciprocating motion to occur smoothly, safely, and for a longer service life. Based on the bearing's movement relative to the shaft, bearings can be classified as follows:

1. Based on the movement of the bearing against the shaft
  - a. Rolling Bearings
  - b. Sliding Bearing
2. Based on the direction of the load on the axis
  - a. Radial Bearings
  - b. Axial Bearings
  - c. Special Rolling Bearings

The comparison between sliding bearings and rolling bearings is that sliding bearings are capable of supporting high-rotating shafts with large loads, while rolling bearings are more suitable for small loads than sliding bearings, depending on the shape of the rolling elements. We can also calculate the magnitude of the radial load of a bearing by using the formula:

$$Pr = X \cdot V \cdot Fr + YFa$$

Speed obtained:

$$F_n = \left(\frac{33.3}{n}\right)^{1/3}$$

General bearing factors,

$$F_h = F_n \frac{C}{pr}$$

Nominal bearing life,

$$L_h = 500 \cdot f_h^3$$

### 3. RESULTS AND DISCUSSION

#### 3.1 Working Principle of Machine

This corn huller machine operates on the rotary motion of a gasoline engine. The power and rotation of the gasoline engine are transmitted through pulleys and belts, which rotate the huller shaft (main shaft) and the blower shaft. Dried corn cobs are fed into the huller chamber through a corn cob feeder, and the rotation of the huller shaft separates the cobs from the kernels.

Corn kernels that have been separated from the corn cob will fall down through the filter holes that have been made in the shelling chamber, while the corn cob will exit through the outlet funnel in the shelling chamber. The blower shaft will rotate the blower, producing pressurized air to clean the dust from the shelling results from the shelling chamber to produce cleaner corn kernels. After getting the clean shelling results, they are collected through the outlet funnel below the shelling chamber.

#### 3.2 Engine RPM Calculation

This corn sheller machine aims to separate corn kernels from the cob, basically all types of corn can be separated from the cob with the sheller machine designed by the author, and the type of corn used by the author in testing the sheller machine is sweet corn or popcorn because it is easier to get in the market and is widely planted by farmers, this corn is used as a sample in testing the sheller machine.

Determining the rotation of the drive shaft, on this machine for every hour it produces 80 kg/hour to shell the corn, if it is assumed that the average number of corn kernels entering the machine is 30 kernels entering the shelling house, and requires 600 rotations on the shelling shaft, then to reach 80 kg/hour requires the following number of rotations:

The design of the corn shelling machine is planned to produce 80 kg /hour.

Mass of 1 cob of corn = 150-200 grams

Mass of 1 corn cob = (20-30)%

Mass of 1 dry corn cob =  $150 - (150 \times \frac{30}{100})$

Mass of 1 dry corn cob = 100 grams

Mass of 1 cob of dry corn = 0.1 kg /1 corn

So the capacity/process =  $\frac{80 \text{ Kg}}{0,1 \text{ Kg}}$

So the capacity/process = is 800 corns

The formula for finding the rotation is:

$$= \frac{80.000 \text{ gram}}{30 \times 100 \text{ gram}} \times 600 = 16000 \text{ putaran}$$

In the shelling process, there is a pause/time to put the material into the shelling house, namely 10 minutes, the shelling process time is.

$$60 - 10 = 50 \text{ menit} = \frac{16000 \text{ putaran}}{50 \text{ menit}}$$

$$= 320 \text{ rpm}$$

### 3.3 Engine Power Calculation

#### 3.3.1 Main shaft mass of the mill

Where :

$$D_1 = 38 \text{ mm} = 0.038 \text{ m}$$

$$t_1 = 199 \text{ mm} = 0.199 \text{ m}$$

So,

$$m_1 = V_{Poros_1} \times \rho \text{ baja St 37}$$

$$m_1 = (\pi r^2 \times t) \rho \text{ baja St 37}$$

$$m_1 = (3,14 \times 0,019^2 \times 0,199) 7850 \frac{kg}{m^3}$$

$$m_1 = 1,77 \text{ kg}$$

The style that occurs,

$$F = m \times g$$

$$= 1.77 \text{ kg} \times 9.81 \text{ m/s}$$

$$= 17.37 \text{ N}$$

For Torque,

$$T = F \times R$$

$$T = 17.37 \times 0.019$$

$$= 0.33 \text{ Nm}$$

So that,

$$P = T \cdot \omega$$

$$P_1 = T \times \frac{2 \times 3,14 \times 1.425}{60}$$

$$= 0.33 \times 149.15$$

$$= 49.22 \text{ Watts}$$

#### 3.3.2 Mass of the Milling Blade Holder Shaft

Where :

$$D_2 = 65 \text{ mm} = 0.065 \text{ m}$$

$$t_2 = 885 \text{ mm} = 0.885 \text{ m}$$

So,

$$M_2 = V_{Poros_2} \times \rho \text{ baja St 37}$$

$$M_2 = (\pi r^2 \times t) \rho \text{ baja St 37}$$

$$M_2(3,14 \times 0,0325^2 \times 0,885) 7850 \frac{kg}{m^3}$$

$$M_2 = (0.00293 \text{ m}^3) 7850 \frac{kg}{m^3}$$

$$M_2 = 23,04 \text{ kg}$$

The style that occurs,

$$F = m \times g$$

$$= 23.04 \text{ kg} \times 9.81$$

$$= 226.03 \text{ N}$$

For Torque,

$$T = F \times R$$

$$T = 226.03 \times 0.0325$$

$$= 7.34 \text{ Nm}$$

So that,

$$P = T \cdot \omega$$

$$P_2 = T \times \frac{2 \times 3,14 \times 1.425}{60}$$

$$= 7.34 \times 149.15$$

$$= 1,095.68 \text{ Watts}$$

### 3.3.3 Corn Huller Blade Mass

Where :

$$D_3 = 20 \text{ mm} = 0.02 \text{ m}$$

$$t_3 = 65 \text{ mm} = 0.065 \text{ m}$$

So,

$$M_3 = V_{\text{Mata Pisau Pemipil}} \times \rho_{\text{baja St37}}$$

$$M_3 = (\pi r^2 \times t) \rho_{\text{baja St 37}}$$

$$M_3 = (3,14 \times 0,01^2 \times 0,065) 7850 \frac{\text{kg}}{\text{m}^3}$$

$$M_3 (0,0003673) 7850 \frac{\text{kg}}{\text{m}^3}$$

$$M_3 = 2,88 \text{ kg}$$

The number of corn sheller eyes is 18 pieces which are connected using welding

The style that occurs,

$$F = m \times g$$

$$= 2.88 \text{ kg} \times 9.81$$

$$= 28.25 \text{ N}$$

For Torque,

$$T = F \times R$$

$$T = 28.25 \times 0.01$$

$$= 0.28 \text{ Nm}$$

So that,

$$P = T \cdot \omega$$

$$P_3 = T \times \frac{2 \times 3,14 \times 1.425}{60}$$

$$= 0.28 \times 149.15$$

$$= 42.13 \text{ Watts}$$

### 3.3.4 Corn Cavity Mass Sheller House Volume of Sheller House

It is known that:

$$L = 900 \text{ mm}$$

$$d = 275 \text{ mm}$$

then the volume of the sheller house

$$V = \pi \times r^2 \times t$$

$$V = 3,14 \times 137,5^2 \times 900$$

$$V = 53.429.062,5 \text{ mm}^3$$

$$V = 0,05342 \text{ m}^3$$

So to find the volume of the corn cavity in the sheller house,

$$V_{\text{cavity}} = V_{\text{sheller housing}} - V_{\text{shaft 2}} - V_{\text{blade}}$$

$$V_{\text{cavity}} = 0.05342 - 0.00293 = 0.00036738$$

$$V_{\text{cavity}} = 0.05011762 \text{ m}^3$$

The mass of the corn cavity in the sheller house is

$$M_4 = V_{\text{rongga}} \times \rho_{\text{jagung}}$$

$$M_4 = 0.05011762 \text{ m}^3 \times 721 \text{ Kg/m}^3$$

$$M_4 = 36.05 \text{ Kg}$$

The style that occurs,

$$\begin{aligned} F &= m \times g \\ &= 36.05 \text{ kg} \times 9.81 \\ &= 353.65 \text{ N} \end{aligned}$$

For Torque,

$$\begin{aligned} T &= F \times R \\ T &= 353.65 \times 0.04 \\ &= 14.14 \text{ Nm} \end{aligned}$$

So that,

$$\begin{aligned} P &= T \cdot \omega \\ P_4 &= T \times \frac{2 \times 3,14 \times 1.425}{60} \\ &= 14.14 \times 149.15 \\ &= 2,108.98 \text{ Watts} \end{aligned}$$

### 3.3.5 Blower shaft mass

Where :

$$D_5 = 20 \text{ mm} = 0.02 \text{ m}$$

$$t_5 = 170 \text{ mm} = 0.17 \text{ m}$$

So,

$$\begin{aligned} M_5 &= V_{poros \ blower} \times \rho \ \text{baja St 37} \\ M_5 &= (\pi r^2 \times l) \rho \ \text{baja St 37} \\ M_5 &= (3,14 \times 0,01^2 \times 0,17) 7850 \frac{\text{kg}}{\text{m}^3} \\ M_5 &= 0,41 \ \text{kg} \end{aligned}$$

The style that occurs,

$$\begin{aligned} F &= m \times g \\ &= 0.41 \text{ kg} \times 9.81 \\ &= 4.02 \text{ N} \end{aligned}$$

For Torque,

$$\begin{aligned} T &= F \times R \\ T &= 4.02 \times 0.01 \\ &= 0.04 \text{ Nm} \end{aligned}$$

So that,

$$\begin{aligned} P &= T \cdot \omega \\ P_5 &= T \times \frac{2 \times 3,14 \times 1.425}{60} \\ &= 0.04 \times 149.15 \\ &= 5.99 \text{ Watts} \end{aligned}$$

So P<sub>Total</sub> is

$$\begin{aligned} P_{\text{Total}} &= P_1 + P_2 + P_3 + P_4 + P_5 \\ &= 49.22 + 1,095.68 + 42.13 + 2,108.98 + 5.99 \\ &= 3,302 \text{ Watts} \\ &= 3,302 : 1,000 \\ &= 3.302 \times 1.34 \\ &= 4.42 \text{ HP} \end{aligned}$$

The power required to design this shelling machine is 4.42 HP , but considering that this machine is not available on the market, the engine used is a 5.5 HP gasoline engine.

### 3.4 Shaft Diameter Calculation

#### 3.4.1 Calculation of the Mill Shaft

The power specifications planned for use are 5.5 HP :

$$P = 5.5 \text{ HP}$$

$$P = 5.5 \times 0.735 \text{ kW}$$

$$P = 4.0425 \text{ Kw}$$

Design power for calculating the screw shaft. For the magnitude of the correction factor (fc) is 1.2 then :

Table 2 Correction Factors

| Power to be Transmitted | f <sub>c</sub> |
|-------------------------|----------------|
| Average power required  | 1.2 – 2.0      |
| Maximum power required  | 0.8 – 1.2      |
| Normal power            | 1.0 – 1.5      |

$$\begin{aligned} P_d &= f_c \times P \\ &= 1.2 \times 4.0425 \text{ kW} \\ &= 4,851 \text{ Kw} \end{aligned}$$

#### 1. Moment of the punter's plan,

$$\begin{aligned} T &= 9.74 \times 10^5 \frac{P_d}{n_2} \\ &= 9.74 \times 10^5 \times \frac{4,851 \text{ kW}}{320 \text{ rpm}} \\ &= 9.74 \times 10^5 \times 0.01816 \\ &= 17,696.15 \text{ kg.mm} \end{aligned}$$

#### 2. Allowable shear stress

The planned shaft material is ST 37 with a tensile strength  $\sigma_b$  of 37 kg/mm<sup>2</sup>

$$\begin{aligned} \tau_a &= \frac{\sigma_b}{Sf_1 \times Sf_2} \\ &= \frac{37 \text{ kg/mm}^2}{6 \times 3} \\ &= 2.056 \text{ kg/mm}^2 \end{aligned}$$

#### 3. Corn sheller shaft diameter

It is known that:

$$K_t = 1,1$$

$$C_b = 1,2$$

$$d_s = \left[ \frac{5,1}{\tau_a} K_t \times C_b \times T \right]^{1/3}$$

$$d_s = \left[ \frac{5,1}{2,056} 1,1 \times 1,2 \times 17.696,15 \right]^{1/3}$$

$$d_s = [57.942,84]^{1/3}$$

$$d_s = 37.3 \text{ mm}$$

Therefore, the diameter of the planned sheller shaft is 37.3 ( mm) while the diameter of the sheller shaft used is 38 (mm). Therefore , the shaft is safe to use.

### 3.4.2 Blower Shaft Calculation

The power specifications planned for use are 5.5 HP :

$$P = 5.5 \text{ HP}$$

$$P = 5.5 \times 0.735 \text{ kW}$$

$$P = 4.0425 \text{ Kw}$$

Design power for calculating the screw shaft. For the magnitude of the correction factor (fc) is 1.2 then :

$$Pd = fc \times P$$

$$= 1.2 \times 4.0425 \text{ kW}$$

$$= 4,851 \text{ kW}$$

#### 1. Planned torsion moment

$$T = 9.74 \times 10^5 \frac{Pd}{n_3}$$

$$= 9.74 \times 10^5 \frac{4,851 \text{ kW}}{1.425 \text{ rpm}}$$

$$= 9.74 \times 10^5 \times 0.003214$$

$$= 3,315.7 \text{ kg.mm}$$

#### 2. Allowable shear stress

The planned shaft material is ST 37 with a tensile strength  $\sigma_b$  of 37 kg/mm<sup>2</sup>

$$\tau_a = \frac{\sigma_b}{Sf_1 \times Sf_2}$$

$$= \frac{37 \text{ kg/mm}^2}{6 \times 3}$$

$$= 2.056 \text{ kg/mm}^2$$

#### 3. Blower shaft diameter

It is known that:

$$K_t = 1.0$$

$$C_b = 1.2$$

$$ds = \left[ \frac{5.1}{\tau_a} K_t \times C_b \times T \right]^{1/3}$$

$$ds = \left[ \frac{5.1}{2,056} 1,0 \times 1,2 \times 3.315,7 \right]^{1/3}$$

$$ds = [9867,6]^{1/3}$$

$$ds = 20.45 \text{ mm}$$

So, the planned diameter of the sheller shaft is 20.25 ( mm) while the diameter of the blower shaft used is 20 (mm).

## 3.5 Pulley Calculation

### 3.5.1 Pulley Shaft

$$\frac{n_1}{n_2} = \frac{D_p}{d_p}$$

Where :

$D_p$  = Diameter of the driven pulley (mm)

$d_p$  = Drive pulley diameter 2 inches

$$= 50.8 \text{ mm}$$

$n_1$  = Drive pulley rotation = 1,425 rpm (According to stationary motor)

$n_2$  = Driven pulley rotation = 320 rpm

$$\frac{n_1}{n_2} = \frac{D_p}{d_p}$$

$$\frac{1.425 \text{ rpm}}{320 \text{ rpm}} = \frac{D_p}{50,8 \text{ mm}}$$

$$D_p = \frac{1.425 \times 50,8}{320}$$

$$D_p = 226.21 \text{ mm}$$

So, the diameter of the driven pulley on the sheller shaft is 226 mm but the one sold on the market is 228.6 mm = 9 inches, so the author uses 228.6 mm = 9 inches.

### 3.5.2 Blower Shaft Pulley

To calculate the blower shaft pulley, the author planned the drive shaft pulley (  $d_1 = 50.8$  mm) to be the same as the pulley diameter for the blower shaft, considering that the driving power source is the same.

It is known that:

$$n_1 = 1,425 \text{ rpm}$$

$$d_1 = 50.8 \text{ mm} = 2 \text{ inches}$$

$$d_3 = 50.8 \text{ mm} = 2 \text{ inches}$$

$$n_3 = \dots?$$

So,

$$n_1 \cdot d_1 = n_3 \cdot d_3$$

$$1.425 \cdot 50.8 = n_3 \cdot 50.8$$

$$n_3 = \frac{1.425 \times 50,8}{50,8}$$

$$n_3 = 1,425 \text{ rpm}$$

Information :

$$n_1 = \text{Power drive pulley rotation (rpm)} = 1425 \text{ rpm (According to stationary motor)}$$

$$n_3 = \text{Driven blower pulley rotation (rpm)}$$

$$d_1 = \text{Diameter of the drive pulley (mm)} = 50.8 \text{ mm} = 2 \text{ inches}$$

$$d_3 = \text{Diameter of the driven blower pulley (mm)}$$

## 3.6 V-Belt Calculation

### 3.6.1 Sheller Shaft Belt

Where :

$$\text{Pulley 1 (dp)} = 50.8 \text{ (mm)}$$

$$\text{Pulley 2 (Dp)} = 228.6 \text{ (mm)}$$

#### 1. Sheller Axis Distance

$$C = 2 \times D_p$$

$$= 2 \times 228.6 \text{ mm}$$

$$= 457.2 \text{ mm}$$

#### 2. Belt Circumference Length

$$L = 2C + \frac{\pi}{2}(d_p + D_p) + \frac{1}{4C}(D_p - d_p)^2$$

$$L = 2 \times 457.2 + \frac{3,14}{2}(50.8 + 228.6) + \frac{1}{4 \times 457,2}(228.6 - 50.8)^2$$

$$L = 914.4 + 438.65 + 17.28$$

$$L = 1,370.33 \text{ mm}$$

$$L = 1,372 \text{ (mm)}$$

The axis distance of the axle C can be expressed as:

$$C = \frac{b + \sqrt{b^2 - 8(Dp - dp)^2}}{8}$$

For the value of b,

$$\begin{aligned} b &= 2L - 3.14 (Dp + dp) \\ b &= 2 \times 1.372 - 3.14 (228.6 + 50.8) \\ b &= 2,744 - 877.31 \\ b &= 1,866.69 \text{ (mm)} \end{aligned}$$

So,

$$C = \frac{1.866,69 + \sqrt{1.866,69^2 - 8(228,6 - 50,8)^2}}{8} \quad C = \frac{1.866,69 + \sqrt{3.484.531,55 - 1.422,4}}{8} \quad C =$$

$$\frac{1.866,69 + 1.866,30}{8}$$

$$C = 466.63 \text{ ( mm)}$$

### 3.6.2 Blower Shaft Belt

Where :

$$\begin{aligned} \text{Pulley 1 (dp)} &= 50.8 \text{ (mm)} \\ \text{Pulley 3 (Dp)} &= 50.8 \text{ ( mm)} \end{aligned}$$

#### 1. Blower Shaft Axial Distance

$$\begin{aligned} C &= 2 \times Dp \\ &= 2 \times 50.8 \text{ mm} \\ &= 101.6 \text{ mm} \end{aligned}$$

#### 2. Circumference length of blower belt

$$\begin{aligned} L &= 2C + \frac{\pi}{2} (dp + Dp) + \frac{1}{4C} (Dp - dp)^2 \\ L &= 2 \times 101.6 + \frac{3,14}{2} (50.8 + 50.8) + \frac{1}{4 \times 127} (50.8 - 50,8)^2 \\ L &= 203.2 + 159.5 + 0 \\ L &= 362.7 \text{ mm} \\ L &= 381 \text{ (mm)} \end{aligned}$$

The axis distance of the axle C can be expressed as:

$$C = \frac{b + \sqrt{b^2 - 8(Dp - dp)^2}}{8}$$

For the value of b,

$$\begin{aligned} b &= 2L - 3.14 (Dp + dp) \\ &= 2 \times 381 - 3.14 (50.8 + 50.8) \\ &= 762 - 319,024 \\ &= 442.97 \text{ ( mm)} \end{aligned}$$

So,

$$C = \frac{442,97 + \sqrt{442,97^2 - 8(50,8 - 50,8)^2}}{8}$$

$$C = \frac{442,97 + \sqrt{196.225,07 - 0}}{8}$$

$$C = \frac{442,97 + 442,97}{8}$$

$$C = 110.74 \text{ ( mm)}$$

## 3.7 Bearing Calculation

### 3.7.1 Sheller Shaft Bearing

Bearing number = 6208  
 Inner diameter (d) = 40 mm  
 Outer diameter (D) = 80 mm  
 Bearing width (B) = 18 mm  
 Radius (r) = 2 mm  
 Specific dynamic nominal capacity  
 (C) = 2,380 kg  
 Specific static nominal capacity  
 (Co) = 1,650 kg

### 1. Equivalent Load Calculation

It is known that:

$$X = 1$$

$$V = 1$$

For the Mass of the Shell Shaft,

$$m = (V_{\text{shaft 1}} + V_{\text{shaft 2}} + V_{\text{blade}}) \times \rho_{\text{baja st 37}}$$

$$m = (0.000227 + 0.002935 + 0.00036738) \times 7850 \text{ kg/m}^3$$

$$m = 27.70 \text{ kg}$$

So,

$$Fr = \frac{m \times g}{\frac{n}{2}}$$

$$= \frac{27,70 \times 9,81}{2}$$

$$= 135.86 \text{ kg}$$

So, the dynamic equivalent load is

$$Pr = X \cdot V \cdot Fr + Y \cdot Fa$$

$$= 1 \times 1 \times 135.86 \text{ kg} + 0$$

$$= 135.86 \text{ kg}$$

Nominal age of the sheller

$$f_h = f_n \cdot \frac{C}{Pr}$$

$$f_n = \left( \frac{33,3}{n^2} \right)^{1/3}$$

$$= \left( \frac{33,3}{320} \right)^{1/3}$$

$$= 0.47$$

$$f_h = f_n \cdot \frac{C}{Pr}$$

$$= 0.47 \cdot \frac{2.380}{135.86}$$

$$= 0.47 \times 17.51$$

$$= 8.23$$

age of the sheller  $L_h$  is

$$L_h = 500 \cdot f_h^3$$

$$= 500 (8,23)^3$$

$$= 500 (557.44)$$

$$= 278,720 \text{ hours}$$

### 3.7.2 Blower Shaft Bearing

Bearing number = 6204

Inner diameter (d) = 20 mm

$$\begin{aligned} \text{Outer diameter (D)} &= 47 \text{ mm} \\ \text{Bearing width (B)} &= 14 \text{ mm} \\ \text{Radius (r)} &= 1.5 \text{ mm} \\ \text{Specific dynamic nominal capacity (C)} &= 1,000 \text{ kg} \\ \text{Specific static nominal capacity (Co)} &= 635 \text{ kg} \end{aligned}$$

1. Equivalent load calculation

It is known that:

$$\begin{aligned} X &= 1 \\ V &= 1 \\ Y &= 2.30 \end{aligned}$$

For the blower shaft mass, namely:

$$\begin{aligned} m &= V_{\text{blower shaft}} \times \rho_{\text{st 37}} \\ m &= 0.00005338 \text{ m}^3 \times 7850 \frac{\text{kg}}{\text{m}^3} \\ m &= 0.41 \text{ kg} \end{aligned}$$

So,

$$\begin{aligned} Fr &= \frac{m \times g}{n} \\ &= \frac{0,41 \times 9,81}{2} \\ &= 2.01 \text{ kg} \end{aligned}$$

Therefore,

$$\begin{aligned} \frac{Fa}{Co} &= 0.014 \\ \frac{Fa}{635 \text{ Kg}} &= 0.014 \\ Fa &= 8.89 \text{ Kg} \end{aligned}$$

So, the dynamic equivalent load is

$$\begin{aligned} Pr &= X \cdot V \cdot Fr + Y \cdot Fa \\ &= 1 \times 1 \times 2.01 \text{ kg} + 2.30 \times 8.89 \\ &= 2.01 \text{ kg} + 20.44 \text{ kg} \\ &= 22.45 \text{ kg} \end{aligned}$$

life  $L_h$  of the blower is

$$\begin{aligned} f_h &= f_n \cdot \frac{C}{Pr} \\ f_n &= \left( \frac{33,3}{n_3} \right)^{1/3} \\ &= \left( \frac{33,3}{1.425} \right)^{1/3} \\ &= 0.28 \end{aligned}$$

So,

$$\begin{aligned} f_h &= f_n \frac{C}{Pr} \\ &= 0.28 \frac{1.000}{22.45} \\ &= 0.28 \times 44.54 \\ &= 12.47 \\ L_h &= 500 \cdot f_h^3 \\ &= 500 (12.47)^3 \\ &= 500 (1,939.09) \end{aligned}$$

= 969,545 hours

## **Maintenance and Repair**

### Maintenance

Maintenance is an activity that is carried out regularly to prevent or reduce the causes of damage, so that maintenance will extend the life of the machine and improve the preparation of the tool so that it functions in good condition.

### Repair

Repairs are work carried out to repair or replace damaged components *which* can result in equipment not functioning properly. Generally, the solution to this repair is simple.

## **5. CONCLUSION**

From the results of the design and construction of a corn husking machine with a capacity of 80 kg/hour using a combustion engine and the trials carried out, the following conclusions can be drawn:

1. Based on the design that has been carried out, the combustion engine power used is a 5.5 HP gasoline combustion engine .
2. The shaft diameter used on the sheller shaft is 38 mm while the blower shaft diameter is 20 mm.
3. The pulley used on the drive has a diameter of 50.8 mm, the sheller shaft pulley is 228.6 mm, the blower shaft pulley is 50.8 mm.
4. Belt on the A71 sheller shaft and the A58 blower shaft belt.
5. The sheller shaft bearing is 6028 while for the blower shaft it is 6024.

## **6. BIBLIOGRAPHY**

(Meriam JL, MT Statistics, 2000 : 404)

RS Khurmi and JK Gupta, *Theory Of Machines* , 1980

Sato, Takeshi and N. Sugianto. 1986. *Drawing Machines According to ISO Standards* . Jakarta: Paradnya Paramita

Sudiar, Asrul. "Implementation and Design of Applications in Bearing and Bearing Planning." *Poros Teknik* 8.2 (2016): 73-78.

Suga, Sularso and Kiyokatsu, *Basics of Planning and Selection of Machine Elements* , 2018.

Surya, Indra, and Tri Pujianto. "DESIGN OF CORN HULLERS." *JOURNAL OF MECHANICAL ENGINEERING* 5.2 (2018).

Tawaf, Nanang. "Design of a Corn Huller for Home Industry." *Indonesian Journal of Applied Science and Technology* 1.1 (2020): 47-54.