Modification Of Coffe Fruits Breaking Machine Two Cylinder Type With Capacity 700 Kg / Jam

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Abstract: Modification of a tool is an early activity of the business development of a product that is needed by the community. In this case wants a tool or breaking machine to improve the production of fast, precise, and efficient. Because there are still many farmers who use single cylindrical coffee-breaking machine even most still use traditional or manual way. The purpose of this research is to modify the simple two-cylinder wet coffee breaking tool so that it can be easily applied in the community, especially to small and medium-sized coffee of farmers in rural areas, and to improve the production result in order to achieve the appropriate result both in the work and quality. . From the calculation of the machine obtained high dimension 1200 mm, width 450 mm and length 600 mm. With the material characteristics are: Sheet plate, Shaft, Iron frame, Cylindrical breaker, Bearing, Pulley, Belt and gasoline engine 6.5 HP. The results of this machine operation is a coffee fruit that has been broken with a capacity of 800 kg / hour.

Keywords: wet coffee fruit, crusher machine, modification, development, bearing, torque, shaft

1 INTRODUCTION

The breaking of wet coffee fruit (pulping) is one of the stages of the process that distinguishes between coffee processing in wet and dry. In wet processing, coffee fruit that has reached the optimum maturity level should be split and dried, while on dry processor, the coffee crops are dried until the water content is procured between 16-17%. Generally, the process of breaking the wet coffee fruit is driven by a source of manual power and motor fuel and is assisted with a certain amount of water. The breaking of the coffee fruit takes place within the space between the rotating cylinder surface (rotor), and the surface of the silent plate (stator). The rotor has a bubble plate and is made of soft copper type metal (Widyotomo et al., 2009; Sri Mulato et al., 2006; Wintgens, 2004). The objective of this researchare: With this research conducted, then there are some benefits that can be obtained are:

1. Facilitate farmers to accelerate the process of drying coffee fruit.
2. This coffee-breaking machine can be mass-produced.
3. Know the insight modification wet coffee breaker machine type two-cylinder.
4. It can attract students to modify the machine, because of the possibility to improve the quality and quantity of the results of splitting, with the propulsion of gasoline or diesel engines.

2. MODIFICATION METHODE

In the modification of this wet coffee breaker tool, the authors conducted a survey first. This survey was conducted with the aim of getting a picture of the design and working system of wet coffee breaker machine.The methods used in the preparation of this report are:

A. Method of observation

Observation method is a method of data collection where the authors make direct observations to clarify the writing because it is expected directly on the media observed.

B. Literature method

Literature method is a method of data collection where the authors read and study materials related to the report.

C. Interview method

Interview method is a method of data collection where the authors conduct direct interviews with interested persons and related agencies.

D. How Machine Works

This two-cylinder wet coffee-breaking machine has a transmission system in the form of pulleys and belts. The rotary motion of the engine shaft is transmitted to the pulleys one and two then from the pulleys one and two transmitted to the pulley of the three and the four pulleys are transmitted using a belt. When the engine is turned on, then the engine shaft will transmit the round through the slot to move the coffee-breaking shaft. If the spindle shaft has been spinning then the wet coffee fruit is ready to be put into the feeder tub (hoppers) and then open the rollers, then the wet coffee fruit will be split through the single breaking cylinder and the two breaker cylinders.

E. Fruit Coffee Breaking Machine Construction.

Based on the table matrix construction wet coffee breaker machine is selected are as follows:

1. Skeletal profile of second and third variants is selected L profile and U profile because the profile has good strength.
2. Power sources are selected by gasoline engine.
3. Transmission system selected first variant of the belt and pulleys because it is easy in use.
4. Hopper selected first variant shaped prism.The reason for choosing the form of prism because it can accommodate the fruit of coffee in large quantities.
5. The outlet is selected first variant because the coffee fruit can come out quickly

3. RESULT AND DISCUSSION

3.1. Counting Machine Torque

In this design to facilitate the calculation is taken some data obtained:

- Diameter of cylindrical solver = 15 cm and 10 cm (before tested 10 cm only)
- The cylinder solver length = 23 cm
- Cylinder gap = 7 mm = 0.7 cm
- Average weight of 1 coffee = 8 g = 0.008 kg / fruit or 125 pieces / kg
- Specific weight of 1 coffee = 0.000561 kg / cm3 = 0,561 gr / cm3
- Average diameter of coffee = 1cm

- The first cylindrical diameter of 15 cm and the second breaking cylinder by 10 cm were calculated based on survey results
- Field and experience in the mechanical machinery industry
- Around the circle of a coffee-soluble cylinder roll roll = π.
  = 3.14. 15 cm
  = 47.1 cm ≈ 47 cm (Taken).

Volume of cylinder gap = Round of sil x Length of sil x Gap sil
= 47 cm x 23 cm x 0.7 cm
= 756.7 cubic cm.

So from 10 kg of coffee to be processed, the weight in each one round can be calculated as follows:
Heavy coffee fruit processed one round:
= Volume / rotation x specific gravity
= 756.7 cm 3 / rotation x 0.561 gr /cm3
= 424.11 gr / rotation

The amount of coffee that is processed in a single round is
= 424.11 gr : 8 gr / coffee fruit
= 53 pieces of coffee.

Specifications of gasoline engine type HONDA GX 200 H
- Engine Type: Single Cylinder, OHV 25, 4-Stroke, Air Cooled
- Compression ratio: 8.5 : 1
- Horse Power Output: 4.8 kW (6.5 HP) / 3600 rpm
- Torque: 12.4 Nm (9.1 lbs ft) at 2,500 rpm
- Maximum Torque: 1.35 kgf-m (13.2 Nm) / 2500 rpm
- Ignition System: Ignition Magnetic Transistor
- Fuel Tank Capacity: 3.6 Liter
- Dimensions (L x W x H): 313 x 386 x 335 mm
- Weight: 16 Kg
- Product Warranty: 12 Months (Service)

Lubricant Capacity: 0.6 Liter, SAE 5W- 30 Counting torque at 6.5 HP engine power at 3600 rpm T = 9.74 x 105 N/n (kg.mm)
Where :
N = Engine power (kW)
N = 3600 rpm
T = 9.74 x 105 N/n Where N = 6.5 HP
= 4849 Watt
= 4.8 kW
= 9.74 x 105 x 4.8 (Kwatt) 3600 (rpm))
= 974000 x 0.0013333333
= 1298.66 kg.mm.
= 12.9 N.m.
Styles that work on coffee-breaking cylinders:
T = *F* . $r1$ where $r1$= 15 cm, r 2 = 7,5 cm = 0,075 m
F = $T/r1$ = 12,9 Nm : 0,075 m
= 172 N

The Rotation of Pulleys Can Be Determined Based on Formula:
N2 = n1/ D2 x D1
Where :
N1 = Engine pivot rotation
N2 = Turn of the pulleys
N2 = n1 /D2 x D1
= 3600 100 x 100 mm
= 3600 rpm.
N3 = n2/D3 x D2
= 3600 250 x 100 mm
= 1440 rpm.
N4 = n3/ D4 x D3
= 1440 /100 x 250 mm
= 3600 rpm.

3.2 Calculation of Engine Power

To calculate the engine power to reach the tool capacity of 700 kg / hr then the required calculation as follows:

P = T .2 π n x 60 (watt) .... (Sularso & Suga, 2008: 7)
Where:
P: Engine power (Watt) n: Engine pivot rotation (rpm)
T: Torque (N.m) π: 3.14
T1 .2phi n1 60 = T2 .2phi n2 60
T1. n1 = T

Figure 3.5. Torque On Cylindrical Shaft Axis Is known :
N1 = 3600 rpm n2 = 3600 rpm
N3 = 1400 rpm n4 = 3600 rpm
T2 = 12.9 N.m

The amount of torque in the driving pulley is:
T1 = 12.9 3600 3600 = 12.9 N.m

Then the machine's power is:
P = T1 .2phi n 60 Watt .... (Sularso & Suga, 2008: 7)
= 12.9. 2 (3.14). 3600 60
= 4860.72 Watts
= 6.5 HP

So the engine power used is 4860,72 Watt, almost the same as the planned power 4846 Watt (6.5 HP). So the machine used is still safe to use.

3.3Planning of Bearing

The bearings used to support the shaft are Deep Bearings Groove Ball Bearings no: 6006. These bearings are used for rotary shafts on rotation (n) 1400 (rpm). The axle diameter of the bearings is 30 mm. The data of planning
- The cylinder spindle shaft is supported by 2 bearings with rotation (n3): 1440 rpm.
- Shaft diameter: 30 mm
- Specific dynamic nominal capacity (C): 1030 Kg
- Specific static nominal capacity (Co): 740 Kg
- Bearing type Deep GrooveBall Bearing no: 6006
- Bearing width (B): 13 mm
- The inner ring rotates then V: 1.

The radial force (Fr) occurring on the axis is 39.24 Kg
- Axial force (Fa) that occurs on the axis: 58.86 Kg
- Fa / C0 = 58,86 / 740 = 0.079
- Radial load factor used X: 0.56
- Axial load factor Y: 1.79
- Load factor V: 1

Equivalent loads can be calculated:
P = X .V. Fr + Y. Fa
= 0.56. 1 .39.24 Kg + 1.79. 58.86 kg
= 21.97 Kg + 105.35 Kg
= 127.32 Kg.

The nominal lifespan of the pads can be calculated by the formula (Sularso & Suga, 2008):

Lh = 500. (33.3 n) 1/3. (CP)
=500. (33.3 1400) 1/3. (1030 127.32)
=500. 0.28. 8.08
=1131.2 Hours.
Where:
Lh = nominal bearing age (hr)
N = 1440 rpm
C = Specific dynamic nominal capacity (Kg)
P = equivalent load (Kg).

Calculation of Engine Operating Capacity
The engine performance test is a step in the operation of a machine. This performance test aims to determine the actual engine capacity and know the quality of the engine made. In addition, this engine performance test is also to determine the deficiencies that exist in the machine, so that in the future can be done improvements on the machine. The test was done three times experiment, where each experiment each use sebnyak 10 kg of wet coffee fruit. Determination of solving capacity using the following equation:
Kap = Wo / t
Where :
Kap = Working capacity (kg / hour)
Wo = Coffee fruit weight (kg)
T = Break time (hr)

The quality of the cracking result is determined by the result of breaking the wet coffee with the average diameter of wet coffee is 1 cm. Sample wet coffee fruit as much as 10 kg. The experimental method is carried out in the following manner:

A. The fruit of coffee is fed into the machine hopper.
B. Open the roll in and stel the gap according to the gap of the coffee fruit diameter.
C. The experiment is done until the coffee that is put into the hopper is all processed and will come out already in a split form
D. The experiment was done 3 times

3.4 The Operation Trial Test data obtained:presented in table

Table 3.1*. Data on Experimental Time of Wet Coffee Breaking Experiment*

Trial number	I	II	III	Average
Time (minutes)	0.75	0.75	0.78	0.75

4. CONCLUSION

From the results of Modification of Coffee Wet-Breaking Machine Type Two Cylinders obtained the following calculation results:

1. Coffee breaker capacity And Round Machine shaft

- The planned coffee-breaking capacity (Q) = 700 Kg / hour.
- The rotation on the engine shaft is 3600 rpm.
- The rotation on the crushing shaft is 1440 rpm
- Axis spacing (C) = 600 mm and 400 mm
- Puli 1 (d1) = 100 mm.
- Puli 2 (d2) = 100 mm.
- Pulle 3 (d3) = 250 mm.
- Puli 4 (d4) = 100 mm

2. Engine Power

- Used engine power = 6.5 HP = 4849 Watt
- Theoretically needed power = 6.5HP = 4860,72 Watt
- Calculation of torque, obtained torque = 1298.66 kg.mm = 2.9 N.m
- The force acting on the cylinder = 172 N

3. Bearing

- Specific dynamic nominal capacity (C): 1030 kg
- Specific static nominal capacity (Co): 740 kg
- Bearing type Deep GrooveBall Bearing, 6006
- Wide Bearing width = 13 mm
- Equivalent load = 127.32 Kg.
- Age bantlan = 2787.6 Hours

4. Experiment results of coffee breaker machine

- The result of testing or experiment of coffee breaker machine that has been done three times obtained the average yield of 800,6 Kg / hour, bigger than the planned capacity is 700 Kg / hour.
- The quality of the results before and after the modification of wet coffee breaker tool is 60% of the coffee is split while it is after the modification is 85% of coffee pieces are split.

5. REFERENCE

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