Design and Development Engine Modifications Noken (Camshaf) Stars In SMK Nusantara Thatch

M A Rais

1 Department of Mechanical Engineering, Faculty of Engineering, University of Bandar Lampung. e-mail: muhammadrais00@gmail.com

Abstract. The purpose of this thesis are: (1) designing a modified engine construction design camshaft, (2) to know the ingredients of engine components and to know calculation engine modification, camshaft. The (3) determining the transmission range of the engine, (4) with the ability to adjust the electrical power for small to medium workshop which is estimated at between 900 to 1300 watts. This design concept refers to the design concept darmawanie with several stages, among others needs, defining the project and a list of requirements, outlines prancangan product concept, then design products. The results of the design of this machine is made is the result: (1) The design of the engine modifications that are efficient, (2) transmission system engine modification is to change the rotation of the motor power from 1400 rpm to 700 rpm, with a component in the form of 2 pulley diameter 3 "and 6", connected by v-belt and shaft diameter of 20 mm used with St37 material. From this machine is capable of producing a modified one camshaft racing/ hour. Keywords. Design; engine development; camshaft

1. Introduction
Motorcycles are two-wheeled vehicle powered by an engine, use of motorcycles in Indonesia is very popular because the price is relatively cheap, affordable for most people and the use of fuel as well as operational cost saving enough. And also a motorcycle is a vehicle formed by some punyusun components, one of which is Nokens as(Camshaft). Noken is a component contained in the 4-stroke engine that serve to set up and move the valve / valve (valve) by pushing with two protrusions (lift). Noken driven by timing chain (chain kamprat / cam chains), which relate to the crankshaft. Noken designed berdasarkan four things:

A. The duration
   is the time opening and closing of the valve in one work cycle is calculated based on changes in the position of the crankshaft measured in terms of degrees.

B. The lift
   height is calculated from the valve forces completely closed valve position through a full open valve position is perfect.

C. Profile
   is the shape of the camshaft, which distinguishes between the camshaft with the other one is seen from the flank and nose. Although the duration and lift the same character is not necessarily camshaft with the same.

D. Lobe separation angle (LSA)
   is the distance between the peak point bulge cam in and camp out which translated into degrees of crankshaft angle.
Grinding process of the camshaft that is now used in two ways: manually and using tools or grinding camshaft homemade machines. The grinding process is done manually, the grinding process using a grinding sitting alone in modifying the camshaft. This process only rely on the experience and skill of the mechanic so that if the poor mechanical finesse it will produce a camshaft which is not good. While the grinding process that uses a tool / homemade machine when compared to manual work much better for finesse not very influential, but the tool / engine modification camshaft that exist today have some drawbacks. Disadvantages engines that exist today are still limited camshaft that can be done, the price of the machine is still too expensive, the movement of holder the camshaft that can only be to the side alone and others. Therefore designer create a "tool / engine modification Camshaft" so that all the above problems can be resolved. The function of this tool is that we can change the duration camshaft standard becomes greater in rank in a matter of degrees of crankshaft as well as we can determine the lift. This engine is a development of existing machines. The purpose of this study is to get the design and working drawings of the camshaft modification machinery construction and determine the level of security on materials such camshaft engine component modification. The benefits of this research is as an application of theory and practice which is obtained when dibangku schools and diperkuliah, as the process of character formation work in the face of world competition work later and provide reference for the community and students in opening new entrepreneurs and entrepreneurial development of industry, workshops and institutions.

2. Methods

2.1 Components Designed

In planning the concept of modification Camshaft engine mechanism is designed and known main components required. The machine is made of several main components, namely for the propulsion electric motors 1 hp 1400 rpm, the transmission belt use V-belt 3 "and 6" and for cashing or body using elbows plate and plate slabs with a thickness of 5mm.

2.2 Image design Build Engineering Modification Camshaft

Caption:
1. Theseat pulley
2. table board
3. Transmission Parts
4. camshaft holder section
5. Catok cross
6. grinding wheel / Sandpaper
7. Frame Machine

Figure 1. Tune lobe separation angle
2.3 *FrameMachine*

Framemachine is a structure that became the basic form that sustains and forming machine, Order on the enginemodificationcamshaft formed from the composition of the L profile bars measuring 40 x 40 x 3 mm.

![FrameMachine](image1)

**Figure 2.** Camshaft Machine Design Modifications

![Wheel Sandpaper](image2)

**Figure 3.** Framemachine

Frameis coupled with the welding connection. Welding is to connect two metal parts by heating to its melting temperature. Welding is done on the enginemodificationcamshaft is using SMAW(ShieldMetalArcWelding) to the connection type I and fillets. Chosen using SMAW welding because it can be used to weld carbon steel of any kind, according to weld L profiles are used as the framework enginemodification. camshaft Moreover, it can save on production costs compared to other types of welding. These components are useful to support other components such as seat-component camshaft, motorcycles, grinding wheels, cross clamp.

2.4 *Abrasive Wheels*

This component is useful to scrape camshaft from the standard diameter shape until kebentuk predetermined diameter. At this stage the speed of rotation of the wheel sandpaper very decisive result of the erosion of the camshaft. The workings of this abrasive wheel is motor driven through an intermediary v-belt and abrasive wheels spinning. Ampals tip wheel will slide against the body and produce camshaft racing camshaft.

2.5 *Cross Catok*

This component is useful as a sledge on a modified engine camshaft and also to regulate the thickness of the erosion.

![CrossVise](image3)

**Figure 5.** CrossVise

![transmission shaft](image4)

**Figure 6.** transmission shaft

![standcamshaft](image5)

**Figure 7.** Standcamshaft

2.6 *Axis*

This component serves to rotate the wheel amplaspada when etching camshaft. This shaft is rotated by an electric motor melalui intermediary v-belt.
2.7 Stand camshaft
This component serves as a place to mount a camshaft and holder camshaft in the engine modification. Camshaft is one component that is vital, because this holder will hold the camshaft during the process of modification. Construction holder camshaft using paired bearing holder above camshaft as a pedestal the shaft and drill chuck. Use of bearings also to reduce friction with the shaft. Holder Camshaft put on sledge transverse and longitudinal sledge that can be driven back and forth or right to left.

2.8 Pully holder
Pully holder on the engine modification camshaft serves as a place of attachment of the bearing, shaft and puly sandpaper. Pully holder construction is the same with the holder camshaft, the camshaft which together are bearing supported by the strip plate thickness of 5 mm.

2.9 DibbleBor
This component serves as a brace camshaft at the time of execution. And this drill dibble placed on the camshaft holder component.

2.10 Method Machine Work
Machine camshaft modification will work when the electric motor is turned on, then will rotate the motor motion of the engine is transmitted to the pulleys 1, of the pulley 1 is transmitted kepuli 2 Use v belt to drive the shaft. Once the shaft rotates the grinding wheel or wheels which have been coated abrasives will spin and camshaft which is mounted on the drill dibble ready to be modified.

3 Results and Discussion
3.1 Preliminary data
Construction Design modifications camshaft engine is determined on the following considerations:

a. ergonomic machine specification making it comfortable for the operator and easily adjusted with a den or small business space and can be moved in place. Estimated engine dimensions length x width x height that is 500x500x410 mm.

b. Source AC electric motor tailored to the capabilities of electrical power for small to medium sized business workshop is expected to average ranged from 900 to 1300 Watt.

c. Easy in operation, maintenance and replacement of machine parts.

3.2 The design of the transmission system
Transmission system consists of a reductant in the form of a V-belt and pulley. The transmission system is expected to reduce the rotation of the motor according to the desired rotation, increasing torque and fulfill the safety requirements for operators. As for the V-belt and pulley selected with consideration capable of connecting the shaft relatively long distance and not meimbulkan noise. Table 3 is the comparison value (ratio) rounds the result of the reduction transmission system modification Camshaft.

Description:
\[ n_1 = 1400 \text{rpm} \]
kerja1 n = 1400rpm x i1  

---

Figure 8. Mounting pulleys and wheels sandpaper
Figure 9. dibble drill
\[ n_{kerja2} = 1400 \text{rpm} \times (i_1 \times i_2) \]
\[ = 1400 \text{rpm} \times i_{\text{total}} \]
\[ \text{final} = n \]

Table 1. Comparison of rotation ratio transmission system modifications engine camshaft.

<table>
<thead>
<tr>
<th>No.</th>
<th>Transmission</th>
<th>Ø (mm)</th>
<th>( i ) work</th>
<th>( n ) work (rpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pulley motors</td>
<td>76.2</td>
<td>1</td>
<td>1400</td>
</tr>
<tr>
<td>2</td>
<td>Pulley shaft</td>
<td>152</td>
<td>0.5</td>
<td>700</td>
</tr>
</tbody>
</table>

\[ i_{\text{total}} (i_1 \times i_2) = 0.5 \]
\[ n_{\text{end}} = 700 \]

3.3 Analysis of Torque Spindle

For every object spun suffered centripetal and centrifugal force. Centripetal force is the force acting on an object moving in a circle in which the direction of the force is always towards the center of the circle. Or it can also be said \( F_s \) (centripetal force) is the force that makes the object to move in a circle. In this case the pulleys sandpaper undergo centripetal force, which amount as follows. Style Sentripetral happened

\[ F_s = m. \]

Where:
- \( M = \) mass of sandpaper (0.07 kg)
- \( r = \) fingers finger pully (0.15 mm)
- \( R = \) fingers sandpaper wheel spokes (150 mm)

\[ V \text{ sought by the following equation: } C_s = \]
\[ C_s = \]
\[ v = 10.99 \]
then:
\[ F_r = m. \]
\[ F_r = m. \]
\[ = 56.4 \text{ N} \]

Then the torque experienced by the shaft, namely:
\[ \text{Torque (TA)} = F \times R \]
\[ = 5.7 \text{ kgx 150 mm} \]
\[ = 855 \text{ kg.mm} \]

So the magnitude of the torque experienced by the shaft is 855 kg.mm or 8.4 Nm.

3.4 Analysis Power Requirement

Knowing the magnitude of the torque experienced by the shaft in the above calculations, the power requirement can be known by entering the amount of torque to the equation. Assuming the efficiency \( (\eta) = 90\% \) and a correction factor \( (f_c) \text{belt} = 1.3 \) (the engine modification camshaft is expected to work every 3-5 hours / day. (Sularso and Suga, 2004: 165). The following is the calculation of the power kebutahan motor (N)
\[ = 720.06 \text{ watts} = 0.96 \text{ Hp} \]

3.5 Propulsion Torque Analysis

by knowing the magnitude of the torque experienced by the shaft in the above calculations, the power requirement can be known by entering the amount of torque to the equation. Assuming efficiency \( (\eta) = 90\% \) and a correction factor \( (f_c) \text{belt} = 1.3 \) (the engine modification camshaft is expected to work every
3-5 hours / day, (Sularso and Suga, 2004: 165). the following is the calculation of the power kebutahan motor (N)

\[ N = 720.06 \text{ watts} = 0.96 \text{ Hp} \]

3.6 Transmission shaft Calculation

Given:
- Power dtranmisikan \((p)\) = 0.746
- rotation axis \((n)\) = 700 rpm
- moment = 11.91 Nm
- axis = 1215.3 kg.mm

Material St 37

shear stress allowed \((\tau_a)\) = 3.08 kg / mm²
(kollision correction factor) is determined = bending correction factor 2

\[
\begin{align*}
\text{determination} &= 2 \\
\text{cost between 1.2 to 2.3, if it is not expected to occur then the bending load is taken} &= 1.0 \\
\end{align*}
\]
(Sularso and kiyokatsu Suga, 2004: 8)

Calculation of shaft diameter \((d_s)\)

\[
\begin{align*}
\text{determine} &= 2 \\
\text{cost between 1.2 to 2.3, if it is not expected to occur then the bending load is taken} &= 1.0 \\
\end{align*}
\]

3.7 Selection Belts - V

Given:
- \(P = \frac{1}{2} \text{ Hp} = 0.746 \text{ kwn} \) 1400 rpm =
  - \(n_2 = 700 \text{ rpm} \)
  - \(I = 2\)

moment:
- \(T_1 = 259.1 \text{ kg.mm} \)
- \(T_2 = 519.1 \text{ kg.mm} \)

V-belts Penampang selected: type A

circle diameter range for pully: \(d_p = 76.2 \text{ mm} (3 ") \)
\[ D_p = 152.4 \text{ mm} (6 ") \]

belt speed (v)
- Round belts is lower than the maximum kecepatan \((1.778 \text{ m/s} < 30 \text{ m/s}) \)
- Good

nominal number selected V-belts and the market = 46

4 Conclusion

4.1 Conclusion modified engine design results camshaft are as follows:

1. machinea modified camshaft uses pully coated sandpaper to grind camshafts. This machine also uses a sledge crosswise and lengthwise to scrape the crank camshafts and engine using drill chuck as pencekam camshaft, so that all the brands camshaft can be done. And the specifications of this machine are as follows:
a. Engine capacity: 1 camshaft racing/h
b. Machine size: 500 mm x 500 mm x 410 mm
c. Propulsion: Electric motor 1 HP
d. Frame machine: profile steel L measuring 40 mm x 40 mm x 3 mm
e. Axles: St 37 diameter 20 mm
f. Transmission: pulleys 6” and 3” with v-belt type A-44

2. The security level of the construction of this machine is based on some analysis from the shaft, machine frame to the transmission system can be classified quite good because it meets several conditions, among others:
   a. Constructiona powerful engine to handle the weight and the forces acting on the machine.
   b. Meet safety for the user.

4.2 Suggestions
Designengne modification camshaft is still far from perfect, both in terms of quality of materials, panampilan, and work systems / functions. Therefore, in order to enhance the design of this machine need their ideas further with every consideration. Some suggestions for steps that can build and memyempurnakan this machine is as follows:

1. It is necessary to cover or protector on the part of the transmission system so that security is more assured and add value to the product.
2. On the legs of the machine frame should be given a vibration-damping rubber as a result of the electric motor.
3. Should choose a good quality sandpaper so as not frequently change sandpaper.
4. Because this machine requires a fairly high precision, preferably at the time penyetting this machine must be done carefully so that it can produce a quality product.

References

[5] Mujisetio, ST, MT. Module motorcycle engineering practice Muhammadiyah University of Magelang: magelang,