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Research paper

Detail Desain Development of Sand Medium Crackers Frying Machine Using Design for Assembly Method

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Abstract

Product Design can influence the complexity of the production process. In production activities are various production processes, one assembly. The assembly process can be said to be important, because the time in the assembly and the number of components can affect the cost of production. Products that have a short assembly time and the number of components that can slightly reduce the cost of production. Product development using Design for Assembly (DFA) needed. DFA is the method used to obtain a design that has few component and assembly costs are low. This research will be conducted using the method of DFA on crackers frying machine with sand media. Frying machine is used to help craftsmen crackers during the frying process using sand media. Toasting is used tubular using the motor. By using DFA passing through several stages to develop concepts acquired in previous investigators, resulting outcomes in the form of detailed design frying pan with a number of fewer components, namely from 93 parts to 43 parts, assembly time is less that of 739.73 seconds to 330, 13 seconds and greater assembly efficiency is from 19.06% to 25.44%.

Keywords: *Frying Machine, DFA, Product Development, Assembly*

1. Introduction

Many companies have tried various new approaches in product design to stay competitive. With globalization, enterprises have to compete with both local and international companies. In the food industry there are several stages in processing food. From some of these stages involve a variety of processing tools. The use of tools in processing food intended to facilitate craftsmen in processing food and help craftsmen in doing things that cannot be done individually. As shown in the crackers industry with sand media. In this industry there are stages that require a tool in processing, one frying pan is used as a tool to finalize crackers with sand media.

Fig 1: Design Concept of Crackers Frying Machine with Sand Media (Purwitasari, Y. (2015)

As seen in Figure 1 frying pan design which has been obtained from the study entitled "Design Tool Repair Frying Crackers Sand Media to Reduce the Risk MSDS Approach Using Reverse Engineering Methods and Redesign". Design of frying machine that has a drive semi-automatically using a motor and two alternative heating system is by gas or wood. To be applied in the field, need to production frying machine. In the production activities to create a product, incoming raw materials will go through several stages production. The process is generally passed in the activities of production, including the assembly process. Assembly process becomes important considerations in designing a design, it is associated with the time of assembly which will have an impact on production costs. Product design that are less precise cause designing become inefficient, thus reducing the reliability of the product and increase the cost of assembly process (Yusri, 2012). The importance of designing for manufacturing is underlined by the fact that about 70% of manufacturing costs of

a product (cost of materials, processing, and assembly) is determined by design decisions, with production decisions (such as process planning or machine tool selection) responsible for only 20% [5].
Viewed from the above statement, need to discuss the method to improve the frying pan which has been obtained as shown in Figure 1. For that, in this study the development of a detailed design conducted on a design concept that is obtained as shown in Figure I.1. Development of detail design is done using Design for Assembly (DFA) method. The purpose of the DFA is to produce a simpler design so that faster assembly time and assembly costs are cheaper. Hence the use of DFA methods resulting design proposals have fewer number of components and faster assembly times, so that production costs can be decreased

2. Discussion and conclusion

In DFA calculation of the design concept, obtained the value of an efficiency is 19.06 %. This efficiency is obtained by multiplying the time between the ideal assembly (3s) with minimum component count divided by total actual assembly time. Results efficiency is affected by the minimum component count and the level of difficulty in the assembly so that it can affect the assembly time on each component.

Fig 2: Design Concept Disassembly

Design concept of frying machine has the following components:

Table 1: Total Component of Design Concept

No	Component Name	Quantity	No	Component Name	Quantity
1	Framework	1	13	Hinge	2
2	Speed reducer	1	14	Bolt M5	12
3	Pillow block bearing	2	15	Mur M5	12
4	Tube	1	16	Cover Side	1
5	As	1	17	Latch on	1
6	Gear	1	18	Bottom Latch	1
7	Chain	1	19	Bolt M03	6
8	Belt	1	20	Mur M03	6
9	Motor	1	21	Cover Motor	1
10	Cover Tube	1	22	Buffer	1
11	Bolt M10	19	23	Burner	1
12	Mur M10	19		Total	93

2.1. Design Proposal

As can be seen in Table 3.1, component count in the design concept about 93 components. Components are most numerous in the nuts and bolts that are fastening process as many as 37 process. In addition, the design of these components may be eliminated as many as 19 components. The number of components that can be eliminated, this can affect the efficiency of the assembly, so that design of the proposed development based on the reduction of components can be eliminated.

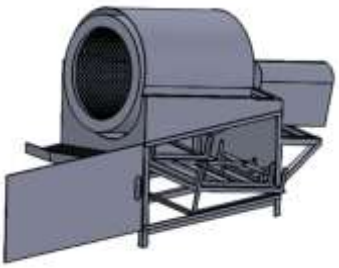

Fig 3: Design Proposal of Frying Machine

In the frying machine that has been modified as shown in Figure 3 has a few changes to the frying machine design concept. These changes occur in framework, Cover tube, cover side, motor and cover motor components.
a) Framework design that has been modified as shown in Figure 4, has some differences compared with the design of the framework in design concept. The difference lies in sliding system used to combine the cover tubes with the the framework, as well as on the side cover using a sliding system to ease in open and close. This change is intended to reduce assembly costs for the installation of the tube and the side cover unbuttoned with bolts
b)Cover tube, As seen in Figure 5 tube cover changes slightly are only removes four holes, where the four holes on this design concept is used as a lock by using bolts.
c)Cover side, As seen in Figure 6, side cover changes are almost the same as cover tube, are eliminates the hole. Other differences occurred in the ellipse-shaped hole that serves as a handle when opening the side cover.
d) Motor, the use of a motor on the design proposal, using a motor that has joined with the gearbox as shown in Figure 7. The assembly process is more practical than in design concept that uses a motor and gearbox or speed reducer separately.
e) Cover Motor, As seen in Figure 8, changes in the motor cover only occurs at a size that adjusts the motor used.

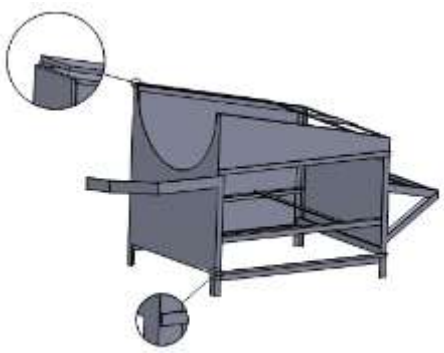

Fig 4: Framework Design Proposal

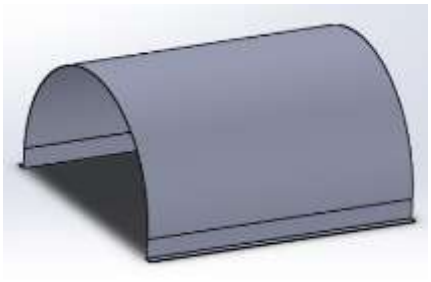

Fig 5: Tube Cover Design Proposal

Fig 6: Cover Side Design Proposal

Fig 7: Motor in Proposal Frying Machine

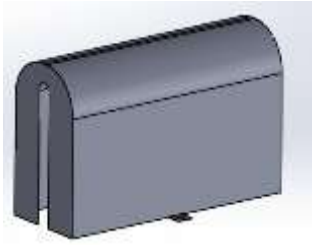

Fig 8: Motor Cover Design Proposal

2.2. DFA Analysis in Design Proposal

From the design proposal obtained component count as follows:

Table 2: Total Component of Design Proposal

No	Component Name	Quantity	No	Component Name	Quantity
1	Framework	1	8	Bolt M10	15
2	Tube	1	9	Mur M10	15
3	As	1	10	Side Cover	1
4	Gear	1	11	Cover Motor	1
5	Chain	1	12	Buffer	1
6	Motor	1	13	Burner	1
7	Cover tube	1	14	Pillow Block Bearing	2
				Total	43

As seen in Table 2, on the design of the proposal obtained the total component count as much as 43 pieces and types of components as much as 14 units. That is to say, component count in the design proposal less than the design concept. In the design proposal overall reduction of components on the bolt, besides there some components that are removed are speed reducer, hinges, fastening and belt. After passing through several stages of the calculation, the results as shown in Table 3.4 In DFA calculation of the design proposal, obtained the value of an efficiency is 25.44%. This efficiency is obtained by multiplying the time between the ideal assembly (3s) with minimum

component count divided by total actual assembly time. Results efficiency is affected by the minimum component count and the level of difficulty in the assembly so that it can affect the assembly time on each component.

3. Conclusion

In order to improve efficiency and reduce assembly time and component, conducted some modifications to some components, chassis, cover tubes and the side cover. Changes that occur mostly conducted to reduce the number of bolts and nuts are used. Changes made is to change the process of merging, of bolts and nuts into the way of shifting (sliding). Effects resulting from the shifting system is the merging less time and reduction of components bolt.
Redesign in frying machine that has been done generates a design that has fewer component count as many as 43 components and assembly time are 330.13 seconds faster than in design concept that has a number of components as many as 93 components and assembly time for 739.73 seconds.
Results redesign frying machine that has been done can improve the efficiency of the assembly are 19.06% to 25.44%

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