MODIFICATION OF CHOCOLATE GRINDER MACHINE CONE TYPE USING REVERSE ENGINEERING METHOD AND VDI 2221 METHOD

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Abstract

Chocolate powder is made from meal / cocoa beans that are separated by brown fat. To obtain cocoa powder, cocoa beans are harvested in perfect ripping conditions. Then cut to take the seeds. Cocoa beans are fermented for 2-8 days. After fermentation is complete, the seeds are dried until the moisture content reaches 6-8%. Then the separation of the skin and the scattering. The next process is the manufacture of chocolate paste. After going through the process of making chocolate paste, the next process is making of powdered chocolate by smoothing using a grinder. Chocolate grinding machine is a tool specially designed to reduce the size of cocoa beans become powder after getting through the cooking process. This research was carried out to modify the grinding machine with the selected benchmarks then carried out a design update to the benchmark. This research will increase the milling capacity and increase the efficiency of the machine so that grinder machine users can have a grinder machine at an affordable price but maximum quality of cocoa powder. By analyzing various methods such as reverse engineering method is an existing product analysis process as a reference for designing a similar product by increasing product excellence, and VDI 2221 method is a systemic approach to design for engineering systems and engineering products. After the research was conducted obtained the design of a chocolate grinder machine that has better performance in grinding the seeds become powder and a larger milling capacity in the grinder machine after being modified.

Keywords: *Grinder Machine, Reverse Engineering, VDI 2221 Method, Chocolate Powder*

1. Introduction

Cocoa powder is a product made from cocoa beans which can be used as food or drink. The cocoa plant origin country comes from tropical regions. Cocoa is a plantation crop that provides a high economic contribution to the country. Based on data from the Ministry of Industry (2007), Indonesia is the third largest cocoa producer in the world after Ivory Coast and Ghana, with a cocoa bean production of 456,000 tons per year. With an area of cocoa plantations in Indonesia measuring 992,448 hectares. The chocolate grinder machine is a tool that is specifically designed to grind cocoa beans after going through the cooking process, which can then turn into cocoa powder that is ready for consumption. Currently, there is an automatic chocolate grinder on the market, which has the advantage of grinding speed, and has two ways of working, manually and automatically.

The problem that will be discussed in this study is how to improve performance and maximize engine function by using the Reverse Engineering method, which is a process of analyzing existing products as a reference for designing similar products by reducing and increasing product excellence [12], [13]. With the reverse engineering method, the principle of performance of a tool, object, or system can be done by analyzing its structure, function and operation. And VDI 2221 method which is a systematic approach to design for engineering systems and engineering products [8]. This method is expected to make it easier for an engineer to master the design systematics without having to learn in detail.

This research tries to modify an automatic chocolate grinding device that can improve the performance of the chocolate grinding machine to meet needs, and has a result of finer cocoa powder.

2. Research Methods

The research method is divided into several stages such as data collection through literature studies. Furthermore, identifying problems, formulating problems, research objectives and benefits, and limiting problems. The following is a research flow chart to make it easier to understand the flow of this research, it can be seen in Figure 1.

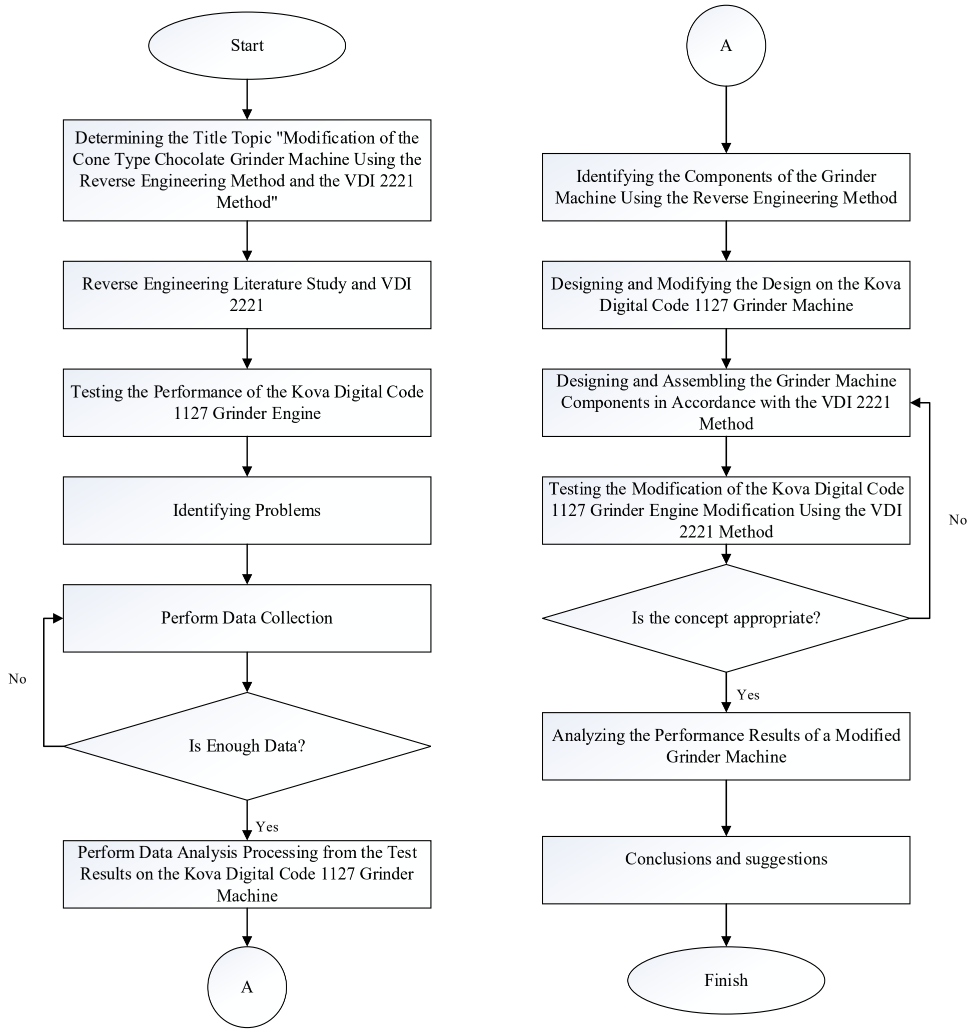
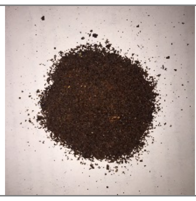


Figure 1. Flowchart of Grinder Engine Modification Design

3. Results and Discussion

Testing and data collection will be carried out by testing on the Kova Digital Code 1127 grinder machine, the tests carried out on the Kova Digital Code 1127 grinder machine use 5 stages of testing where each trial uses 100 grams of coffee beans and cocoa beans to be milled with two different levels of finer cocoa powder, namely medium, and fine. The experimental data of capacity of the grinder machine, data can be seen in Table 1, Table 2, and Table 3.

Table 1. Examination Results of Kova Digital Code 1127 Grinder Machine

Testing	**Level of Refinement**			
	Coffee beans		**Cacao bean**	
	Medium	**Fine**	**Medium**	**Fine**
1				

Testing	Level of Refinement			
	Coffee beans		Cacao bean	
	Medium	Fine	Medium	Fine
2				
3				
4				
5				

Table 2. Grinder Machine Performance Test on Coffee Beans

No. Testing	Level of Refinement	Time (Seconds)	Initial Weight (Gram)	Results After Milling (Gram)	Milling Capacity (Gram / Minute)
1	Medium	25	100	58	139,2
	Fine	25	100	41	98,4
2	Medium	25	100	62	148,8
	Fine	25	100	41	98,4
3	Medium	25	100	63	151,2
	Fine	25	100	42	100,8
4	Medium	25	100	64	153,6
	Fine	25	100	40	96
5	Medium	25	100	69	165,6
	Fine	25	100	43	103,2

Table 3. Grinder Machine Performance Test on Chocolate Beans

No. Testing	Level of Refinement	Time (Seconds)	Initial Weight (Gram)	Results After Milling (Gram)	Milling Capacity (Gram / Minute)
1	Medium	25	100	39	93,6
	Fine	25	100	27	64,8
2	Medium	25	100	63	151,2
	Fine	25	100	36	86,4
3	Medium	25	100	64	153,6
	Fine	25	100	31	74,4
4	Medium	25	100	48	115,2
	Fine	25	100	38	91,2
5	Medium	25	100	69	165,6
	Fine	25	100	34	81,6

Table 2 and Table 3 show that the average grinder using the Kova Digital Code 1127 grinder machine for medium coffee beans is 151.7 gr per minute and for fine coffee beans is 99.4 gr per minute. Whereas for medium cocoa beans is 135.8 grams per minute and fine cocoa beans are 79.7 grams per minute, if you estimate for one hour of grinding time, the average value for medium coffee beans is 9.1 kg per hour and beans. 5,9 kg of fine coffee per hour. Meanwhile, the estimation for one hour milling period obtained an average value for medium cocoa beans 8.2 kg per hour and fine cocoa beans 4.8 kg per hour.

4. VDI 2221 Method [2],[3],[4],[8]

In this study, designing using the VDI 2221 method is one of the methods to solve problems and increase the use of materials and technology. The VDI 2221 method makes it easy for designers to master the design system without having to master in details.

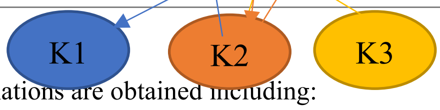
Table 4. List of Initial Specifications

No.	Factor	D/W	Specification
1	Energy	W	Efficient use of electricity
2		D	Able to work stably and consistently
3	Force	W	Weight <2500 gr
4	Geometry	W	Dimensions 22 cm x 14 cm x 35 cm
5	Treatment	D	Anti-Rust
6		W	Spare parts are easy to get
7	Material	D	Using food grade stainless steel
8		D	Motor dynamo 200 W
9		D	Conical Grinder 40 mm
10	Assembly	D	Easy to assemble and assemble
11	Cost	D	Affordable production costs

After determining the initial specifications (Table 4), the next step is to create a sub-function solution principle to select the components that will be used in the grinder engine design. The principle of sub-function solutions is made into several alternatives and analyzed to produce products with high efficiency values. After making the sub-function solution principle, the next step is to select the components that will be used in the grinder engine design. By determining the combination that is likely to form the most efficient and most supportive product. The principle combination of sub-function solutions can be seen in Table 5.

Table 5. The Principle of Sub-Function Solution and the Combination of the Sub-Function Solution Principle

No.	Principle of Solution / Sub Functions	Information	1	2	3
1	Movers	Buy	Dynamo 130 W	Dynamo 150 W	Dynamo 200 W
2	Hopper	Made	250 gr	300 gr	500 gr
3	Machine Body	Made	Plastic	Stainless Steel	Alumunium
4	Grinder Components	Buy	Burr 64 mm	Conical 40 mm	Conical 48 mm
5	Power Switch	Buy	Manual	Semi Automatic	-



Based on the solution principles above, several combinations are obtained including:

1. K1 (Combination 1): 1-1, 2-1, 3-1, 4-2, 5-2
2. K2 (Combination 2): 1-2, 2-2, 3-2, 4-3, 5-2
3. K3 (Combination 3): 1-3, 2-3, 3-2, 4-2, 5-2

Because there are 3 kinds of combinations, a selection must be made so that the final design can approach the design demands. One way to choose a combination can be done by using a selection diagram as in Table 6 [2],[3],[4],[8],[12].

Table 6. Selection of Solution Variations

INDUSTRIAL ENGINEERING	**Table for Selection of Variation of Solutions for Grinder Machines**
variant of the solution principle	**Selection criteria** **+ Yes** **- N o** **? Less information** **! Check Specifications**
	Decision variant solution mark (SV) **+ The solution sought** **- delete the solution** **? Gather information** **! See specs**

A: In accordance with the overall function
B: According to the wish list
C: Within the production cost limit
D: knowledge of the concept is adequate
F: according to the designer's wishes
G: Meets security requirements

	A	B	C	D	F	G	Information	SV
K1	+	-	-	+	-	+	Appropriate	**-**
K2	+	-	-	+	-	+	Appropriate	**-**
K3	+	+	+	+	+	+	**Not Appropriate**	+

Based on Table 6 above, the results of an alternative combination of the principles of the researcher's solution consider several factors to realize the design including:
- Fulfills the requirements of the wish list
- Affordable production costs
- Availability of materials
- Ease of maintenance and operation of the machine
- Security

So that from these alternatives, the researcher can conclude the best combination for making a grinder machine, namely Combination 3. Then combination 3 will be continued to the next process [2],[3],[4],[8].

5. Reverse Engineering Activities [2],[3],[4],[9],[10]

In this study, reverse engineering is used to modify or design a new product by developing certain product components. Activities that will be carried out to analyze a product using the reverse engineering method are:

5.1. Disassembly

At this stage, disassembly is carried out on the grinder engine benchmarks which function to identify and analyze each function of the product components. The product that was dismantled was the Kova Digital Code 1127 grinder machine (Figure 2).

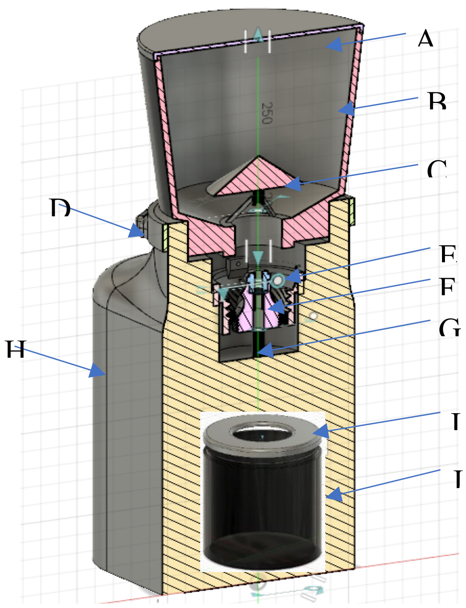
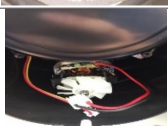


Figure 2. Components of Kova Digital Grinder Machine

The results of disassembly on the grinder engine show that the dimensions of the Kova Digital Code 1127 grinder engine are 180 mm x 120 mm x 300 mm, with 10 components, and use PP and ABS plastic body material while the stainless steel cutting edge material measures 38 mm. The results of the disassembly of the Kova Digital Code 1127 grinder engine were obtained Bill of Material data. List of components and BOM can be seen in Table 7 and Figure 3 [2],[10],[11].

Table 7.Components of the Kova Digital Code 1127 Grinder Machine

Component	Components and Description	Picture	Dimensions / Specifications
A	Hopper cover serves to protect the seeds from being exposed to dust when stored		Diameter: 12 cm Thickness: 1 cm Material: ABS Plastic
B	The hopper serves as a coffee bean storage container		Diameter (above): 11,5 cm Diameter (bottom): 7,5 cm Height: 10 cm Material: ABS Plastic
C	Anti-Pental functions as a regulator of the entry of coffee beans so that coffee beans do not bounce during grinding		Diameter: 5 cm Height: 1,5 cm Material: ABS Plastic
D	The turning ring functions as a level control for the fineness of the milling		Diameter: 10 cm Thickness: 2,5 cm Material: ABS Plastic
E	The Outer Conical Grinder functions as the outer blade to turn the seeds into finer and smaller pieces		Diameter: 3,8 cm Material: Stainless Steel
F	Inner Conical Grinder functions as the inner rotating blade to turn the seeds into finer, smaller pieces		Diameter: ± 3 cm Material: Stainless Steel
G	The dynamo functions as a conical grinder drive		Power: 200W Type: Armature Dynamo (DC)
H	The engine body functions as a dynamo and other components.		Length: 18 cm Width: 12 cm Height: 18 cm Material: ABS Plastic
I	The container lid serves as the entry point for the seeds that have gone through the milled process and as a container cover		Diameter: 9 cm Thickness: 1 cm Material: ABS Plastic
J	The container functions as a container for seeds that have gone through the milling process.		Diameter: 8,5 cm Height: 7,5 cm Material: ABS

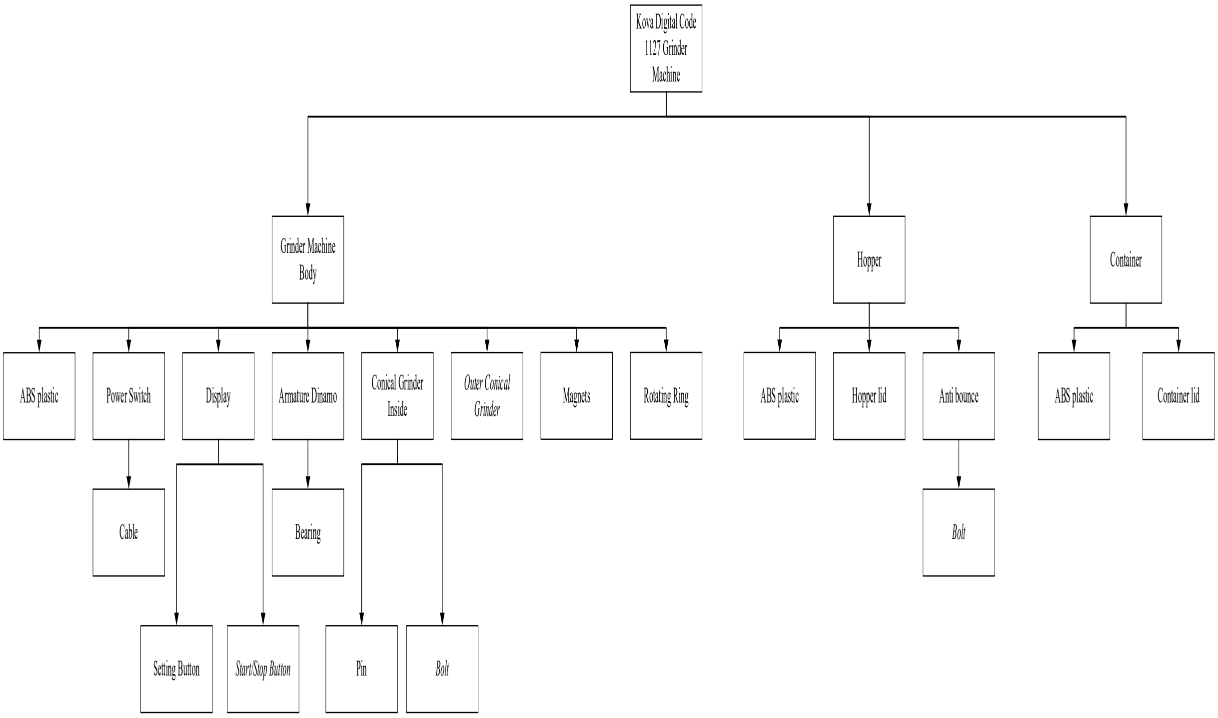


Figure 3. Bill of Material

5.2. Assembly

At this stage, reassembly is carried out to analyze the ease and difficulty of assembling and reassembling components. The results from the assembly of the Kova Digital Code 1127 grinder machine obtained the Operation Process Chart (OPC) data. The image of the grinder engine OPC can be seen in Figure 4.

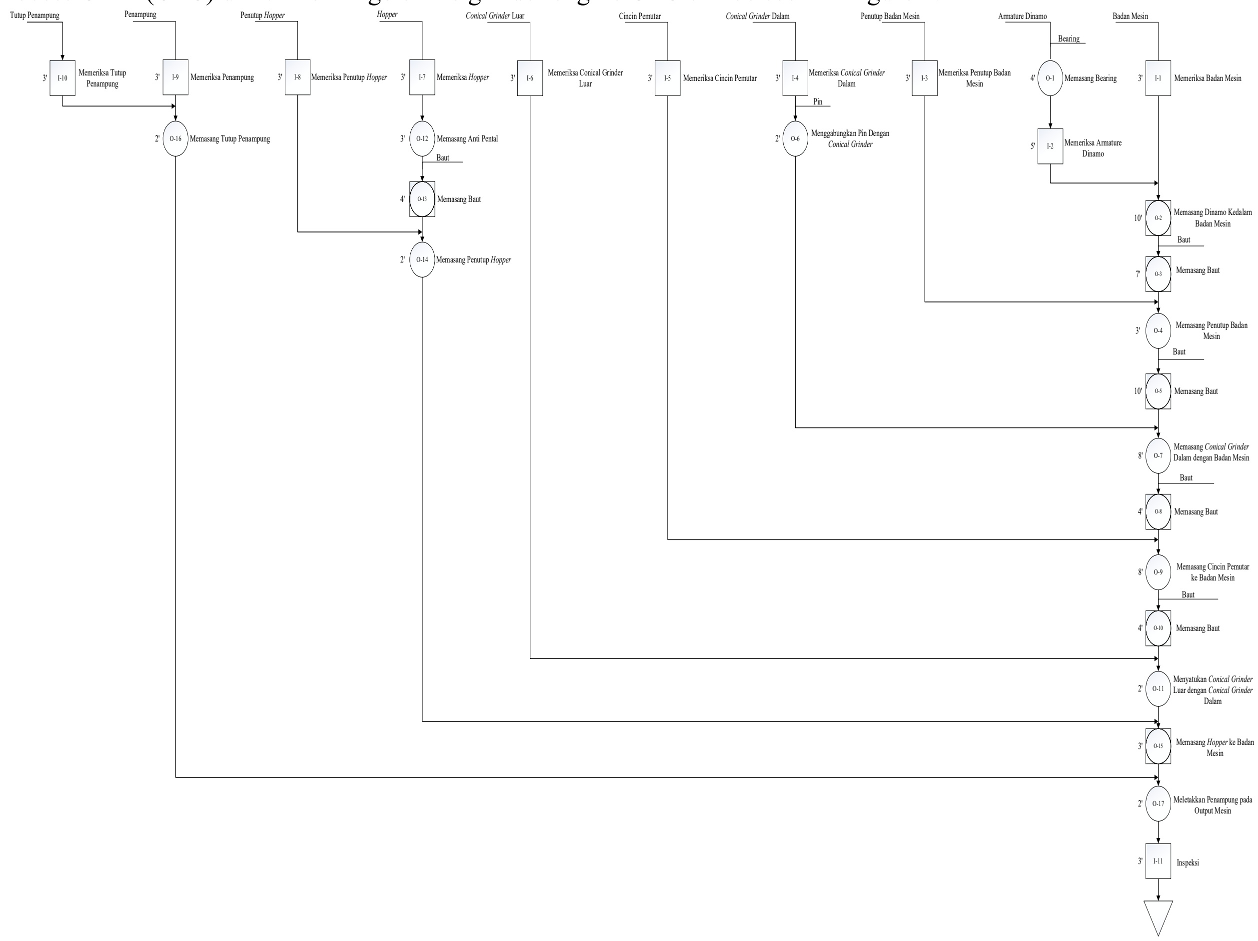


Figure 4.Operation Process Chart on Kova Digital Grinder Machine

6. Benchmarking [1]

At this stage, compare the advantages and disadvantages of similar products, then determine the components you want to benchmark. The arrangement of new products used 2 familiar products, which will be explained as follows:

a. Kova Digital Code 1127 Grinder Machine

Benchmarking obtained from the kova digital code 1127 grinder engine is a dynamo power of 200 W, the type of grinder, the level of smoothness, and the main frame, with the consideration that the kova digital code 1127 frame has a frame that is not too large and easy to modify. An image of a digital kova grinder code 1127 can be seen in Figure 5 (A).

b. Welhome coffee grinder conical burr with scale ZD-17W

Benchmarking obtained from the wellhome grinder machine is the machine body material made of stainless steel, the holding capacity and hopper capacity of ± 450 gr, with the consideration of having better material and a larger capacity than the Kova digital code 1127 grinder machine. wellhome can be seen in Figure 5 (B).

(A) (B)

Figure 5. Kova Digital Code 1127 and Wellhome

7. Designing a New Grinder Machine Design

At this stage, designing a grinder machine by combining and developing the benchmarks that we use by increasing the material we will use then increasing the capacity of the grinder engine, changing the position of the anti-pental, and developing the conical grinder diameter from a modified 38 mm size so that it uses a conical diameter. 40 mm grinder from several previous reverse engineering stages was implemented in 3D using fusion 360 software.

8. Prototyping

At this stage, a new grinder machine that has been designed or designed, then carries out the process by making a manufacturing grinder machine made of stainless steel, 40 mm conical grinder, enlarged capacity, and using a 200 W dynamo.

(b) Front view (c) Back view (a) Conical Grinder 40 mm

Figure 6. New Grinder Machine Design

9. New Grinder Machine Specifications

Specification data is needed as a reference in grinder engine manufacturing. The new grinder machine design specifications are changes to the hopper where the old grimder machine can only accommodate 250 grams of beans while the new grinder machine can accommodate 500 grams of beans. Then changes to the material that was previously full of plastic were redesigned using stainless steel so that it is more elegant and looks solid. Then the changes to the previous conical grinder have a size of 38 mm to 40 mm. Then changes to the anti-pental where the anti-pental location on the old grinder machine has a height of 15 mm, while the new grinder machine has a height of 25 mm making it easier for the cocoa beans to enter the mill. The new grinder engine specifications can be seen in Figure 7 [2],[3],[4].

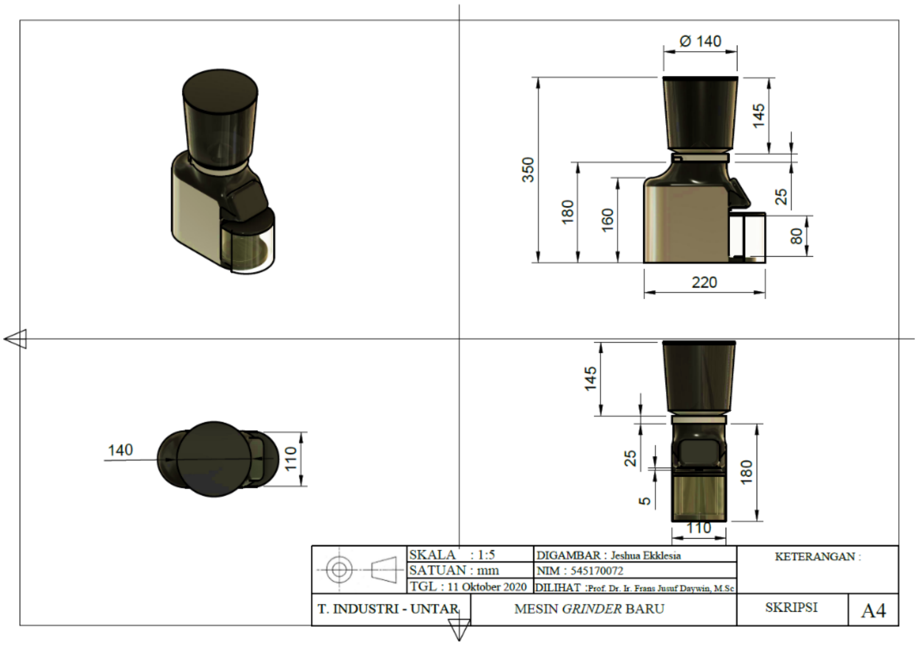


Figure 7. New Grinder Machine Specifications

The following is a table of new grinder engine specifications can be seen in Table 8 below.

Table 8. Specifications for New Grinder Machines

Information	Dimensions
X axis length	110 mm
Y axis length	220 mm
Z axis length	350 mm
Hopper capacity	± 500 gr
Container Capacity	± 300 gr

After modifying the grinder engine using the reverse engineering method, the results of the prototyping of a new grinder engine are obtained, where the new grinder engine has a more elegant and sturdy design made of stainless steel, has a larger capacity, and has a larger conical grinder size. . So that making the new grinder machine can smooth the seeds finer than the previous grinder machine.

10. Analysis of Grinder Cone Type Engine Modification Results

At this stage, retest the process of grinding cocoa beans. Tests carried out on a grinder machine used 5 stages of testing where each trial used 100 grams of cocoa beans to be milled with two different levels of fineness, namely medium and fine. The thing that is concerned is how much cocoa bean grinding is produced after being modified the height of the anti-pental, and also the size of the conical grinder that is enlarged to 40 mm. The results and experimental data can be seen in Table 9 and Table 10.

Table 9.The Grinder Machine Experiment Results after Modification

Testing	**Level of Refinement Cocoa Bean**	
	Medium	**Fine**
1		

Testing	Level of Refinement Cocoa Bean	
	Medium	**Fine**
2		
3		
4		
5		

Table 10. Grinder Machine Performance Test after Modification

No. Testing	Level of Refinement	Times (Second)	Initial Weight (Gram)	Yield After Grinding (Gram)	Milling Capacity (Gram / Minute)
1	Medium	25	100	67	160,8
	Fine	25	100	39	93,6
2	Medium	25	100	64	153,6
	Fine	25	100	41	98,4
3	Medium	25	100	66	158,4
	Fine	25	100	38	91,2
4	Medium	25	100	62	148,8
	Fine	25	100	40	96
5	Medium	25	100	68	163,2
	Fine	25	100	43	103,2

Table 10 above shows that the average grinding of medium cocoa beans using a grinder machine after modification is 156.96 gr per minute and for the average grinding of fine cocoa beans is 96.5 g per minute. Whereas for the average milling of medium cocoa beans using the kova digital grinder machine code 1127 is 135.8 gr per minute and for the average grinding of fine cocoa beans is 79.7 gr per minute, if it is estimated for one hour, then Obtained the average value for milling medium cocoa beans using a grinder machine after modification is 9.42 kg per hour and the average grinding of fine cocoa beans 5.8 kg per hour. While the estimate for the one hour milling period, the average value for medium cocoa beans using the kova digital code 1127 grinder machine is 8.2 kg per hour and the average grinding of fine cocoa beans is 4.8 kg per hour.

From the results obtained in the new grinder engine trial by comparing with the trial before modification, the most obvious level is that the medium milling capacity has increased 14.9% from the original 8.2 kg per hour to 9.42 kg per hour fine grinding also increased 20.8% from the original 4.8 kg per hour to 5.8 kg per hour.

11. Conclusion

Based on the above discussion that the author has previously described regarding the grinder engine modification process using the reverse engineering method and the VDI 2221 method, the authors can conclude as follows:

1. The results of the grinder engine design are obtained:
   a. The advantages of the digital kova grinder machine are that the digital kova is a machine that has a digital control panel, the type of blade is conical grinder, has 31 level controls ranging from course to fine, and also has an attractive frame design that is not too large so it's easy to carry or move. However, digital kova has disadvantages, namely anti-pental which is not high enough so that the seeds are difficult to enter into the grinding blade, the capacity is small, has a conical grinder diameter of 38 mm

which causes the grind of seeds is not optimal, and also the material used is not good so it looks less elegant and sturdy.

b. The advantages of the new grinder machine are that the new grinder machine is a practical machine, can be operated easily, has a digital control panel, has 31 settings for smoothness levels, has a large enough storage area of approximately 500 grams, has better materials, namely using stainless steel food grade so that the new grinder machine looks more elegant and sturdy, has a conical grinder diameter of 40 mm so that the grinding of the seeds is maximized. The disadvantage of the new grinder is that it has a larger weight and is slightly heavier due to the material used, namely stainless steel and a larger storage capacity, which costs a little more.

2. The stages in designing using the reverse engineering method to design a new grinder are as follows:
   a. Disassembly at this stage is the disassembly of the kova digital grinder engine benchmarks in order to find out the actual or actual size which will be used as a benchmark in grinder engine design.
   b. Assembly at this stage is a re-combining of the grinder engine to analyze the ease and difficulty of dismantling and combining the grinder engine.
   c. Benchmarking at this stage compares the advantages and disadvantages of the existing grinder engine so that it can be developed and determine the components you want to benchmark, so that the new grinder engine is more optimal.
   d. The design at this stage designs a grinder machine by combining and developing the benchmarks that we use using the Fusion 360 software.
   e. Prototyping at this stage a new grinder engine that has been designed or designed, then carries out the process by making the grinder machine manufacture.
3. The engine design obtained based on the VDI 2221 method produces the 3rd combination which embodiments are not much different from the existing grinder engine, only component development is applied so that the design and performance of the grinder engine is more optimal.
4. The function of this research is to modify the grinder engine to optimize and improve the performance of the grinder engine, then to find out the concepts that exist in the grinder engine and the components contained in the grinder engine.
5. From the results of the grinder engine modification design, it was found that the test results were quite satisfactory, namely an increase in the grinding capacity of the grinder engine. Previously, the old grinder machine had a cocoa bean grinding capacity of 8.2 kg per hour for medium fineness and 4.8 kg per hour for fine fineness. The grinding capacity of the grinder machine after being modified to 9.42 kg per hour for medium fineness level and 5.8 kg per hour for fine fineness level. Another improvement is the hopper capacity and storage capacity, because the hopper capacity before modification can only accommodate ± 250 grams of cocoa beans and storage capacity of ± 100 grams. After the modification, the new hopper capacity can accommodate ± 500 gr of cocoa beans and ± 300 gr of storage capacity. Thus increasing the effectiveness of the new grinder machine users because it greatly shortens the time needed to fill the hopper because the new grinder machine can accommodate more seeds and accommodate more grain results.

12. Bibliography

Camp, Robert C. 1989. *Benchmarking: The Search for Industry Best Practices that Lead to Superior Performance*. Milwaukee: ASQC Quality Press.

Daywin, F. J., Gozali, L., Widodo, L., Doaly, C. O., & Ross, M. W. H. (2020, July). Community Service Report: Designing The Ergonomic Roasting Machine For Coffee Seed With Additional Electrical Motor At Seduh Kopi Coffee Shop. In IOP Conference Series: Materials Science and Engineering (Vol. 852, No. 1, p. 012091). IOP Publishing.

Daywin, F. J., Utama, D. W., Kosasih, W., & Wiliam, K. (2019). PERANCANGAN MESIN 3D PRINTER DENGAN METODE REVERSE ENGINEERING (Studi Kasus di Laboratorium Mekatronika dan Robotics Universitas Tarumanagara). Jurnal Ilmiah Teknik Industri, 7(2).

Daywin, F. J., Doaly, C. O., Gozali, L., Kosasih, W., & Taek, G. (2020, December). Improving the Quality of Coffee Shops in Jabodetabek Area by Application and Modification of Coffee Roaster Machine Capacity 400-600 Gram Coffee Beans Using the Reverse Engineering and Engineering Design Method. In IOP Conference Series: Materials Science and Engineering (Vol. 1007, No. 1, p. 012132). IOP Publishing.

Daywin, F. J., Gozali, L., Doaly, C. O., Salim, A., Ibrahim, A., Fatima, M., & Inggrid, P. (2020, December). The Design of Coffee Grinder Machine Knockdown With 8 Levels of Coarseness. In IOP Conference Series: Materials Science and Engineering (Vol. 1007, No. 1, p. 012089). IOP Publishing [5] Dermawan, Rifki. 2019. PENGEMBANGAN MESIN PENGUPAS KULIT KOPI MENGGUNAKAN METODE VDI 2221. Program Studi Teknik Mesin, Fakultas Teknologi Industri, Institut Sains Dan Teknologi Nasional, Jakarta, Indonesia.

Eilam, Eldad., 2005, *Reversing: Secrets of Reverse Engineering*. Indianapolis: Wiley Publishing.

Otto Kevin N., and Wood Kristin L.,1998, Product Design, Techniques in Reverse Engineering and Product Development, Printed USA.
Pahl, G., Beitz, W., Feldhusen, J., and Grote, K.H., 2007, *Engineering Design: A Systematic Approach*. 3nd ed., London.
Prasojo, Tuwuh. W, Perancangan Ulang Mesin Pencacah Rumput Dengan metode *Reverse Engineering.* Jurnal Teknik Industri Universitas Muhammadiyah Surakarta (2016).
Taek, Guswiyanta. 2020. Peningkatan Kualitas Kedai Kopi Dengan Menggunakan Modifikasi Mesin Sangrai Kopi Kapasitas 400-600 Gram Biji Kopi Di JABODETABEK Dengan Metode *Reverse Engineering.* Program Studi Teknik Industri, Fakultas Teknik. Universitas Tarumanagara.
Tonella, P., and Potrich A., 2007, *Reverse Engineering of Object Oriented Code*. Springer Science and Business Media, Inc.
Ulrich, Karl T & Steven Eppinger. 2001. Perancangan dan Pengembangan Produk, Salemba Teknika, Bandung.
Wibowo, Dwi Basuki. (2006). Memahami *Reverse Engineering* melalui pembongkaran Produk Diprogram S-1 Teknik Mesin. Jurnal.unimus.ac.id.

Biography

Jeshua Ekklesia is a student from Tarumanagara University majoring in Industrial Engineering. He was born on 30th April 1999. He was the second of three children. He has served as an external representative of the Association of Industrial Engineering Students of Tarumanagara University. He has also been a member of the talent and interest in the executive board of engineering faculty students. He once worked in an e-commerce company as a data entry. He also had an internship at PT. Plastech Indonesia.

Frans Jusuf Daywin was born in Makasar, Indonesia on 24th November 1942. is a lecturer in the Department of Agricultural Engineering at Faculty of Agricultural Technology Bogor Agricultural University since 1964 conducted teaching, research, and extension work in the field of farm power and machinery and become a professor in Internal Combustion Engine and Farm Power directing and supervising undergraduate and graduate students thesis and dissertation and retired as a professor in 2007. In 1994 up to present as a professor in Internal Combustion Engine and Farm Power at Mechanical Engineering Program Study and Industrial Engineering Program Study Universitas Tarumanagara, directing and supervising undergraduate student's theses in Agricultural Engineering and Food Engineering Desain. In 2016 up to present teaching undergraduate courses of the introduction of concept technology, research methodology, and seminar, writing a scientific paper and scientific communication, and directing and supervising undergraduate student's theses in Industrial Engineering Program Study at the Faculty of Engineering Universitas Tarumanagara. He got his Ir degree in Agricultural Engineering, Bogor Agricultural University Indonesia in 1966, and finished the Master of Science in Agricultural Engineering at the University of Philippines, Los Banos, the Philippines 1981, and got the Doctor in Agricultural Engineering, Bogor Agricultural University Indonesia in 1991. He joined 4-month farm machinery training at ISEKI CO, AOTS, Japan in 1969 and 14 days agricultural engineering training at IRRI, Los Banos the Philippines, in March 1980. He received the honors "SATYA LANCANA KARYA SATYA XXX TAHUN" from the President of the Republic of Indonesia, April 22nd, 2006, and received appreciation as Team Jury from the Government of Indonesia Minister of Industry in Industry Start-Up 2008. He did several research and survey in the field of farm machinery, farm mechanization, agricultural engineering feasibility study in-field performance and cost analysis, land clearing and soil preparation in secondary forest and alang-alang field farm 1966 up to 1998. Up till now he is still doing research in designing food processing engineering in agriculture products. Up to the present he already elaborated as a conceptor of about 20 Indonesia National Standard (SNI) in the field of machinery and equipment. He joins the Professional Societies as a member: Indonesia Society of Agricultural Engineers (PERTETA); Indonesia Society of Engineers (PII); member of BKM-PII, and member of Majelis Penilai Insinyur Profesional BKM-PII.

Adianto was born on 29th April, 1955. he completed his "Sarjana Fisika Degree" in 1982 from the Physics Department of the Faculty of Sciences and Mathematics, Gadjah Mada University, Yogyakarta. In 1978 when he got his Bachelor of Science in Physics (B.Sc.) he started working as a Staff of "Field of Nuclear Physics Laboratory", "Pure Materials Research Center and Instrumentation Yogyakarta", Atomic Energy Agency (BATAN). In 1986 to 1993 he received a scholarship from the Ministry of Research and Technology of the Republic of Indonesia to continue his studies in England at the Department of Electronic and Electrical Engineering, University of Salford, England. He received his M.Sc. degree in the field of Computer Instrumentation in 1988 and a Ph.D. degree in the field of Material Science in 1993. He returned back to Indonesia, then in 1994 he moved to Jakarta and appointed as a "Head of Engineering and Advanced Technology", (Echelon IIIA) at "Nuclear Science and Technology Empowerment Center", Atomic Energy Agency, BATAN, Jakarta. In 2000 he was assigned to the Ministry of Research and Technology to serve as

Assistant Deputy fpr Science Accreditation and Development Center (Echelon IIA) and in 2005 he was assigned as Assistant Director for Academic Affairs, to Organize Graduate Research in PUSPIPTEK Serpong. In 2008, he took early retirement as a Governmen Official to take a full time lecturer at Universitas Tarumanagara, Jakarta. Adianto started his profession as a lecturer in the Department of Mechanical Engineering, Faculty of Engineering, Tarumanagara University and the Department of Mechanical Engineering, Faculty of Industrial Technology, Trisakti University of Indonesia from 1994 until now. He has taught mathematics, mechatronics, English and physics, but Physics is the main subject he teaches. As a full time lecturer at Universitas tarumanagara, in 2012 he was appointed as a Vice Dean for Academic and Student Affairs, Faculty of Engineering, and in 2016 up to now, he was appointed as a Director for Student Affairs, Universitas Tarumangara. During his profession as a researcher at the Atomic Energy Agency, the Ministry of Research and Technology and as a lecturer at Tarumanagara University, Adianto as an Associate Professor has published scientific and research papers of more than 35 titles at home and abroad.

Lina Gozali is a lecturer at the Industrial Engineering Department of Universitas Tarumangara since 2006 and a freelance lecturer at Universitas Trisakti since 1995. She graduated with her Bachelor's degree at Trisakti University, Jakarta - Indonesia, then she got her Master's Degree at STIE IBII, Jakarta – Indonesia, and she recently got her Ph.D. at Universiti Teknologi Malaysia, Kuala Lumpur – Malaysia in 2018. Her apprentice college experience was in paper industry at Kertas Bekasi Teguh, shoes industry at PT Jaya Harapan Barutama, and automotive chain drive industry at Federal Superior Chain Manufacturing. She teaches Production System and Supply Chain Management Subjects. She did a research about Indonesian Business Incubator for her Ph.D. She has written almost 70 publications since 2008 in the Industrial Engineering research sector, such as Production Scheduling, Plant Layout, Maintenance, Line Balancing, Supply Chain Management, Production Planning, and Inventory Control. She had worked at PT. Astra Otoparts Tbk before she became a lecturer.

Carla Olyvia Doaly is a lecturer in the Industrial Engineering Department at Universitas Tarumanagara graduated with my bachelor's degree from Institut Teknologi Nasional Malang, which study the Industrial Engineering program, then continued my Master Degree at Institut Teknologi Bandung majoring in Industrial engineering and management and a special field of Enterprise Engineering. I am very interested in studying industrial engineering by doing research related to System Design and Engineering, Supply Chain Management, Operations Research and Analysis, Information System Management, Occupational Health and Safety, Facilities Engineering, Quality and Reliability Engineering.

Agustinus Purna Irawan was born in Mataram - Musirawas, South Sumatera, August 28, 1971. Is a Lecturer at Universitas Tarumanagara and has served as Chancellor since 2016 until now. Obtained a Bachelor of Mechanical Engineering from the Faculty of Engineering, Gadjah Mada University (1995), a Masters in Mechanical Engineering from the Faculty of Engineering, University of Indonesia (2003), a Doctor of Mechanical Engineering from the Faculty of Engineering, University of Indonesia (2011), Professional Engineer (Ir) Mechanical Engineering from the Faculty of Engineering, Gadjah Mada University (2019) and Professor of Mechanical Engineering from the Ministry of Education and Culture (2014). The fields of scientific research and publication include: Product Design and Development, Strength of Materials, Natural Fiber Composites with implementation in the field of prosthesis and automotive components. Obtaining Research and Community Service Grants for Higher Education / Research and Technology BRIN / Untar / Others ≥ 100 titles; Patents: 7 and still in process: 4; Copyright: 9 books; Textbooks: 6 books; Book Chapter: 2 chapters; Scientific articles ≥ 100 titles. Obtained a Professional Certificate, namely the Educator Certificate, the Intermediate Professional Engineer Certificate (IPM) of the Indonesian Engineers Association (BKM PII) Vocational Engineer Association (BKM PII), and the ASEAN Engineer Certificate (ASEAN Eng.) From the ASEAN Federation Engineering Organizations (AFEO). He is active in education, various scientific activities, the world of business, professional associations, and various social activities. Received several awards: Best Graduate S2 UI GPA 4.00 cum laude (2003); First best Lecturer Kopertis Region III DKI Jakarta (2011); Best Presentation at the Seminar on Research Results of the Centralized Program, PUPT Dikti (2014); Honorary Member of The ASEAN Federation of Engineering Organizations, AFEO (2018); Best PTS Chancellor for the Academic Leader Award Program (2019).