Fabrication of Portable Angle Grinder Stand

(Fabrikasi Stand Pengisar Sudut Mudah Alih)

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Abstract

An angle grinder that is also known as a disc grinder or a side grinder is a hand-held power tool used for polishing, cutting and grinding works. Workers often had difficulties in maintaining the right position in using the angle grinder to cut metal, which often resulted in minor position shifts. This often affected the results of the process as the size of the cut metal is often different from the required measurement. Hence, this project aims to fabricate a stand that can move forward and backward with portable and ergonomic features to attach the angle grinder. With these features, we hope to reduce the production time for a work price by 30%. The material that we used to fabricate this stand was a mild steel hollow bar, mild steel plate and hollow pipe. The methods that we applied in this fabrication works were arc welding, grinding, drilling and joint. The significant result of using this angle grinder stand was the time consumption when cutting the workpiece and the accuracy compared to using hand. In conclusion, this angle grinder stand is easy to operate and ergonomic.

Keywords: Grinder Stand, Portable, Angle

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INTRODUCTION

An angle grinder also known as a disc grinder or a side grinder is a hand-held power tool used for polishing, cutting and grinding (Norton, 2019). They may be powered by compressed air, electricity, batteries, or a petrol engine (Ib-admin, 2020). Just like any other workshop, an angle grinder is an essential tool in the workshop because it has many uses when it comes to fabrication.

The thing we know certainly is that somebody, somewhere, at some point in time invented them because they were surrounded by rough and difficult-to-cut metals. Maybe that's all that matters. There are conflicting stories about who invented the angle grinder. One story claim that it was invented in 1954 by a German company named Ackermann + Schmitt. In 1954, Ackermann + Schmitt unveiled the first high-speed angle grinder, called the DL 9. Another story says that Thomas Joseph invented the first angle grinder in 1973 (Miller, 2020).

The problem that worker is facing is they often had difficulties in maintaining the right position when using an angle grinder to cut their workpiece which often resulted in minor position shift. Therefore, the objective of this project is to fabricate an ergonomic angle grinder stand that can be adjustable with forward and backward directions. This angle grinder stand was fabricated for small industries users, and it is a user-friendly tool. The limitation of this grinder is for the use of the "Fixman FM406710" angle grinder. Besides that, this grinder stand could only cut straight and 45º workpiece must not thicker than 15mm and 9.5-inch-long, and the height of the cutting disc from the table is 16mm.

METHODOLOGY

Firstly, the angle grinder stand design was made using Autodesk Inventor apps (Figure 1). A few sketches had been drawn and the final design was chosen based on the technical aspect, effectiveness, and cost of fabrication. The development of this angle grinder stand is based on the flow chart shown in figure 2.

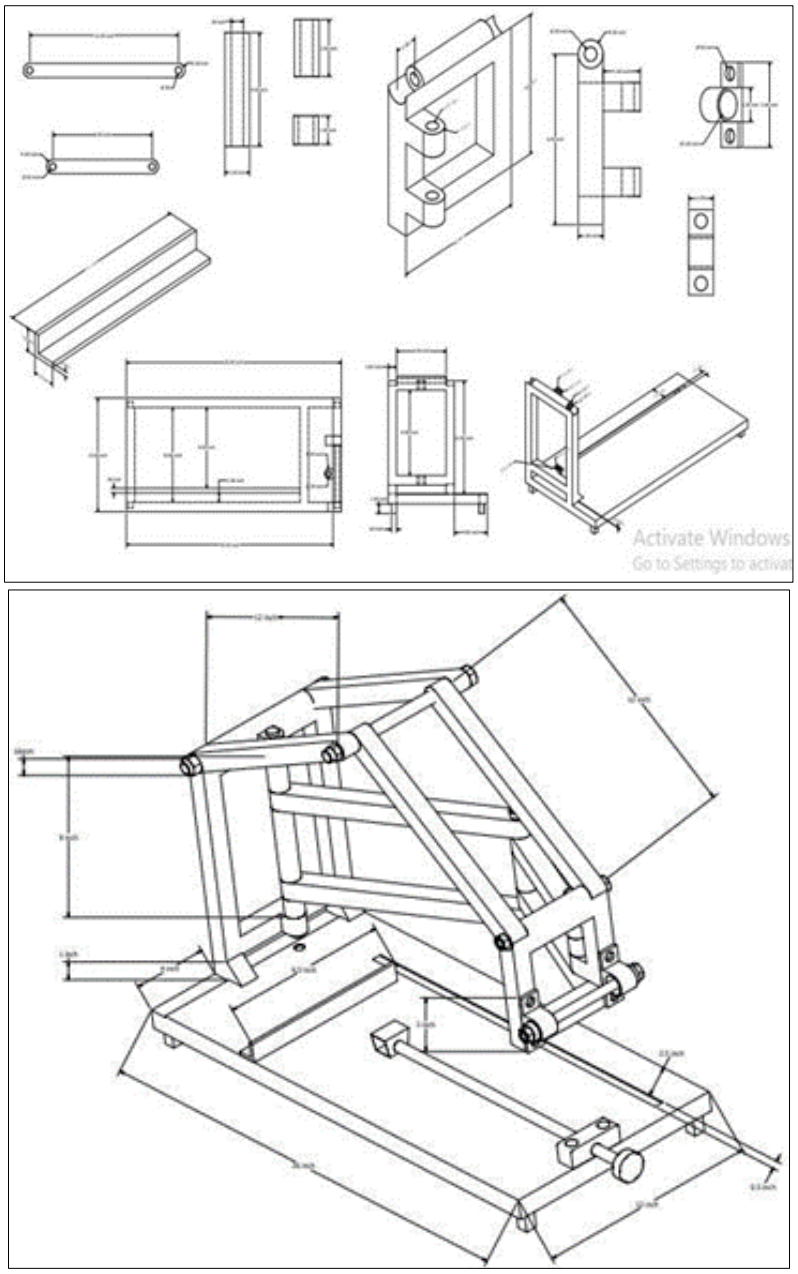

Figure 1. Design of angle grinder stand

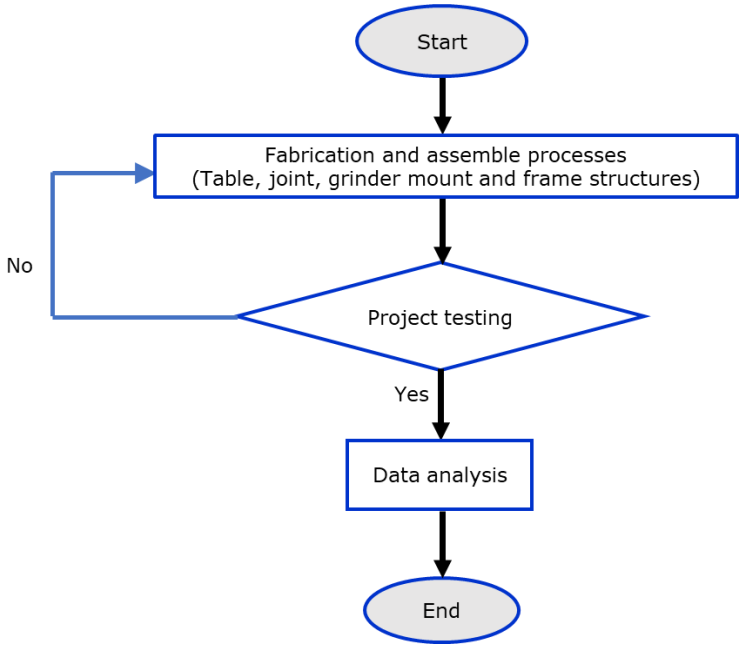

Figure 2. Flow chart of Angle Grinder Stand.

The main structure of the grinder stand consists of the table, frame and joint of the stand. The table was made with 4 mild steel hollow bars, these bars were welded at all angles to fabricate into a rectangle shape. After that, the mild steel plate was placed on top of the rectangle hollow bars and welded together as being shown in Figure 3.

Figure 3. Table of the angle grinder stand.

After finishing the welded the plate onto the hollow bar, grind the table to make the path for the grinder disc to move and carry out the cutting process easier in the future. Then

proceeded with fabricating the joint of the stand, mild steel hollow bar and a collar bush were used. Firstly, the end of the hollow bar was grinded to form a "C" shape on both sides as to be shown in Figure 4. Next, the collar bush was placed at the end of the hollow bar and make sure that the hollow was centered with the bush as being shown in Figure 5. There were ten joints need to be fabricated, where joints were 12in long and 2 joints are 8in long as is shown in Figure 6.

Figure 4. The "C" shape edge

Figure 5. The hollow bar was placed at the centered of the collar bush

Figure 6. Joint for the angle grinder stand

Figure 8 shows where the grinder will be mounted, to make this part, you need four mild steel hollow bar, two with 9 inch long and another two with 6 inch long, both edge of the hollow bar is cut at 45º angle as shown in Figure 7. Joints and welded all sides of the hollow bar to form a square. Next, welded two plates at the front of the part. This is where the grinder will be mounted. Lastly, welded two small irons where the spring was attached and all the collar bush in the position with the joint connected.

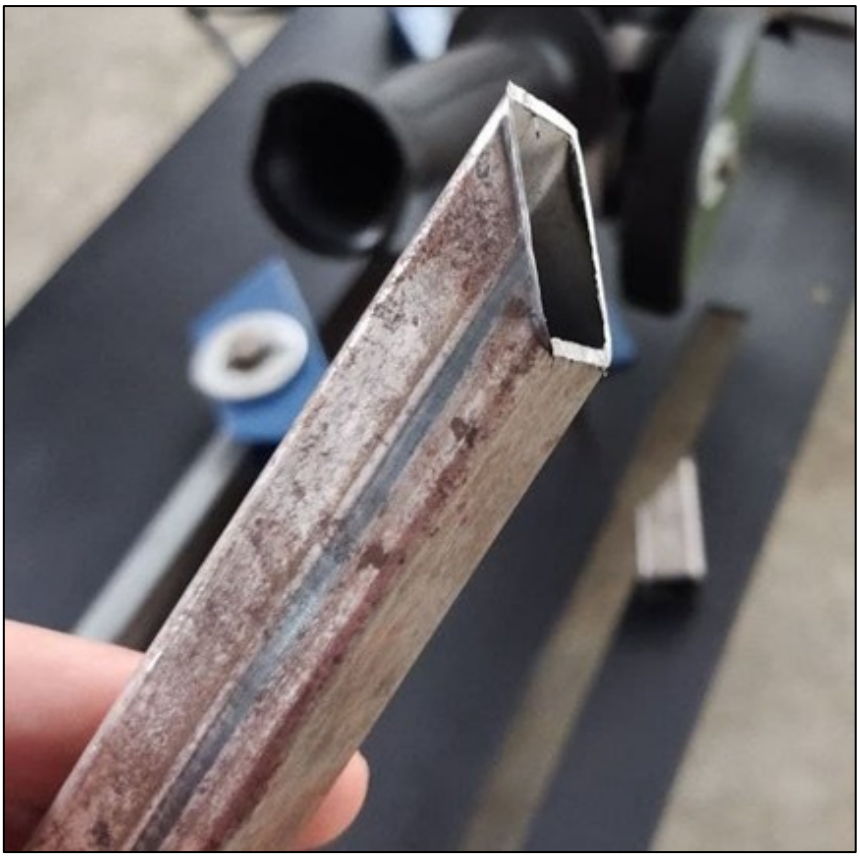

Figure 7. The 45º cutting edge.

Figure 8. Grinder mounted.

The frame was the easiest part in the fabrication process, welded two of the 12-inch-long hollow bar with only one collar bush at the end, to the back of the table with 4.5-inch gap between both hollow bars as shown in Figure 9. After finishing fabrication all the parts, joint every part with nuts and bolts. All joints must be tight but not too tight because this will affect the movement of the joints.

Figure 9. The Frame of the grinder stand.

RESULTS

The completed fabrication of the angle grinder stand is shown in Figure 10. The operation of this angle grinder stand was easy and simple, just by inserting the plug the switch and ready to be used.

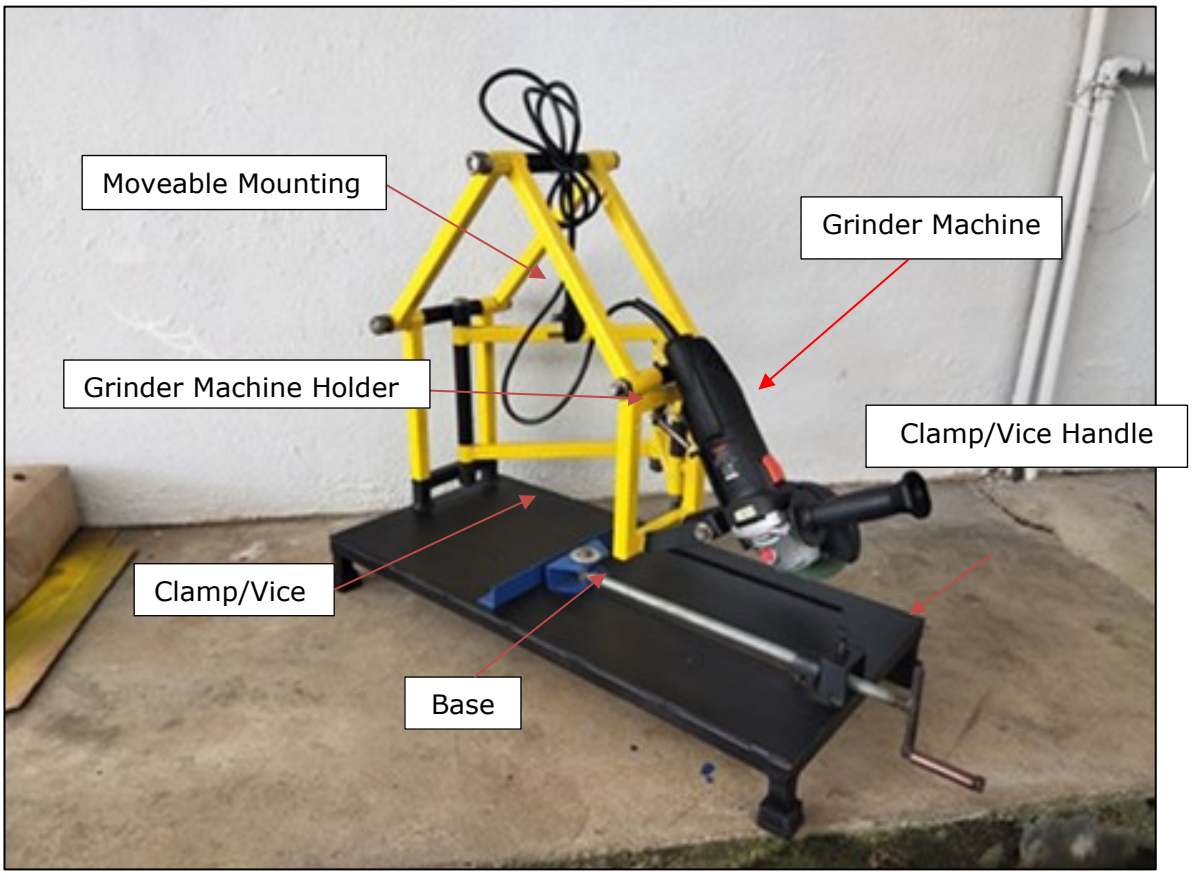

Figure 10. Completed Angle grinder stand.

The grinder could be used to cut hollow pipe or plywood, just switch the disc according to the workpiece that you are working with. Equation 1 was used to calculate the percentage improvement of grinding works. The effectiveness of this angle grinder stand was evaluated based on the time consumption of straight and 45° cutting processes on mild steel hollow bar, mild steel plate and a wooden plate. The results are shown in Table 1. Analysis showed that by using this grinder stand, the time consumption of the straight and 45° cutting processes for the four types of materials had decreased between 35.5% to 66.6%. This result showed that this portable grinder stand was a user-friendly tool compared to using hands during the cutting process.

$$\left(\frac{T_1 - T_2}{T_1}\right) \times 100\% \qquad \text{(Eq 1)}$$

Table 1. Time comparison between using grinder stand and hand

No	Material/Process	Time using stand, T_2 (s)	Time using hand, T_1 (s)	Percentage improvement (%)
1	Straight cut (Mild steel hollow bar 19x19x1.2 mm)	3	9	66.6%
2	45º cut (Mild steel hollow bar 19x19x1.2 mm)	8	16	50.0%
3	Straight cut (Mild steel plate 3mm thickness and 94mm long)	29	45	35.5%
4	Straight cut (Wooden plate 12mm thickness and 62mm long)	3	5	40.0%

Figure 11 is an angle grinder stand from Grizzly Industrial that is available in amazon online shopping website and it cost around RM250.00 in the western country. Although this product is cheaper but our grinder stand is able to cut plywood or mild steel plate and other workpieces with bigger diameter. The total cost of our portable grinder stand was estimated at RM267.48 as being shown in Table 2. Overall, the price was reasonable and affordable.

Figure 11. Grizzly Industrial G8183 - 4-1/2" Angle Grinder Stand
(Grizzly Industrial, 2021)

Table 2. Total cost of portable grinder stand fabrication

No	Item	Quantity	Price Per Unit	Amount
1.	Hollow Bar 19 x 19MM x 1.2 (6 meter)	2	RM23.00	RM46.00
2.	Grinder 710W	1	RM99.00	RM99.00
3.	Mild Steel Plate (Recycle)	1	/	/
4.	Rubber Square feet	4	RM0.50	RM2.00
5.	M.S Bolt ½" x10'' Shaft	1	RM8.00 per KG	RM2.00 (0.250kg)
6.	L Shape Angle Mild Steal(Recycle)	1	/	/
7.	M.S Bolt ½" x7'' Shaft	3	RM8.00 per KG	RM4.52 (0.565kg)
8.	M.S Bolt ½" x9'' Shaft	2	RM8.00 per KG	RM3.80 (0.475kg)
9.	1/2" nut	12	RM9.00 per KG	RM4.32 (0.48kg)
10.	Collar Bush ½"	24	RM2.80	RM67.20
11.	Spring	2	RM3.00	RM6.00
12.	Hollow pipe (Recycle)	1	/	/
13.	Mild Steel Bar (Recycle)	1	/	/
14.	Full stud ½ "	1	RM12.00	RM12.00
15.	Washer (Recycle)	9	/	/
16.	Spray Paint (Yellow, Silverand Flat Black)	3	RM5.00	RM15.00
17.	Sand paper	2	RM0.50	RM1.00
18.	Grinder Blade (Iron)	1	RM1.00	RM1.00
19.	Saw Blade (Wood)	1	RM3.00	RM3.00
20.	Mild Steal Bar	1	/	/
21.	M.S Bolt 3/8 X5''	1	RM8.00	RM0.56
22.	M.S Nut 3/8	1	RM8.00	RM0.08
	Total cost			RM267.48

CONCLUSION

In conclusion, the portable angle grinder stand has been successfully fabricated. Besides, this grinder stand could move forward and backward during the cutting process. Moreover, we hope that this stand can reduce the time consumption of cutting a workpiece. Our suggestion for this product is to use grinder that can use a cutting disc that is more than 100mm in diameter so that it can cut material that is bigger than 15mm in diameter. The other suggestion is this project needs an improvement on its variety of use of other types and model of hand grinder machine since in this project we can only use one specific type and model of hand grinder machine. The study of its stability and capability on its mounting need to be conducted.

REFERENCES

Norton, S. G. (2019). Why an angle grinder is an essential tool? Retrieved from https://www.nortonabrasives.com/en-gb/resources/expertise/why-angle-grinder-essential-tool

Ib-admin (2020). Angle grinder buying guide. Retrieved from https://www.industrybuying.com/articles/angle-grinder-buying-guide/

Miller, T. (2020). History of angle grinder. Retrieved from https://ronixtools.com/en/blog/history-of-power-tools-series-the-history-of-angle- grinders/

Amazon (2021). Grizzly Industrial G8183-4-1/2" Angle Grinder Stand. Retrieved from https://www.amazon.com/Grizzly-G8183-2-Inch-Angle-Grinder/dp/B0000DD72K