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ANGLE GRINDER STAND AS A SUPPORTIVE TOOL FOR CUTTING METAL PROCESS

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Abstract

The goal of this project was to examine the plausibility of a supplementary tool known as "Angle Grinder Stand" that can possibly aid the process of metal cutting in producing metal plates that were cut properly according to required measurements. There were 30 students from a welding technology programme of a local vocational institution who tested this tool and were required to express their ratings on its function and features by completing

questionnaires. The findings revealed that the students found this tool efficient, safe, useful and easy to use. This suggested that this tool could be potentially replicated and promoted across vocational institutions and factories in order to provide welders an improved experience in cutting metal plates and other types of materials of a better quality.

Keywords

Grinder, Metal Cutting Process, Metal Plates, Welding

1. Introduction

This project examined the feasibility of a specifically invented stand for angle grinder to facilitate the process of cutting metal properly. The purpose of this project was to assist students of the welding technology programme in cutting metal properly by propping the angle grinder during the process of cutting metal which enabled the welders to maintain the position needed to procure the precise measurement of cut metal in the end of the process. This equipment might also help the students to be in comfortable posture while executing the task and reduce physical work demand which allowed them complete the job quicker.

Grain Handling Safety Coalition (2015) defined angle grinders as a handheld power tool that welders regularly use to cut, grind and polish metal objects. The source of the power can be electricity, gas or pneumatics and this tool is available in many sizes. There are many safety measures that welders need to pay attention to while using this tool. Welders are warned not to grind on the side of the wheel and they must use both hands in handling it. They are instructed to keep their hands away from rotating wheel and avoid continuous vibration. They also should maintain good footing, balance and work position. It is clear that individuals who work in welding-related areas require tools that help them stay safe and become more efficient and probably productive in their jobs. This innovation might have potential in meeting these needs.

Health and Safety in Welding (2006) stipulated that welding poses harm to those involved directly with it where the health and safety of welders might be at high risk of obvious and subtle hazards. It was clearly stated in the guideline that manual handling in welding tasks can involve heavy and repetitive manual work as well as sustained awkward postures for long periods without a break. Hence, this issues might need to be assessed and tackled. It was also stated that poor design of hand tools can cause musculoskeletal disorder. Thus, this research project aimed to help address the demanding and difficult nature of a specific welding task.

2. Problem Statement

Welders often had difficulties in maintaining the right position in using 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 was often different than the required measurement. They also had to endure the physical work demand of cutting metal which usually took longer duration to be completed and this was made worst by the uncomfortable postures they had to be in during the process. Previous study showed only a small percentage of students who were able to cut metal in the desired size while majority of them produced metal plates that did not meet the required measurements. Many of the students complained that the process made them feel exhausted. Thus, this equipment was designed in order to tackle these issues and improve the students' quality of work.

3. Precision in Welding-Related Tasks

Hastomo (2009) claimed that welders found it challenging to cut metal in the precise size that their customers requested. This could be attributed to the lack of supporting tools that could improve welding-related tasks. Thus, there is a need to review the plausibility of introducing supportive tools that can aid welders produce desired results. In order to design this tool, there were several studies on other cutting tools that were analyzed to identify specific features that were crucial in designing this equipment. Lim, Huang, He, Sun and Liu (2003) examined the effects of ceramic cutting tool in producing properly cut objects and discovered that certain mechanical features of the cutting tool might contribute to its efficiency in cutting objects according to specific measurements. Hence, this project was designed by taking into account certain mechanical features and ergonomic concepts that should be incorporated into this complementary cutting tool.

4. Workload and Productivity in Welding Operations

Any tools that can alleviate welders' workload might be a great complement to the existing main tools because these tools can reduce their physical burden and increase their efficiency in completing specific tasks. Wahyuni et al. (2018) conducted a study on six workers at a welding workshop in North Sumatra, Indonesia to examine the workload of these individuals. Physiological method (pulse rate and energy consumption) and workload analysis (productive time) were used to determine the level of these workers' workload. It was discovered that their workload was classified excessive that it resulted in delayed

completion of products due to the amount of jobs that required more energy than what the workers had. This might be the reason why there were many complaints issued by the customers on delayed delivery of products that they ordered from the workshop. The findings of this study implied the causal relationship between workload and productivity of workers in welding workshops. Thus, this angle grinder stand can possibly help welders perform the grinding task more efficiently than the usual operation.

Arumsari and Gunani (2013) argued that workload is an important factor in determine work efficiency that directly influences work productivity. Excessive workload results in a work environment that is less comfortable and conducive for workers as they tend to become stressed easily (Anwar, 2015). If welders had to cope with physically demanding task that repetitively drained them of their energy and mental strength, it was likely that they would not perform well in executing tasks no matter how easy this task might seem.

5. Health Risks

Nugroho (2008) argued that metal cutting process could pose a major risk of harm on welders and it was necessary to improve the safety and convenience of the existing tools. Shahriyari, Afshari and Mahmood Latifi (2018) revealed several factors that caused welders to experience physical pain and fatigue. These were awkward postures and prolonged strain on back and neck that welders had to endure while executing certain tasks, the nature of the work and the design of the workstation. They discovered that shoulders and lower back were the worst affected body parts. This kind of persistent issue that welders constantly experienced at workplace needs to be resolved in order to protect the health and safety of the workers. This study attempted to determine whether this angle grinder stand could prop the metal cutting operation so that the welders did not need to exert more energy and endure poor postures while performing the task.

6. Objective

The goal of this project was to determine the plausibility of the tool in supplementing the process of cutting metal plates with the proper measurement of breadth and width as well as examining its potential in being safer and quicker.

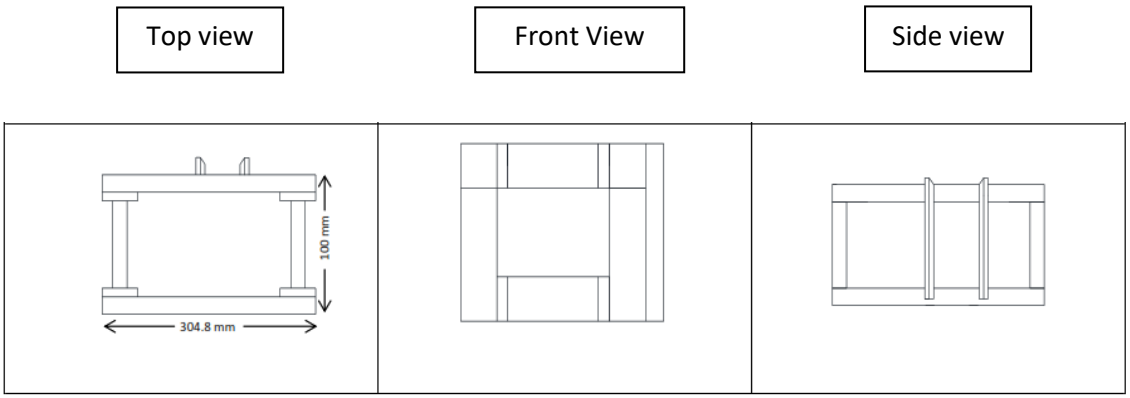

Figure 1: *The Diagram of the "Stand for Grinder Cutting" from Three Angles of Views*

7. Methodology

There were 30 respondents who were involved in this study. These 30 individuals were students from the welding technology programme of a vocational college in the interior region of Sabah. These students were given the opportunity to try this supplementary tool during a series of metal cutting sessions. They were then required to answer a questionnaire that was designed to elicit their opinions on the practicality and potential of the tool. Widnjosoebroto (1995) explained that the best way to elicit respondents' opinions on a tool was to let them use the tool first so they could gain first-hand experience.

8. Finding and Discussion

There were six main items in the questionnaires that the respondents were required to complete. The respondents were expected to rate their opinions on each item based on five points Likert-scale. The five point scales represented their level of approval on the items which were 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree) and 5 (strong disagree). Table 1.0 illustrates the respondents' ratings.

Table 1: *The Analysis of the Respondents' Rating on Each Item in the Questionnaire*

No	Item	Scale				
		1	2	3	4	5
1	The tool is useful in facilitating the metal cutting process	-	-	-	50%	50%
2	The tool reduces the time taken to cut metal plates	-	-	-	43%	57%
3	The tool makes the metal cutting process safer	-	-	-	56%	44%

4	The tool is made of materials that were harmless and suitable	-	-	-	25%	80%
5	The tool is convenient and easy to carry	-	-	-	37%	62%
6	The tool can be used to cut metal plates that are large	-	-	-	13%	87%

The findings revealed that all of the students expressed their total approval on the features and functions of the tool in supplementing metal cutting process. Their highest rating was on the function of the tool in complementing the process of cutting metal plates of larger size. They also expressed strong approval on the materials used to build the tool which was harmless and suitable. Other than these two aspects, they also had positive opinions on the usefulness, the efficiency, ease of use and safety of the tool. This signified the added value that this tool might have in the metal cutting process.

The respondents generally gave higher rating on whether the project reduced the time taken in cutting metal. They also gave equally high rating on whether it made the process easier. These findings were consistent with what Wahyuni et al. (2018) discovered in their research that the main reason why there was a slow progress in the welding work was the excessive workload that caused the welders to lose their efficiency and productivity. If the workload could be alleviated in any manner that was possible such as the usage of supportive tools, the welders might be able to work faster and produce metal products of better quality.

The respondents thought that the angle grinder stand was safe, convenient and harmless. This finding indicated that the tool might be able to reduce the health risk and physical strain that welders were often exposed to when using various hand tools particularly angle grinder. As asserted by Health and Safety in Welding (2006), manual handling in welding is highly associated with heavy and repetitive work that could affect the health of welders and this necessitated the need to revise the conventional methods to be safer. Nugroho (2008) suggested in modifying and making changes on the existing tools in order to tackle any health risks at welding workplace. This project was able to offer insight on how supportive tools can improve the safety of the workplace.

Since these students expressed their approval on the various aspects of this tool after using it during the metal cutting process that they did during their classes, it showed that this tool could be used in welding workshops for welders including practical classes for students of vocational programmes. It can improve welders' quality of work and increase the efficiency of this physically demanding task. Hence, this tool could be replicated and

promoted as a supplementary type of equipment for welding programmes in all vocational institutions and welding workshops.

9. Conclusion

The purpose of this research was to examine the feasibility of this tool, angle grinder stand, in improving the quality of work in metal cutting process, lowering the health risk associated with the task and reducing the amount of time taken in completing the process. The findings revealed that the students expressed their approval on its functions and features. Hence, this show that this item might have potential to be used across vocational institutions and could possibly commercialized to cater to the needs of industry that involve metal cutting process and manufacturing. Most importantly, this research showed that supportive tools can improve the productivity, efficiency and safety of the main tools at least in the context of welding work.

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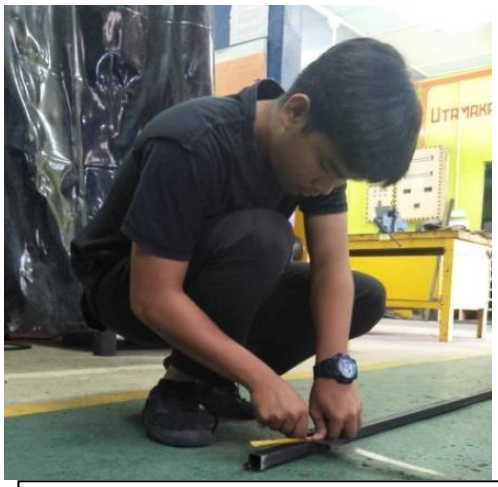
Appendix



Step 1: Measuring the materials required to create the tool

Step 2: Cutting the materials

Step 3: Welding the material

Step 4: Creating clearance holes on the surface

Step 5: grinding the different parts of the tool

Step 6: Paint the exterior parts of the tool

Stand for Grinder Cutting