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Design and Analysis of Tungsten Carbide Sludge Removal Machine for Maintenance Department in Cutting Tool Manufacturer

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Abstract

In Cutting Tool Industries, the grinding process for producing cutting tools creates carbide sludge which is a combination of carbide waste from the product material and coolant from the grinding machine. Since carbide sludge will be filtered in the filter machine, a monthly maintenance is necessary for the filter machine which includes transferring accumulated carbide sludge into the waste barrel. The current process of removing carbide sludge from the filter machine requires 2 to 3 person and takes a considerable amount of time. The process also requires several types of equipment such as jack and forklift which requires skilled workers to operate. The aim of this research is to develop a carbide sludge remover machine that fits perfectly into ABC Cutting Tool Industries production line. The methodology used for this research is by following Deming Cycle Approach (PDCA), observation, conceptual generation through PUGH method and design software (CATIA). The benefit of this research is a design and analysis of carbide sludge remover machine that could reduce the number of workers required for the waste removal process. It also simplifies the operation of removing carbide sludge from the filter machine. This research may contribute to the cost reduction for the carbide sludge removal process over time and also improve the safety of the operator. A fully automated Carbide Sludge Remover can also be the next part of this research as well as the intelligent carbide sludge indicator sensor that linked with the operation of the company.

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1. Introduction

Tungsten carbide is the main material for producing a cutting tool. It has been selected for cutting tool material due to its great physical properties and its ability to withstand high stress. One of its weakness is the increased brittle condition of the tungsten carbide when exerted with excessive force. ABC Industries SDN BHD is a cutting tool manufacturer located in Shah Alam, Malaysia. As a cutting tool manufacturer, ABC Industries need to handle tungsten carbide as the raw material.

Removing carbide sludge is one of the main parts in the cutting tool industry. It is a process where waste carbide sludge which has been accumulated inside the filter machine will be removed from the filter into the waste barrel by any means possible. Even though there is automated flushing system for the newer model of filter system, the available filter machine at ABC Industries comes from an older model which requires the carbide sludge removal process to be done manually.

Since ABC Industries is applying lean manufacturing into their system, the process of removing carbide sludge has taken the attention of the management team where the process needs to be improved. The current efficiency of removing carbide sludge needs to be improved due to improper tool usage which could lead to an accident. Due to improper tool usage, the number of workers that are required to perform the procedure has increased. This could lead to a higher cost for the company to pay their workers.

The understanding of carbide sludge removal process gives a better perspective to the problem and better approach for designing the machine. It also helps to categorize the main mechanism and important parts required.

2. Literature Review

Lean Manufacturing is a concept which aims for a more productive and more effective production by eliminating all elements of waste in the manufacturing process. As a system, it is aimed to perform production with minimum manpower, minimum production area, minimum resources, minimum level of holding inventories, minimum defects and producing products at the shortest time with less customer dissatisfaction [1]. In order to have a leaner manufacturing process, elimination of the elements of waste is one of the most important elements in order to obtain maximum outputs with the minimum inputs [2], [8-14].

ABC Industries is a cutting tool manufacturing company which is located in Shah Alam, Malaysia. The company is in the phase of implementing the Lean manufacturing concept into their production line. As a cutting tool manufacturer, the factory is filled with tungsten carbide as the raw material for the cutting tool developed in ABC Industries. The waste of tungsten carbide is known as carbide sludge which could be recycled into tungsten carbide again.

In the effort of upholding Lean Manufacturing, ABC Industries is trying to improve their waste elimination process. With 21 systems for the different type of cutting tool production, the carbide sludge that are accumulated from the grinding machines are directed to the nearest filter machine and stored there. After one month, the maintenance team will remove the stored carbide sludge into a barrel and sent for recycle purpose. Current procedure at ABC Industries requires 2 to 3 person to operate the process. Without proper equipment, the process would take approximately 30 minutes per system. Figure 1 shows the standard operating procedure (SOP) for retrieving the carbide sludge from the filter machine. The material where the maintenance team needs to handle is tungsten carbide sludge.

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