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Analysing and Preventing the Un-Guarded Polishing Machine Hazards by using Industrial Safety Methodologies

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Abstract: ***The main objective of this work is to ensure the safety for machine operators and also for machines by preventing the hazards causing by un-guarded components. Most of the engineering works needs the manufacturing process with polishing machines or buffers. Polishing machines or buffers are used to polish various types of metallic and non-metallic components. In real life most of these polishing machines are not guarded properly. It creates safety issues related machine and men. Two main safety hazards associated with polishing machines during polishing processes were considered in this project. Un-guarded polishing machine including rotating shafts locating between motor and the polishing wheel and Un-guarded spindle end and nut on the polishing wheel. This analysis is done by using Fault Tree analysis and Job safety analysis. It can be noted that add a permanent cover/guard that encloses the rotating shaft so that it is not accessible. The spindle end and nut can be guarded with a guard similar to the guards used on grinders. The guard must cover the spindle end and nut in the centre of the polishing wheel so that they are not accessible and no projection hazards exist. This guard may come up from the floor or may be attached to the motor or other stationary portion of the machine. Ensure that the guard itself does not create additional hazards and that all other moving parts such as belts and pulleys are fully guarded.***
Keywords: Hazards, Job safety analysis, Fault tree Analysis, Guard, Polishing machines.

I. INTRODUCTION

Crushed hands and arms, severed fingers, blindness -- the list of possible machinery-related injuries is as long as it is horrifying. There seem to be as many hazards created by moving machine parts as there are types of machines. Safeguards are essential for protecting workers from needless and preventable injuries. A good rule to remember is: Any machine part, function, or process which many cause injury must be safeguarded. When the operation of a machine or accidental contact with it can injure the operator or others in the vicinity, the hazards must be either controlled or eliminated. This manual describes the various hazards of mechanical motion and presents some techniques for protecting workers from these hazards. General information covered in this chapter includes where mechanical hazards occur, the hazards created by different kinds of motions and the requirements for effective safeguards, as well as a brief discussion of non-mechanical hazards. Polishers and buffing machines are used to impart a fine (low Ra) surface finish on the exterior of a part. To improve surface finish, they use abrasive grain slurries or compounds on buffs, bobs, cloth naps, laps, very fine grit nonwovens, and coated abrasives. Many types of polishers and buffing machines are available. Choices include disc finishing and centre less finishing machines, buffers, cylindrical polishers, honing machines, lapping machines, orbital devices, polishing lathes, super finishing equipment, vibratory or oscillatory machines, and specialty devices. Safety trip controls provide a quick means for deactivating the machine in an emergency situation. A pressure-sensitive body bar, when depressed, will deactivate the machine. If the operator or anyone trips, loses balance, or is drawn toward the machine, applying pressure to the bar will stop the operation. The positioning of the bar, therefore, is critical. It must stop the machine before a part of the employee's body reaches the danger area. A pressure-sensitive body bar located on the front of a rubber mill. When pressed by hand, the safety deactivates the machine. Because the triprod has to be actuated by the operator during an emergency situation, its proper position is also critical. A triprod located above the rubber mill. Safety tripwire cables are located around the perimeter of or near the danger area. The operator must be able to reach the cable with either hand to stop the machine. A calender equipped with this type of control and a tomato sorter with a safety tripwire cable. All of these tripwire rods or other safety devices must be manually reset to restart the machine. Simply releasing the tripwire to restart the machine will not ensure that the employee is out of danger when the machine restarts. There are many ways to safeguard machines. The type of operation, the size or shape of stock, the method of handling, and the physical layout of the work area, the type of material, and production requirements or limitations will help to determine the appropriate safeguarding method for the individual machine. As a general rule, power

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transmission apparatus is best protected by fixed guards that enclose the danger areas. For hazards at the point of operation, where moving parts actually perform work on stock, several kinds of safeguarding may be possible. One must always choose the most effective and practical means available. Hazards are analysed by Fault tree analysis and Job safety analysis. Fault tree analysis (FTA) is a top down, deductive failure analysis in which an undesired state of a system is analysed using Boolean logic to combine a series of lower-level events. It contains undesired event, basic event, un developed event, Conditioning event and Intermediate event. A job safety analysis (JSA) is a procedure which helps integrate accepted safety and health principles and practices into a particular task or job operation. In a JSA, each basic step of the job is to identify potential hazards and to recommend the safest way to do the job.

II. METHODOLOGY

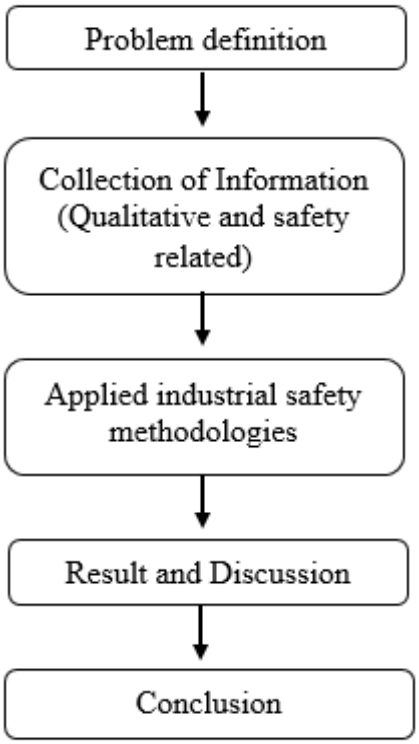

Fig 1. Methodology

III. IDENTIFICATION OF PROBLEM AND EXPERIMENTAL SETUP

A. Problem Definition

Most of the engineering works needs the manufacturing process with polishing machines or buffers. Polishing machines or buffers are used to polish various types of metallic and non-metallic components. In real life most of these polishing machines are not guarded properly. Two main safety hazards associated with polishing machines during polishing processes were considered in this project.

1) Un-guarded polishing machine including rotating shafts locating between motor and the polishing wheel
2) Un-guarded spindle end and nut on the polishing wheel.

B. Experimental Work

The polishing machine such as surface grinding machine, cylindrical grinding machine were operated from that in actual practise the polishing machines (Grinding machine) are not guarded properly. Two main safety hazards associated with polishing machines (Grinding machines) during polishing processes were considered in this project. Un-guarded polishing machine including rotating shafts locating between motor and the polishing wheel and Un-guarded spindle end and nut on the polishing wheel.

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Fig 2. Surface grinding Machine

Fig 3. Jewellery Polishing Machine

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Fig 4. Cylindrical grinding Machine

IV. RESULTS AND DISCUSSION

A. Fault Tree and Job safety Analysis for Surface grinding Machine process

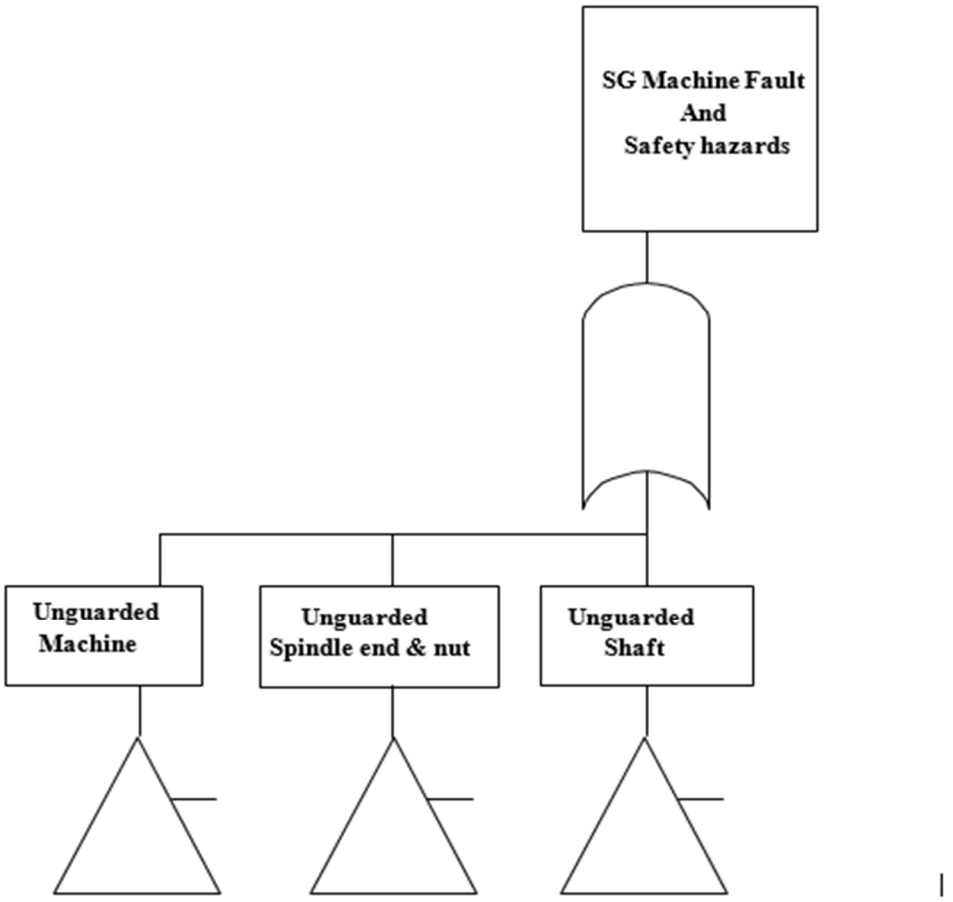

Fig 5 Fault Tree Analysis for Surface grinding Machine

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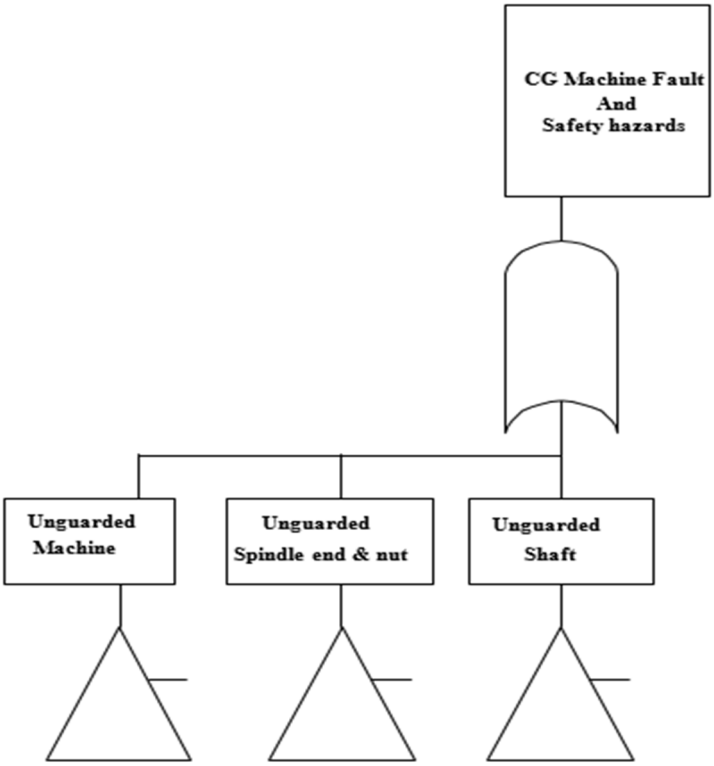

Fig 6. Fault Tree Analysis for cylindrical grinding Machine process

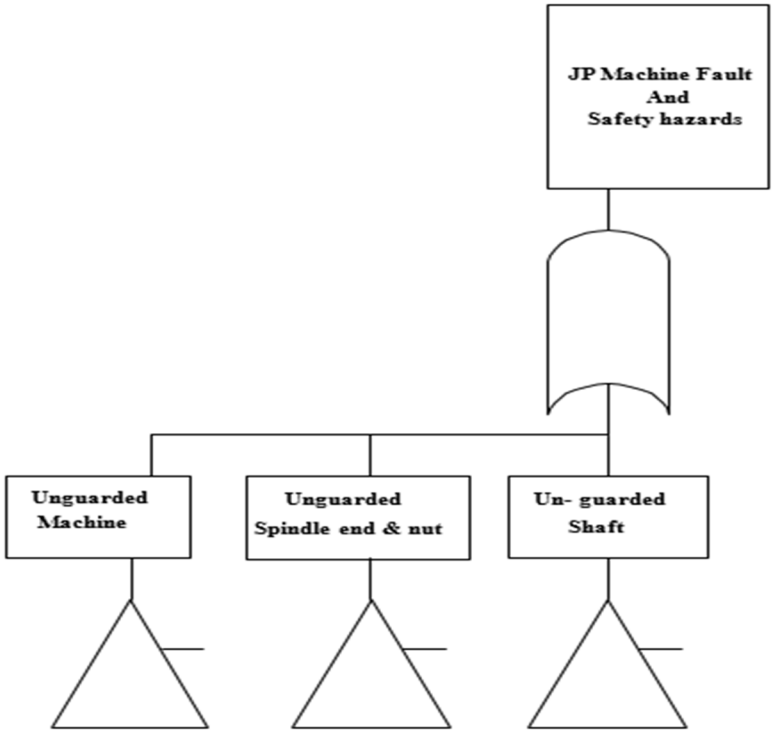

Fig 7. Fault Tree Analysis for jewelry polishing Machine

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Picture of task/equipment:	Task:	OPERATING A SURFACE GRINDING MACHINE
	Name of Shop or Dept:	
	Job Title(s):	
	Analyzed by:	
	Date:	

Required PPE:

2. Ear plugs
3. Safety glasses

Required/Recommended Trainings:

1 Surface grinding Operations

TASK	HAZARDS	CONTROLS
2. Grinding Operations	1.Un-guarded polishing machine including rotating shafts locating between motor and the polishing wheel 2. Un-guarded spindle end and nut on the polishing wheel.	1. Add a permanent cover/guard that encloses the rotating shaft. 2.The guard must cover the spindle end and nut in the centre of the grinding wheel

Fig 8. Job Safety Analysis form for Surface grinding machine process

Picture of task/equipment:	Task:	OPERATING A CYLINDRICAL GRINDING MACHINE
	Name of Shop or Dept:	
	Job Title(s):	
	Analyzed by:	
	Date:	

Required PPE:

1.Ear plugs
2.Safety glasses

Required/Recommended Trainings:

1. Cylindrical grinding Operations

TASK	HAZARDS	CONTROLS
1. Grinding Operations	1.Un-guarded polishing machine including rotating shafts locating between motor and the polishing wheel 2. Un-guarded spindle end and nut on the polishing wheel.	1. Add a permanent cover/guard that encloses the rotating shaft. 2.The guard must cover the spindle end and nut in the centre of the grinding wheel

Fig 9. Job Safety Analysis form for cylindrical grinding machine process

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Picture of task/equipment:	Task:	OPERATING A JEWELRY POLISHING MACHINE
	Name of Shop or Dept:	
	Job Title(s):	
	Analyzed by:	
	Date:	

Required PPE:

1.Ear plugs
2.Safety glasses

Required/Recommended Trainings:

1. Polishing Operations

TASK	HAZARDS	CONTROLS
1. Polishing Operations	1.Un-guarded polishing machine including rotating shafts locating between motor and the polishing wheel 2. Un-guarded spindle end and nut on the polishing wheel.	1. Add a permanent cover/guard that encloses the rotating shaft. 2.The guard must cover the spindle end and nut in the centre of the grinding wheel

Fig 10. Job Safety Analysis form for Jewelry Polishing machine process

Fault Tree Analysis for surface grinding machine, cylindrical grinding machine and jewelry polishing machine process. It can be noted that all kind of polishing machines have same safety issues like Un-guarded polishing machine including rotating shafts locating between motor and the polishing wheel and Un-guarded spindle end and nut on the polishing wheel. Job Safety analysis done for surface grinding machine process. The job safety analysis form is shown in the figure 8. It contain three parts such as task hazards and control. It can be noted that, the hazard part contain the followings, Un-guarded polishing machine including rotating shafts locating between motor and the polishing wheel and Un-guarded spindle end and nut on the polishing wheel. Control part contain the followings Add a permanent cover/guard that encloses the rotating shaft and the guard must cover the spindle end and nut in the centre of the grinding wheel. Same results obtained in Job Safety analysis for cylindrical grinding machine as well as in Job Safety analysis for Jewelry Polishing machine which shown in Fig 8,9 and 10.

VI. CONCLUSION

Most of the engineering works needs the manufacturing process with polishing machines or buffers. Polishing machines such as surface grinding, cylindrical grinding and jewelry polishing machine or buffers are used to polish various types of metallic and non-metallic components. In real life most of these polishing machines are not guarded properly. It creates safety issues related machine and men. Two main safety hazards associated with polishing machines during polishing processes were considered in this project. Un-guarded polishing machine including rotating shafts locating between motor and the polishing wheel and Un-guarded spindle end and nut on the polishing wheel. This analysis is done by using Fault Tree analysis and Job safety analysis. The following outcome obtained in job safety analysis for surface grinding, cylindrical grinding and jewelry polishing machine process. So the following control action should match all kind of polishing machines. Add a permanent cover/guard that encloses the rotating shaft so that it is not accessible. The spindle end and nut can be guarded with a guard similar to the guards used on grinders. The guard must cover the spindle end and nut in the centre of the polishing wheel so that they are not accessible and no projection hazards

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exist. This guard may come up from the floor or may be attached to the motor or other stationary portion of the machine. Ensure that the guard itself does not create additional hazards and that all other moving parts such as belts and pulleys are fully guarded.

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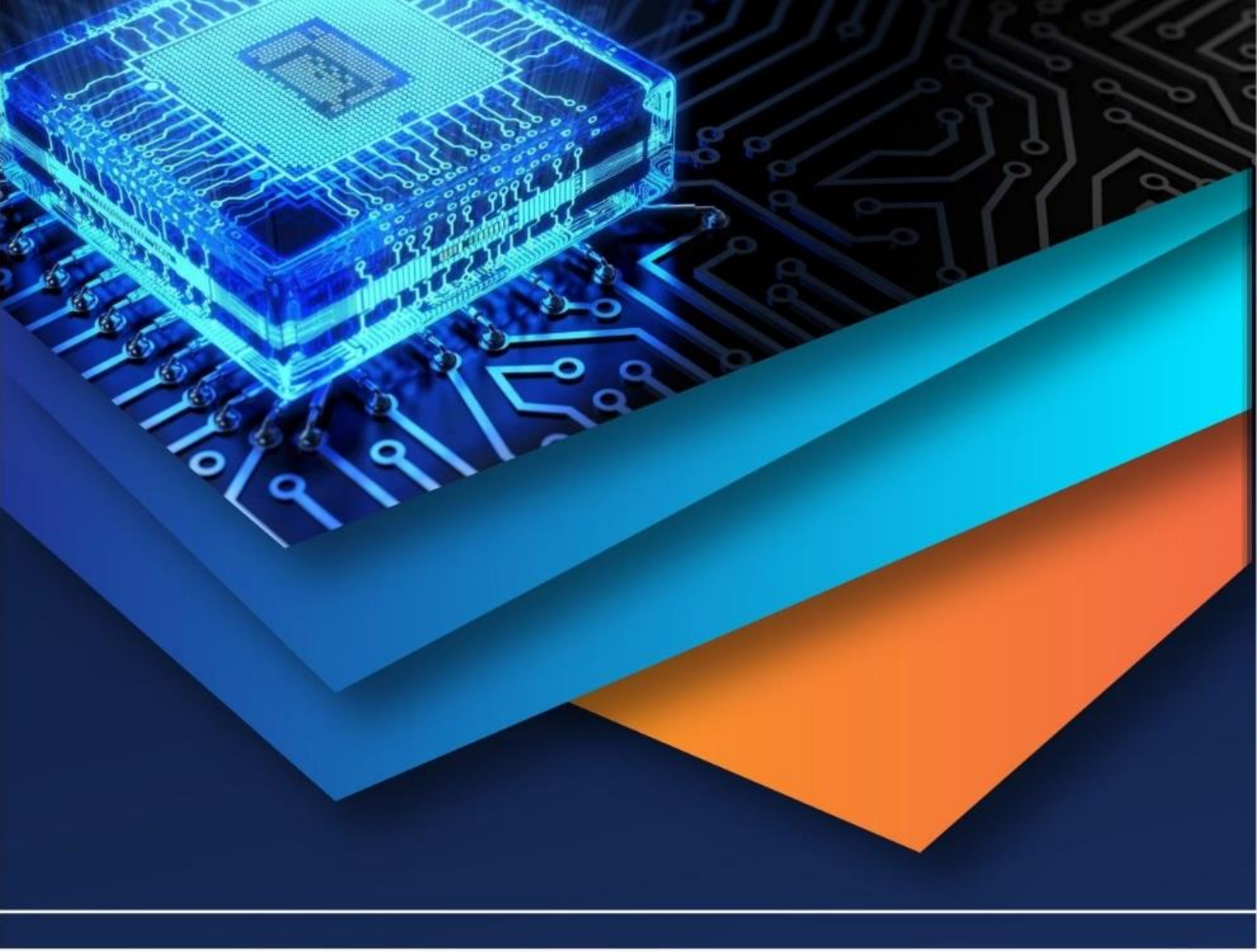

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