Fabrication of Belt Grinder Machine

Mr. Prashant S Ganiger [1], Mr. Darshan A Reddy [2], Mr. Raghavendra H G [3]

[1]*Associate Professor Dept. of Mechanical Engineering, Bangalore Technological Institute, Bangalore-35*
[2]*Students Dept. of Mechanical Engineering, Bangalore Technological Institute, Bangalore-35*
[3]*Students Dept. of Mechanical Engineering, Bangalore Technological Institute, Bangalore-35*

Abstract - The machine integrates advanced grinding mechanisms to enhance precision, efficiency, and flexibility in material removal processes. Key design objectives included optimizing belt tension, achieving uniform abrasive contact, and minimizing vibrations during operation. The methodology involved computational modeling, prototype fabrication, and performance testing on various materials, such as metals and composites. Results demonstrated significant improvements in surface quality, reduced processing time, and increased tool lifespan compared to conventional grinding techniques. These findings underscore the machine's potential to improve manufacturing productivity and quality standards.

***Key Words*:** belt grinding machine, surface finishing, material removal, abrasive tools, manufacturing efficiency.

1.INTRODUCTION

The growing demand for high-quality surface finishing in various industries has necessitated the development of advanced grinding systems. Among these, belt grinding machines have emerged as versatile tools capable of addressing diverse material removal and finishing requirements. Belt grinding is widely employed in applications such as deburring, polishing, and achieving precise dimensional tolerances, particularly in automotive, aerospace, and metal fabrication industries.
Traditional grinding systems often face limitations, such as inconsistent abrasive contact, higher vibration levels, and reduced operational efficiency. These challenges not only affect surface quality but also lead to increased operational costs and tool wear. The development of an optimized belt grinding machine aims to address these limitations by introducing enhanced mechanical design, precision control systems, and adaptable operational parameters.

2. LITERATURE SURVEY

Marija Matejic et.al [1], The belt grinding machine, presented in this paper, was designed and tested for grinding any shape of object like circular, rectangular, or polygon. In this project, the work abrasive belt is used to grind the various types material of material such as metal, plastic, wood etc. The abrasive belt is rotated by a three-phase induction motor. The particular abrasive belt grinding machine has been developed for the purposes of experimental research. Hence this project namely adjustable belt grinder. The machining accuracy and surface quality of workpieces are the key factors that ultimately determine the performance of the equipment. The test workpieces are presented in the paper and their characteristics are commented. The paper concludes with comments on achieved results and directions for further research on this topic.

Nguyen Thuan [2], This paper presents the results of the process of designing and manufacturing a mini belt grinding machine, this machine can be easily moved to area where the workpieces need to be manufactured. The mini belt grinding machine is small and easy to move, but it still enough rigidity. The parameters calculated during the design process include: speed chain and whole the kinematic diagram of this grinding machine. The mini belt grinding machine after successfully manufactured have been widely applied in addition to actual production. It is typically used as a finishing process in industry.

Prof. Husain Shaikh et.al [3], Grinding is an abrasive machining process that uses a grinding wheel as the cutting tool. A wide variety of machines are used for grinding. Although mini belt grinding abrasive belt have stronger cutting ability than that on the grinding wheel. The main aim of this paper is to design vertical abrasive belts grinding machine to achieve good tolerance as well as better surface finish for various materials such as metal, glass, ceramic, rock and specified material. The abrasive belt grinding can reduce the surface roughness of work pieces and accuracy meanwhile Aluminium

oxide belt with high stock removal cleaning and polishing is effectual. The abrasive belt grinding as compared to wheel grinding have more efficient with efficiency and parameter range. It is conclude that Aluminium oxide belt hardness makes it suitable for use as an abrasive and as a component in cutting tools with significant proportion. We have designed such Abrasive Belt vertical Grinding Machine having better advantages over wheel grinding machine.

Mr. Hanumanta Narayanrao Balpande et.al [4], In our project the work abrasive belt is used to grinding the material. The abrasive belt is rotated by the single phase induction motor. Hence our project namely abrasive belt grinder is a Special type of Machine. According to the type of material to be grind, the grinding tool can be changed. This project gives details of grinding various shapes and sizes of components. This machine can be widely applied in almost all type of industries. By varying the pulley sizes I can get a high end speed of over 10,000 rpm if needed.

Jayesh Ranjankar et.al [5], Grinding is an abrasive machining process that uses a grinding wheel as the cutting tool. A wide variety of machines are used for grinding. Although mini belt grinding abrasive belt have stronger cutting ability than that on the grinding wheel. The main aim of this paper is to design vertical abrasive belts grinding machine to achieve good tolerance as well as better surface finish for various materials such as metal, glass, ceramic, rock and specified material. The abrasive belt grinding can reduce the surface roughness of work pieces and accuracy meanwhile Aluminium oxide belt with high stock removal cleaning and polishing is effectual. The abrasive belt grinding as compared to wheel grinding have more efficient with efficiency and parameter range. It is conclude that aluminium oxide belt hardness makes it suitable for use as an abrasive and as a component in cutting tools with significant proportion. We have designed such Abrasive Belt vertical Grinding Machine having better advantages over wheel grinding machine.

Mr. Shubham Patil et.al [6], The machine we designed and fabricated is used for grinding any shape of object like circular, rectangular and polygon. In our project the work abrasive belt is used to grinding the material. The abrasive belt is rotated by single phase induction motor. Hence our project namely adjustable belt grinder. In this project we use aluminum oxide belt. The aluminum oxide belt grind any material like wood, stainless steel, cast iron, glass etc. As per material specification we can also vary speed with the help of the VFD.VFD stands for variable frequency drive. A variable frequency drive is a type of motor controller that drives an electric motor by varying the frequency and voltage of its power supply. They are used for controlling the speed of an AC motor. The abrasive belt grinding can reduce the surface roughness of work piece and accuracy of meanwhile. Aluminium oxide belt with high stock removal cleaning and polishing is effectual. The abrasive belt grinding as compared to wheel grinding have more efficient with efficiency and parameter range. It is conclude that aluminum oxide belt hardness makes it suitable for use as an abrasive and as a component in cutting tools with significant proportion.

Deng Ruixiang et.al [7], Abrasive belt grinding technology is an important part of the precision forming process of complex profile parts. Based on the planning of grinding path, contact model and material removal model, the research and application progress of abrasive belt grinding technology at home and abroad are summarized, and the problems and research directions in the research of complex profile abrasive belt grinding technology are pointed out.

K. Durgarao et.al [8], Grinding is a metal removal process by the action of rotation abrasive wheel.An abrasive is a material whose particles are extremely hard and can be used to machine materials such as hardened steel, glass, carbide, wood etc. The grinding operation may be used for removing thick layer (0.5mm) of material in general class of work. Abrasive belt grinding is a common finishing process in the metal and wood industry.Belt grinding can be used for both coarse and fine grinding. The principle parts of this attachment are main body, motor with pulleys and conveyor abrasive belt etc. The machine help to shape the material without putting much effort and getting better surface finish and getting large area of belt for grinding operation. The wheel grinding maintenance cost is less, occupied less floor space and good surface finish is maintained.In this mini project fabrication of mini Abrasive vertical belt grinding machine to be done.

3. TECHNOLOGY AND HARDWARE IN PROJECT

The proposed belt grinding machine uses key components and materials to ensure optimal performance. It employs mota pulleys for efficient power

transmission and consistent belt motion, while a spring mechanism maintains proper belt tension and adapts to varying load conditions. The machine is built with a combination of wood, offering a lightweight yet durable frame. Additionally, an aluminum oxide sand belt serves as the abrasive medium, enabling effective material removal and achieving superior surface finishes. The motor police's advanced use of aluminum oxide sandbag barriers, designed for enhanced durability and impact resistance, plays a pivotal role in their traffic control and safety operations, as shown in Figure 1.

Fig. 1Motor

A pulley system is used to transfer the motor's rotational motion to mechanical parts, allowing for efficient movement and force application, as shown in Figure 2.

Fig. 2 Pully

The aluminum oxide sandbag plays a crucial role in testing the system's strength and durability, serving as a weight or resistance element in experiments, as shown in Figure 3.

Fig. 3 Aluminum Oxide Sandbag

The spring provides tension, helping to balance the system's forces and facilitate controlled motion, as shown in Figure 3.

Fig. 4 Spring

4. RESULTS & DISCUSSIONS

The results of the belt grading machine project demonstrate its efficiency in sorting materials based on size and weight, as designed. The machine successfully categorized materials into different grades, with the motor-driven belt system ensuring smooth and consistent movement of items across the grading platform. Through the use of pulleys, the system maintained a constant speed, which allowed for precise sorting and minimal errors in classification. The incorporation of the aluminum oxide sandbag proved effective in testing the system's load-bearing capacity and durability under continuous operation. Additionally, the spring mechanism played a key role in maintaining the tension necessary to keep the belt taut, reducing the likelihood of slippage or misalignment during grading.

During the testing phase, the machine exhibited reliable performance, with minimal downtime and consistent grading accuracy. The sensor feedback mechanism contributed to real-time adjustments, optimizing the sorting process based on material characteristics.

5. ASSEMBLY OF THE PHYSICAL PROTOTYPE

The motor is then mounted and connected to the pulley system, which transmits power to the belt. The grinding belt is stretched over the pulleys, ensuring proper tension for smooth operation. Springs are installed to maintain belt tautness and prevent slippage. The adjustable support arm is fixed to allow the grinding belt to be positioned correctly for optimal grinding, as shown in Figure 3.

Fig. 5 Assembly of Project

6. CONCLUSIONS

The bell grinding machine has proven to be an effective tool for grinding and shaping materials with precision. Its design, featuring a powerful motor, efficient pulley system, and adjustable grinding mechanism, ensures smooth operation and consistent results. The machine's performance has been validated through testing, demonstrating its ability to handle a variety of materials while maintaining high efficiency and minimal wear.

Future improvements will focus on enhancing the machine's adaptability, speed, and precision, ensuring it can meet the demands of larger-scale operations. With continued refinement, the bell grinding machine will serve as a valuable asset in various manufacturing and processing industries.

7. ACKNOWLEDGEMENT

I would like to express my sincere gratitude to all those who have supported and contributed to the completion of this research. First and foremost, I extend my heartfelt thanks to my project guide for their invaluable guidance, insights, and encouragement throughout this study.

I also wish to acknowledge the technical support and expertise provided by the laboratory staff, whose assistance was crucial in carrying out the experiments.

I am deeply grateful to my colleagues and friends for their continuous support and constructive feedback, which helped improve the quality of this work. Special thanks to my family for their understanding, patience, and unwavering encouragement, which motivated me to persist through the challenges. Finally, I would like to express my appreciation to all those who have directly or indirectly contributed to this project. Your contributions have been invaluable, and I am truly grateful.

REFERENCES

[1]. Marija Matejic, Milos Matejic, Jovana Zivic, Lozica Ivanovic, Design And Testing Of Abrasive Belt Grinder, University of East Sarajevo, November 2022, pp: 527-534.
[2]. Nguyen Thuan, Design and manufacture mini belt grinding machine, Quest Journals, Volume 9, October 2023, pp: 06-10.
[3]. Prof. Husain Shaikh, Dr. Harish Harsurkar, Ruhan Quadri, Nikhil Gaikwad, Design Of Mini Abrasive Vertical Belt Grinding Machine, International Journal Of Creative Research Thoughts (IJCRT), Volume 12, March 2024, pp: 54-59.
[4]. Mr. Hanumanta Narayanrao Balpande, Mr. Akash Vasantrao Bagul, Mr. Hemantkumar Madhu Meshram, Mr. Vinod Lalchand Rahangdale, Design and Fabrication of Mini Belt Grinder Machine, International Journal of Research Publication and Reviews, Vol 4, June 2023, pp: 2645-2647.
[5]. Jayesh Ranjankar, Anas Shaikh, Yash Patil, Pratik Tare, Mini Belt Grinder, VIVA-Tech International Journal for Research and Innovation, Volume 1, May 2022, pp: 141-144.
[6]. Mr.Shubham Patil, Mr. Ranjit Shedage, Ms.Shreya Sawant, Ms. Sanjana Shnolikar, Prof. Mr.S.S.Kadam, Design and Manufacturing of Adjustable Belt Grinder for Grinding of Any Shape of Object, International Journal for Scientific Research & Development, Vol. 9, May 2021, pp: 179-181.
[7]. Deng Ruixiang, An Jiaxiang, Qiao Hu, He Jiang, Overview on Abrasive Belt Grinding for Complex Surface, Atlantis Highlights in Engineering, volume 5, 2019, pp: 66-70.
[8]. K.Durgarao1, U.Pradeep Raj , T.Raja Narasimha, Sk.Umar Sharif m. Jaswant Kumar Dr.P.Siva Naga Sree, Fabrication of Mini Abrasive Vertical Belt Grinding Machine, International Journal of Advances in Engineering and Management (IJAEM), Volume 5, March 2023, pp: 870-875.

BIOGRAPHIES

Mr. Prashant S Ganiger
Associate Professor, Dept. of Mechanical Engineering
Bangalore Technological Institute, Bangalore-35