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Design and Fabrication of Abrasive Belt Oblique Grinding Machine

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ABSTRACT: Machining processing industries have continuously developed and improved technologies and processes to transform finished product to obtain better super finished product quality and thus increase products. Abrasive machining is one of the most important of these Processes and therefore merits special attention and study. Belt grinding is an abrasive machining process used on metals and other materials. It is typically used as a finishing process in industry. The main objective of this project is to design and fabricate an abrasive belt grinding which can be used as versatile grinding machine, the work area can be rotated from 0 degree to 180 degree. The 0 degree work area can be used for bottom grinding of component, the 90 degree work area can be used for vertical grinding of component and The 180 degree work area can be used for top grinding of component.

KEYWORDS: Advanced machining, Grinding process, Belt grinding, Abrasive Marching, Finished product

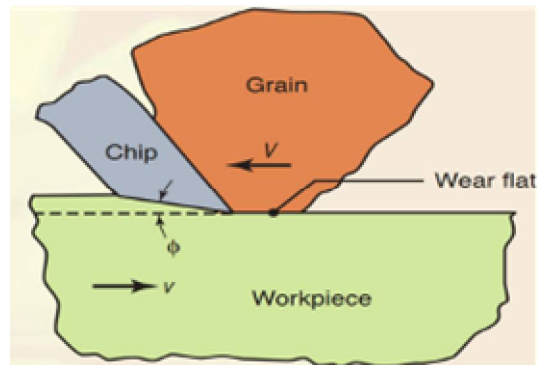
1. INTRODUCTION

With the increasing requirements of modern industrial technology and high-performance technological products in respect of part precision, surface integrity, machining efficiency and batch quality stability, grinding has played a more and more important role. It becomes an important part of advanced machining technology and equipment, and is a research frontier in manufacturing science. Grinding is the process of removing metal by the application of abrasives which are bonded to form a rotating wheel or belt. When the moving abrasive particles contact the workpiece, they act as tiny cutting tools, each particle cutting a tiny chip from the workpiece. It is a common error to believe that grinding abrasive wheels remove material by a rubbing action; actually, the process is as much a cutting action as drilling, milling, and lathe turning. Grinding is used to finish work pieces that must show high surface quality (e.g., low surface roughness) and high accuracy of shape and dimension. As the accuracy in dimensions in grinding is on the order of 0.005mm, in most applications it tends to be a finishing operation and removes comparatively little metal, about 0.25 to 0.50 mm depth. However, there are some roughing applications in which grinding removes high volumes of metal quite rapidly. Thus, grinding is a diverse field. Therefore we have designed grinding machine in miniature and portable form which can give very precise machining and grind up to 0.01-0.005 mm depth with high accuracy.

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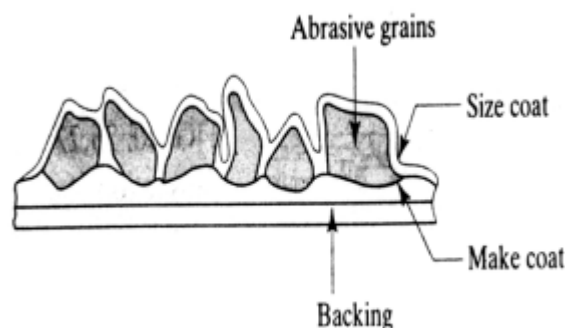
1.1 Belt Grinding Machine

Belt grinding is an abrasive machining process used on metals and other materials. It is typically used as a finishing process in industry. A belt, coated in abrasive material, is run over the surface to be processed in order to remove material or produce the desired finish. The belt grinding process is variable by adjusting certain parameters such as belt speed, grinding pressure, feed speed, durometer of the contact drum, size of the contact drum and the abrasive belt that is used. The machines can be made for wet or dry operation. Furthermore, a wide belt grinding machine can be constructed with single or multiple heads. The first head is used for coarse grinding and the next heads gradually make a finer finish. Wide belt grinding is also used as a high stock removal method for special metals (e.g. stainless steel, titanium, and nickel alloys).

Belt grinding belongs to elastic grinding and has the multi-functions of grinding, milling and polishing, etc. It is characterized by good workpiece-shape adaptability, low vibration of grinding system, low roughness of machining surface, maintenance of residual compressive stresses, low grinding temperature and resistance to workpiece burning; it also has the feature of cool grinding. The V-shaped section can be finished only by the belt grinding method.

1.2 Abrasive process

An **abrasive** is a material, often a mineral, that is used to shape or finish a workpiece through rubbing which leads to part of the workpiece being worn away. Abrasive Process is a designation for the material removing process with hard mineral (abrasive) grains being used as the cutting tool. The grinding technique, which adopts abrasive wheel or belt to remove materials, is the most widely applied.



Abrasive belt grinding is a common finishing process in the metal and wood working industries. Coated abrasive belts are used in the same speed range as bonded wheels, but they are not generally dressed when the abrasive becomes dull. The wide spread application of coated abrasive belts and long standing operating practices have led to different kinds of quality requirements. The abrasive belt machining technique is more significant for precision machining and finishing.

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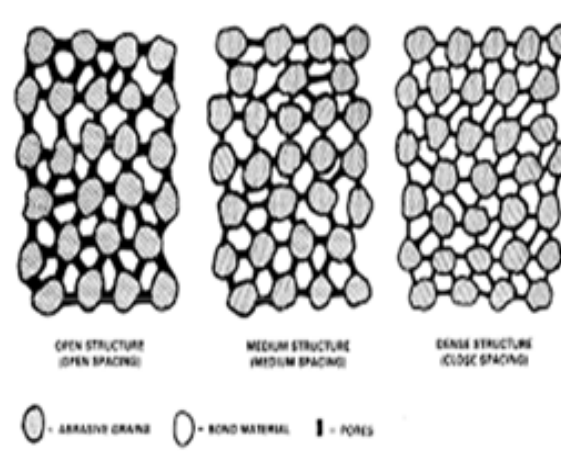
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They have reported that the performance difference between sol gel alumina grain and fused grains, it was observed, similar trend on material removal and belt wear for different work materials.

Abrasives (grits) with large negative rake angle surrounded cutting edges do not form chips but will plow or rub. Proportion of cutting, plowing and rubbing will change continuously as the abrasives wear. Coated abrasives are also used on belts. Coated abrasives are also used as belts for high rate material removal. Belt speeds ~700-1800 m/min. Abrasives (Al_2O_3 , ZrO_2 , SiC) deposited on flexible backing material (paper, cotton, rayon polyester). Matrix made of resins.

1.3 Grit, Grate & Structure

Grit size ranging from 2 mm (the large grain) (about F 10 using FEPA standards) to about 40 micrometers (about F 240 or P 360). These minerals are either crushed or are already of a sufficiently small size (anywhere from macroscopic grains as large as about 2 mm to microscopic grains about 0.001 mm in diameter) to permit their use as an abrasive. These grains, commonly called grit, have rough edges, often terminating in points which will decrease the surface area in contact and increase the localized contact pressure. The abrasive and the material to be worked are brought into contact while in relative motion to each other. Force applied through the grains causes fragments of the worked material to break away while simultaneously smoothing the abrasive grain and/or causing the grain to work loose from the rest of the abrasive.



II. NEED AND SCOPE

The literature survey on belt grinding shows certain limited Understanding of material removal, wear and grinding process. Compared to the grinding with wheels, involving non rigid wheel with belt grinding is another way to enhance the flexibility. The aim is through systematic approach to optimize parametric setting to achieve the desired output and precision in Coated abrasive belt grinding. There are several objectives possible for grinding with coated abrasives. Among them is the right application (e.g. finish or stock removal), time saving and efficiency of the abrasive tool. To achieve the above objectives, it is essential to look in more detail to the variables which affect them. These include the work material properties, the grit and abrasive type of the grinding belt, belt speed, belt sequences, contact wheel hardness and diameter, serration, type of lubricant (or dry) and grinding pressure. Changing these variables will affect the performances of the belt grinding process. The most important chaos in manufacturing field are higher life, lower wear and perfect finishing. It finish the product very faster and to perform the work simply.

The main objective of this project is to:

- Improve the grinding characteristics of coated abrasive belt grinding process and develop a methodology to maximize the output and usage of belt grinding.
- Ignite the growth in the belt type machining process and alternate from usual process.

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- o Develop statistical model considering individual and interactive parametric influence on performance indicator.

III. OBLIQUE GRINDING MACHINE OVERVIEW

3.1 Objective

The Objective of this project is to design and fabricate an abrasive belt grinding which can be used as versatile grinding machine by changing its work area from 0 to 180 degree with four rollers and length of the belt could be adjustable for making belt at proper tension.

3.2 Problem Definition

The abrasive belt grinding which is used currently have the working area as fixed one. The work can be rotated here the work area cannot be changed. so it can be used only for components which can be carried by hand and the fixed components where we have grind down or upside cannot be done with the current machines. In normal hand grinding the burr removal and finishing process cannot done at same level in a large surface.

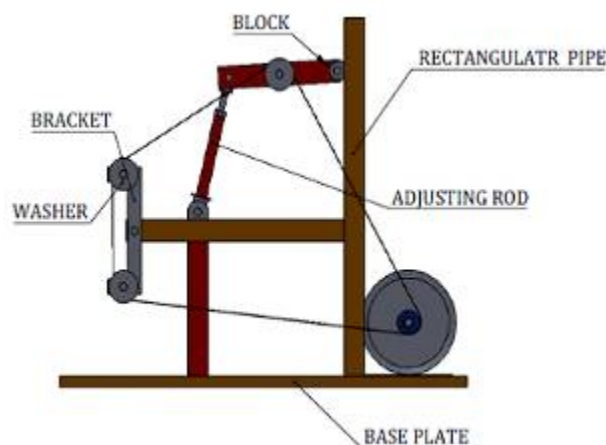
3.3 Solution Methodology

In this project we are going to design and fabricate a abrasive belt grinding which can be used as versatile grinding machine, the work area can be rotated from 0 degree to 180 degree. The 0 degree work area can be used for bottom grinding of component, the 90 degree work area can be used for vertical grinding of component and The 180 degree work area can be used for top grinding of component.

IV. CONCEPT DESIGN

4.1 Experimental setup

The first most step of the setup is to manufacture the various parts of the machine and the then the abrasives are to be selected which is used in belt. Based on the material and its property that is to be machined the grit size of the belt varies. The base frame is made up of steel channels and the rollers are fitted in proper location for proper tension of the grinding belt and to change the location of the work area. The motor is connected to the pulley and the power is transmitted from pulley to rollers and the belt assembled over the rollers carryout the desired surface finishing of the component.



4.2 Changing variables

There are several objectives possible for grinding with coated abrasives. Among them is the right application (e.g. finish or stock removal), time saving and efficiency of the abrasive tool. To achieve the above objectives, it is essential

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to look in more detail to the variables which affect them. These include the work material properties, the grit and abrasive type of the grinding belt, belt speed, belt sequences, contact wheel hardness and diameter, serration, type of lubricant (or dry) and grinding pressure. Changing these variables will affect the performances of the belt grinding process. The selection of the rollers and abrasive to match the grinding parameters required for a specific operation is very critical. Stock removal generally requires a harder, serrated rubber contact wheel, and coarse grade ceramic abrasives. Finishing generally requires the use of a smooth faced contact wheel and fine grade abrasives.

V. OPERATION METHODOLOGY

Thus, this Belt type grinding machine is generally used for polishing the small metallic components and worn the surface of woody components. In this machine abrasive belt fitted on the rollers. The coupling is used for transmission of power from electric motor to the roller shaft. As the first shaft from the motor is rotated then all the rollers rotated with same speed because of abrasive belt wound over the surface.

When we keep the any small part on abrasive belt and apply the pressure over the surface of the belt, then the small component polished. Because of this machine, good quality of glassing also obtained for good looking component. The abrasive belt is available in various sizes in the market. Belt grinding machine may be dry belt wet belt or combination belt. Belt grinding machine is used for heavy stock removal or for light polishing work depending upon the type of belt grade used. This Oblique grinding machine is used for the grinding of any oblique surfaces. The grinding can be done for the stationary object. The angle grinding is done based on the position of the two adjustable rollers in the machine. The flexibility of the belts are adjusted using the screw. Thus, the finishing will be smooth and any angled parts are finished.

VI. CONCLUSION

Still we are working over the project, As per the problem identified during survey in company, case study of problem, and also with help of research papers, international journals; we conclude that Abrasive Belt Oblique Grinding is effective than wheel grinding. Abrasive belt oblique grinding and polishing combines many operations for efficient surface finishing. And it can fulfill the accuracy for super finishing of key which required for company as per their design. Also we can use the surface belt oblique grinder and we can obtain the different super finishing quality with the help of using different grade abrasive belt. This Grinding machine has the versatile operations and achieve the operations of all other Belt grinding methods.

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