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Fabrication of Mini Abrasive Vertical Belt Grinding Machine

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ABSTRACT: 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.

KEYWORDS: Abrasive belt, wheel grinding, aluminium oxide, Pulley.

I. INTRODUCTION :

Belt grinding is a rough machining procedure utilized on wood and different materials. It is commonly utilized as a completing procedure in industry. A belt, covered in rough material, is kept running over the surface to be handled so as to evacuate material or create the ideal finish. This Belt Grinder project is made from wood. This Mini grinder Project consists of 775 motor which is fundamentally rotates the pulley attached to it, along with a mini grinder, grinding paper and an abrasive belt grinder. The second pulley is attached to the wooden base vertically with the tensioner spring. Grinding paper is then fitted in pulley. To support the mini grinder a base frame is provided, it helps in grinding wooden material. Components used for making this belt grinder are DC motor, spring, base Frame (support frame), abrasive grinder belt, coupling and a pulleys.Belt grinder helps to shape the material without putting much effort and produced accurate resultss.Shown fig -1.

FIG -1 Abrasivevertical belt grinding machine.

II. LITERATURE REVIEW:

MR. Shubham patil et. al.,[1]: Work abrasive belt is used to grind any shape of object like circular, rectangular and polygon. In this project we use aluminum oxide belt which grind any material like wood, stainless steel, cast iron, glass etc. As per material specification we can also vary speed with the help of variable frequency drive. Work abrasive belt is used to grind any shape of object like circular, rectangular and polygon. In this project we use aluminum oxide belt which grind any material like wood, stainless steel, cast iron, glass etc. As per material specification we can also vary speed with the help of variable frequency drive. Avinash parkhe et. al.,[2]: Abrasive belt grinding can reduce the surface roughness of work pieces and accuracy mean while 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. An jiaxiang et. al.,[3]: 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, when 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. MR .Vigneashwara Pandiyan et. al.,[4]: Material removal in belt grinding is a dynamic process involving multiple parameters such as cutting speed, force, polymer wheel hardness, feed, and grit size. This article explores the effects of these parameters on the abrasive belt grinding process to model material removal. Six different 11 regression modelling methodologies have been applied to the experimental data determined using the Taguchi design of experiments MR. Hua chai et. al.,[5]: Aviation engine is the "heart" of plane, while the blade is the most important component of aero engine. Blade material requires sufficient mechanical properties, high chemical stability and good manufacturability. The abrasive belt grinding is acknowledged as the best way of finishing blade surface. Xiangyang Ren-Bernd Kuhlenkotter et. al.,[6]: This study discusses the application of piezo electric material in microfluid drive technology. It is fast responding and high speed precision. Here piezoelectric materials are applied in the microfluidic drive technology due to their excellent dielectric, piezoelectric and optical properties, where the piezoelectric ceramic is chosen in theoretical and experimental research. The piezoelectric ceramic has the advantages of high piezoelectricity and dielectric constant, and can be processed into any shape. The microfluidic drive device with the piezoelectric material and its working principle are introduced. The researching results show that at the voltage of 150V, the elongation length of the piezoelectric ceramic is 18.556μm, the maximum displacement of the driven fluid is 4.761mm, and the driven volume of fluid is 0.714μl. The work here can promote the application of piezoelectric materials in microfluidic technology. M. Chandrasekar et. al.,[7]: Abrasive belt grinding machine has been mainly developed for grinding the specimen to get a good surface finish. This machine is using the motor source of ac current operated device. Grinding is the process of removing metal by the application of abrasives which are bonded to form a rotating wheel. MR.Arwizet-karudin et. al.,[8]: Belt burrs have their own advantages in several types of work, but still, belt grinders are rarely used. The existing belt grinding functions are considered too minimal and makes people choose to use other grinders. Using a belt grinder will certainly provide benefits to the user because the belt grinding efficiency is good in certain operations. 12 Vigneashwara Pandiyan et. al.,[9]: The removal of material from a surface due to the belt grinding process has a non-linear relationship with the process variables. Process variables include the grit and abrasive type of grinding belt, belt speed, contact wheel, grinding force, and grinding force. This paper describes a systematic approach to optimize process parameters to achieve the desired stock removal in a compliant Abrasive Belt Grinding process. T. Tjahjowidodo et.al.,[10]: Tool life is a significant criterion in coated abrasive machining since deterioration of abrasive grains increases the surface irregularity and adversely affects the finishing quality. With this tool condition monitoring predicting system, the effectiveness of the belt and the surface integrity of the material is secure. Various time and frequency domain features are extracted from sensor signals obtained from the accelerometer, acoustic sensor and force sensor mounted on the belt grinding setup. Tingting Wang et. al.,[11]: Study presents a numerical simulation method to precisely predict the machined surface topography of aeroengine blade while using abrasive belt grinding technique. Considering the effect of curvature change of blade on the elastic contact state, a complex This simulation model of the contact deformation at grinding interface was established, and the numerical prediction model of nonlinear time-varying contact deformation in whole grinding process was obtained. Furthermore, this contact deformation law was superimposed on motion trajectory equation of abrasive particles to accurately obtain the space location of the grinding points. Guijian Xiao et. al.,[12]: The high performance of aero-engines requires light-weight aero-engine blades, so hollow structures have been widely used in aero-engine blades. At present, the measurement of aero-engine blades is mainly carried out with coordinate measuring machines (CMM). This method can measure most of the aeroengine blades through direct contact. However, the complex surface, the chord width, and the large torsion of the profile of a hollow blade lead to measurement difficulties. 13 Kangkang Song1 et. al.,[13]: As an important material, titanium alloy is widely used in the manufacture of aircraft engine parts, and its processed surface quality is critical to the performance of aircraft engines. Abrasive belt grinding (ABG) is a kind of elastic grinding, which plays a significant role in improving titanium alloys' surface integrity. To validate the mathematical model's effectiveness from the grinding parameters to the surface residual stress after grinding, firstly, according to the molecular dynamics theory and ABG process, a physical model of titanium alloy ABG molecular system is proposed, and the embedded atom method is chosen as the interatomic potential of titanium alloy. Dahu Zhub, C. Han Dinga et. al.,[14]: Robotic abrasive belt grinding has emerged as a finishing process in recent years for machining components with high surface finish owing to its advantages of excellent flexibility and high efficiency. The profile accuracy of components, however, is difficult to be guaranteed due to the contact wheel deformation in conformity with the surface of workpiece. To overcome this problem, an improved cutting force model is developed to analyze and assess the force-controlled robotic abrasive belt grinding mechanisms based on the experimental observation of the over- and under-cutting phenomenon on the cut-in and cut-off paths. Specifically, a material removal rate model considering the effects of cut-in and cutoff paths is firstly built to demonstrate the real robotic belt grinding process. Tie Zhang and Jiewen Su et. al.,[15]: Collision may occur during the grinding of a workpiece by a robot sand belt. To solve this problem, a collision-free planning algorithm for the robot motion path is developed based on the collision layer method. Collision-free planning of the robot motion path is studied, and a means to adjust the machining frame on the belt is determined (i.e. moving along the axis of the belt and rotating around the tangent line). The planning curve is rapidly found on the collision layer using neighborhood search and recursive methods, and the amount of collision detection is significantly reduced. The planning curve is transformed into the robot motion path. Simulation and experimentation show that the amount of collision detection required by the proposed algorithm is 3.86% less than that required by a method using a complete collision layer. Moreover, the robot grinds the workpiece without collision. The proposed method is simple, stable, and easy to implement and 14 possesses a good engineering application value. Vigneashwara Pandiyan et. al.,[16]: Industrial interest in tool condition monitoring for compliant coated abrasives has significantly augmented in recent years as unlike other abrasive machining processes the grains are not regenerated. Tool life is a significant criterion in coated abrasive machining since deterioration of abrasive grains increases the surface irregularity and adversely affects the finishing quality. Predicting tool life in real time for coated abrasives not only helps to optimize the of the tool's life cycle but also secures the surface quality of finished components. Wei Wang et. al.,[17]: Robotic belt grinding systems can be used not only to replace low efficiency, high pollution manual finishing operations but also to improve production rate and manufacturing flexibility, especially for grinding small batches of workpieces with complicated features. The contact wheel is made from soft material with significant elasticity and is tensioned by a grinding belt. Soft contact between the workpiece and contact wheel provides the benefits of high surface quality but reduces the dimensional accuracy of the finished workpiece. This paper analyzes the contact wheel's deformation caused by belt tension in order to accurately predict the depth of cut. The elastic mechanics based on the power series method is employed to establish and solve the tension model, and the deformation of the contact wheel is obtained. The validity of the analytical model is verified by a finite element software. Then, two modified models of grinding stress distribution are developed, and the distribution of depth of grinding is predicted. Tests are running and showing that the prediction error is less than 3.1% on a given grinding path. An accurate, fast method is thus developed to predict the depth of cut for belt grinding. Lai Zou1 et. al.,[18]: Abrasive belt grinding is considered a flexible and precision machining method. The complicated contact status prevents the traditional simulation model from accurately predicting the machined surface topography, so this paper develops a new numerical simulation approach to solve this issue. The abrasive belt surface topography was detected using a 3D appearance optical scanning apparatus 15 and was processed by surface fitting and noise filtering. Based on the Johnson transformation system and filter impulse function, the surface topography generation of non-Gauss abrasive belt was realized. The simulation result showed that it was well consistent with the measured topography. Subsequently, a vibration model was superimposed on the original moving track of abrasive grain in consideration of flexible grinding characteristic to

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establish the grain kinematic model of abrasive belt. Y. J.Wang et. al.,[19]: Belt grinding technology is used for machining the complex surface of a blade; however, it is difficult to ensure processing accuracy. To solve this problem, a surface removal contour (SRC) model for grinding the complex paper discusses why the normal contact pressure between the grinding wheel and workpiece surface accords with the Hertz contact theory, and further, the calculation method for the pressure distribution of the Hertz contact is given. Second, the SRC model is determined from the material removal rate (MRR) nonlinear model. To determine the parameters of the MRR nonlinear and linear models, an abrasive belt grinding experiment was performed, which showed the relative error for the MRR nonlinear model and for the linear model. Third, combined with the Hertz contact theory, a SRC model based on the MRR nonlinear model was built. A. Jourani et. al.,[20]: Belt grinding is a finishing manufacturing process, which usually follows a hard turning operation. Experimental investigations show that the belt grinding process improves the surface texture and leads to compressive residual stresses. To study the contact between the belt constituted by abrasive grains and the surface, in particular to understand the physical of abrasion, a three-dimensional numerical model is established and presented in this paper. This method provided important and essential information to understand the way the abrasive grains remove the material in the belt and workpiece interface. Important data induced: the normal load distribution, the local coefficient of friction, which depends on the attack angle and then the tangential load on each abrasive grain could be computed. The pressure distribution, the surface deformation and the distribution of real contact area could be also determined by this model. 2005 Elsevier B.V. All rights reserved

III. METHODOLOGY:

This chapter says about the methodology of abrasive vertical belt grinding machine.The Belt type grinding machine is generally used for polishing the small metallic components and worm 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 as show in fig 3.1. 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 the machine, good quality of glassing also obtained for good looking component. The abrasive belt is available in various size in the market. Belt grinding machine may be dry wet belt or combination belt. Belt grinding machine is used for heavy stoke 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 surface. 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 Shown in figure -2. The flexibility of the belts are adjusted using the screw. Thus, the finishing will be smooth and any angled parts are finished.

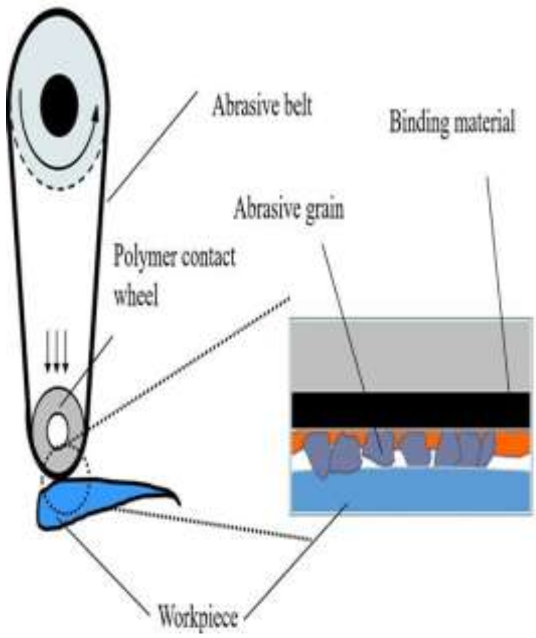

FIG -2. Belt grinding process.

IV. WORKING PRINCIPLE :

Working Principle: The abrasive belt is used to grind the material. This abrasive belt is rotated by the single phase induction motor, In our project consists of end bearing with bearing cap, roller, shaft, single phase induction motor and abrasive belt. This whole arrangement is fixed on the frame structure where the components rests. The roller wheels are mounted on the two end bearing with bearing cap by suitable arrangement. There are two wheel is used in our project to rotate the abrasive belt. One side of the roller wheels shaft, one v-pully arrangement is used to rotate the abrasive belt through the belt drive mechanism. Belt grinding is an abrasive machining process used on metals on metals and other materials as shown in figure- 3. It is typically used as a finishing process in industries. A belt coated in

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abrasive material, is run over the surface to be processed in order to remove material or produces the desired finish.

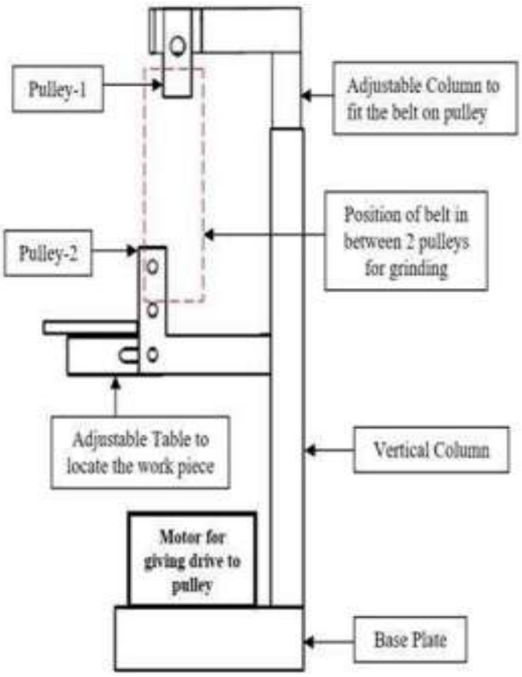

FIG – 3. Front view of belt grinding machine.

V. FABRICATION :

This chapter discuss about fabrication and working principle of abrasive vertical belt grinding machine. Components required • Abrasive Belt • DC Motor • Couplings • Joints • Mounts • Rods • Base Frame • Screws & Bolts.The abrasive belt is used to grind the material. This abrasive belt is rotated by the single phase induction motor. In our project consist of end bearings with bearing cap, roller wheel, shaft, single phase induction motor and abrasive belt. This whole arrangement is fixed on the frame structure where the component rests as show in fig 4.1. The roller wheel is mounted on the two end bearings with bearing cap by suitable arrangement. There are two roller wheel is used in our project to rotate the abrasive belt. One side of the roller wheel shaft, one v-pulley is coupled by suitable arrangement. Fig-4. Front view of belt grinding machine. The single phase induction motor with V-pulley arrangement is used to rotate the abrasive belt through the belt drive mechanism.

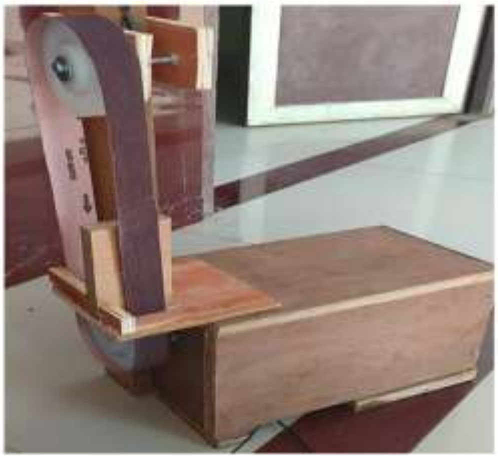

FIG – 4. Mini abrasive belt grinding machine

APPLICATIONS OF ABRASIVE BELT GRINDING:

- Grinding outside the job in any size of body can be done.
- Finishing surface roughness, removal of micron burrs, cosmetic finishes polishing.
- Deburring radius,burr removal,edge breaking.
- high stock removal, cleaning eliminating mill or tool marks dimensioning.

ADVANTAGES OF ABRASIVE BELT GRINDING:

• The machine is compact and rigid in size.
• Maintenance is less.
• It can be used on any place of small grinding application.
• By varying the pully diameter the speed of the abrasive belt to be changed.

VI. RESULT:

The mini abrasive vertical belt grinding machine has been developed for grinding thespecimen to get a good surface finishing. This grinding operation may be used for removing layerup to (0.5) mm. It has maximum area of contact during removal process so that less contact pressure is developed at the surface of work piece. This vertical grinding machine has a special capacity of changing the speed of grinding wheel from 150rpm-500rpm compared to conventionalgrinding machine. This feature enable to get better surface finish of by changing the speed depended upon the type of material. The mini abrasive vertical belt grinding machine is preparedand operated successfully.

VII. CONCLUSION :

Grinding machine fabricated in this can be utilized a small scale industries and automobile maintenance shops. It develops less temperature due to use of softer grade resin wheels and increase the life of grinding wheel.This grinding machine gives greater metal removal rate and good surface finish Compared to conventional grinding machine is done.

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