

Design and manufacture mini belt grinding machine

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ABSTRACT: 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.

KEYWORDS: Grinding machine; Belt grinding machine; Cutting Process; Kinematic.

Received 20 Sep., 2023; Revised 30 Sep., 2023; Accepted 04 Oct., 2023 © The author(s) 2023.

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I. INTRODUCTION

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 [1].

Belt grinding is a versatile process suitable for all kinds of different applications. There are three different applications of the belt grinding technology.

- Finishing: surface roughness, removal of micro burrs, cosmetic finishes, polishing.
- Deburring: radiusing, burr removal, edge breaking.
- Stock removal: high stock removal, cleaning (e.g. of corrosion), eliminating mill or tool marks, dimensioning.

Wide belt grinding is a familiar process in industry as well as home applications. There are several basic methods for belt grinding

- Stroke belt
- Platen belt
- Wide belt
- Backstand
- Centreless
- Portable

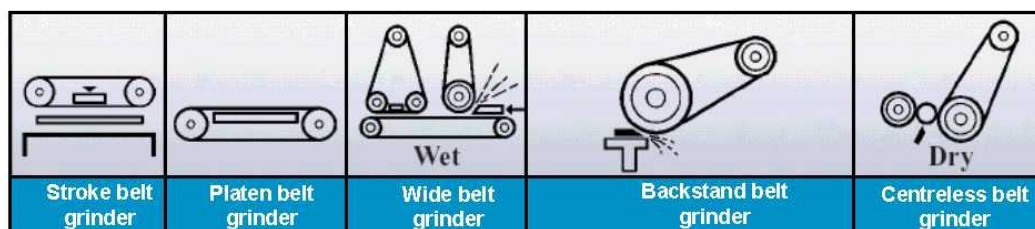


Figure 1: Basic methods for belt grinding

In general there are three basic elements of the belt-grinding machine: work rest support, grinding head and a regulating head. These components differ for all the methods but in general the workpiece is pressed between the grinding head and the rest support. The objective of the regulating head is to coordinate the belt pressure.

There have been many research papers on belt grinding machine, for example a research on design and fabrication of abrasive belt grinding [3]. An article written on design and fabrication of mini belt grinder machine [4]. An article written on design of mini abrasive vertical belt grinding machine [5].

In conducting this study, we researched the aforementioned studies and scoured several websites [1,2] to get an overview of the problem we will be designing. That helps to optimize the design and manufacturing process of our products.

In this paper, we present results of research, design and manufacture mini belt grinding machine used to manufacture workpieces at the construction site with outstanding productivity and quality. At the same time, the machine is automatic, reducing labor, time and processing costs.

II. THEORITICAL BASIS FOR DESIGN

There are several objectives possible for grinding with coated abrasives. Among them are the right application - 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.

In the wide belt method, a contact wheel supports the abrasive belt. The selection of the contact wheel 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.

The different parts of the belt grinding machine [7].

- Base: The base usually provides the base of the machine under the moving machine as it provides support to any vertical and horizontal machine. The base should generally be strong and sturdy. It is usually made of stainless steel and helps everyone else because if the base is strong then the rest will be able to do the other part. The base must be tied tightly at the bottom because if the base is not fastened then other parts of the machine will not work properly. The result is that the machine will not wear out properly and will not perform well
- Worktable: Work bases are usually placed on the work table and they are moved back and forth. The table is very important for any vertical or bench belt machine because the foil is placed in this place, the operators work easily and it is placed properly. The worktable is firmly attached to the base and it can rotate.
- Column: This is usually a vertical column with a wheel guard wheel hand and abrasive wheel. It strengthens the machine and supports the machine so that the machine stays stable.
- Abrasive wheel-grand: Using compartment traversing up or down vertical feed hand wheel is also called Grinders push the belt forward over the head to touch the work piece.
- Pulleys: The abrasive grinding machine has two poles with a belt at the top and lore and an upper pulley. Above them is an abrasive belt. Abrasive particles consist of aluminum oxide silicon carbide and bromium nitrite. This is why they are called abrasive belts. The whole machine has a casing that protects it from any kind of damage.
- Belt supporting plate: This plate usually supports the belt. When the work piece touches the belt, it does not push the belt too far back.
- Motor pulley: The motor that drives the machine also has an open inside which is connected to the belt.

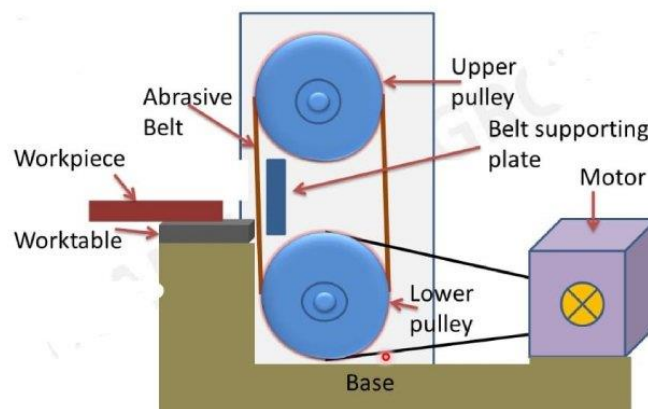


Figure 2: Different parts on belt grinding machine

Normally, movements in belt grinding machine include:

- The circular motion of the motor the main cutting speed.
- The circular motion of the upper pulley
- The circular motion of the lower pulley
- The complex movement of the abrasive belt.
- The movement of the workpiece (performed by workers).

III. DESIGN THE KINEMATIC DIAGRAM OF BELT GRINDING MACHINE

The principle of cutting on belt grinding machine [8].

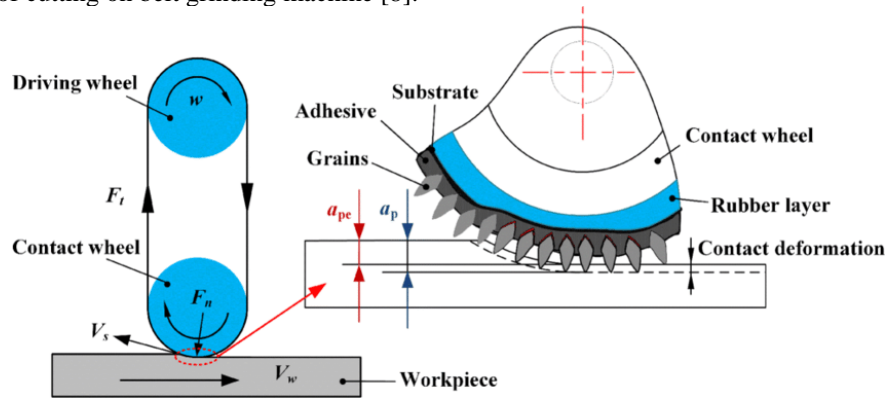


Figure 3: The principle of cutting on belt grinding machine.

An abrasive belt grinding process consists of a coated abrasive belt that is fixed firmly around, at least, two rotating polymer contact wheels. The polymer wheel enables the grinding process to appropriately manufacture free-form surfaces due to its capability to adjust to the grinding surface. The significant benefit of the belt grinding process is that there is no requirement of a coolant system as the grinding belts with the typical length of 2 to 5m can cool down during the return strokes on the process. Similar to traditional grinding processes, many machining parameters, e.g., the grinding belt topography features and belt grinding parameters, have an impact on the grinding result. Although super finishing by belt grinding is a straightforward and inexpensive process, essential aspects of material removal phenomenon are not well grasped. Hence the industry relies heavily on operators' knowledge.

Speed kinematic chain:

$$n_{motor}(\text{round}/\text{min}) \cdot i_{12} \cdot i_v \cdot i_{34} = n_{pulley}(\text{round}/\text{min})$$

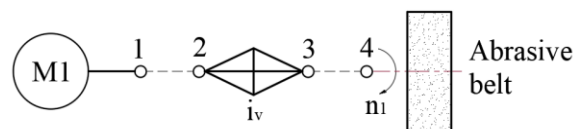


Figure 4: Kinematic diagram of belt grinding machine

In the speed kinematic chain, we choose direct drive from the motor to the cutting tool (abrasive belt). This option helps to reduce power loss and enhance the rigidity of the technology system.

IV. STRUCTURAL DESIGN AND MANUFACTURE OF BELT GRINDING MACHINE

After the kinematic design is completed, the belt grinding machine is structurally designed and manufactured, as shown in Figure 5, Figure 6, Figure 7, Figure 8 and Figure 9.

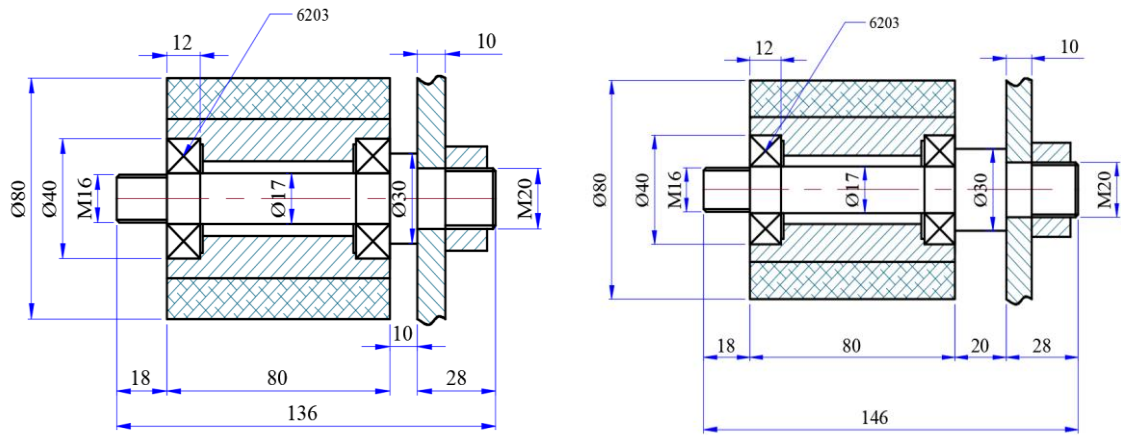


Figure 5: 2D drawing of the pulley of belt grinding machine

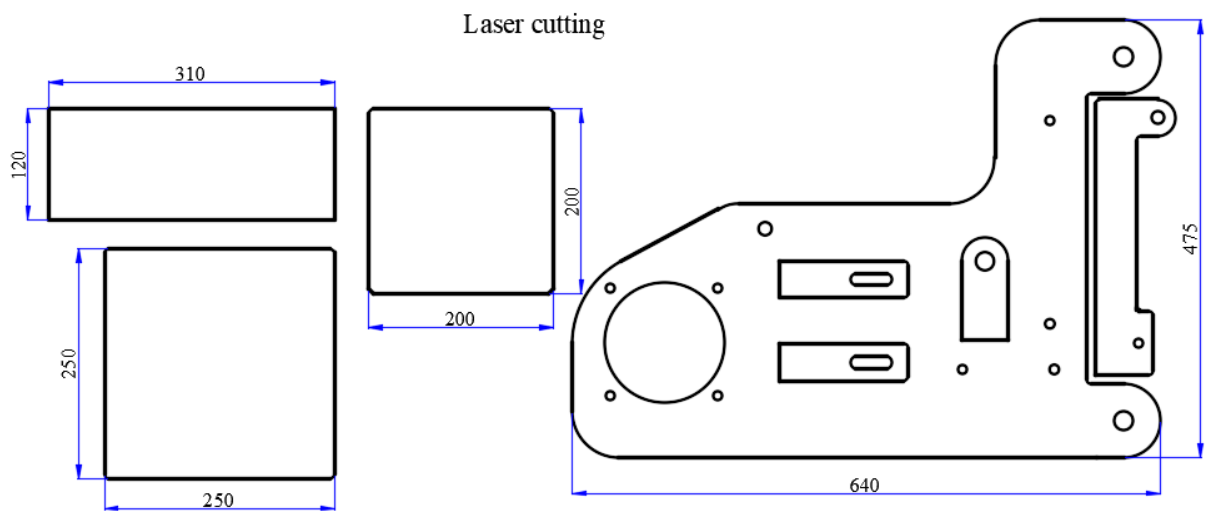


Figure 6: 2D drawing of the base of belt grinding machine

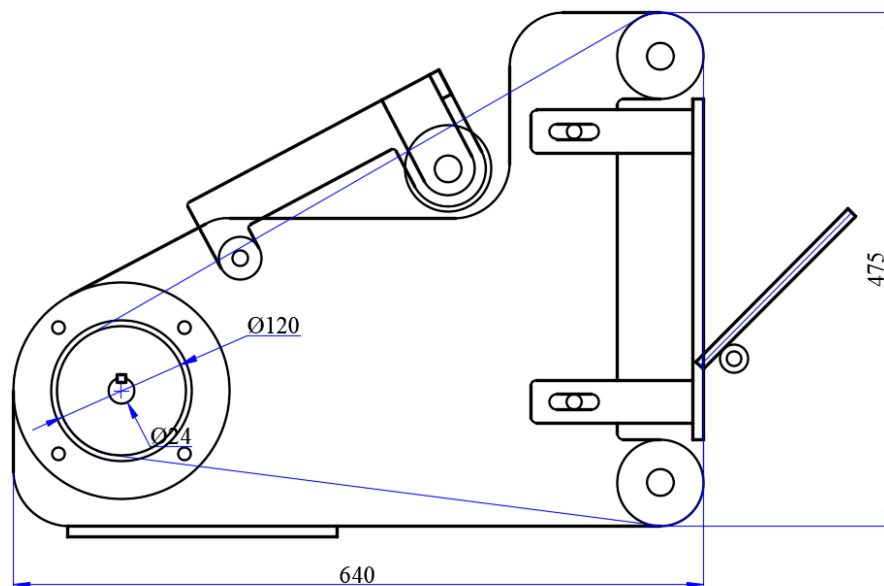


Figure 7: 2D drawing of the whole belt grinding machine

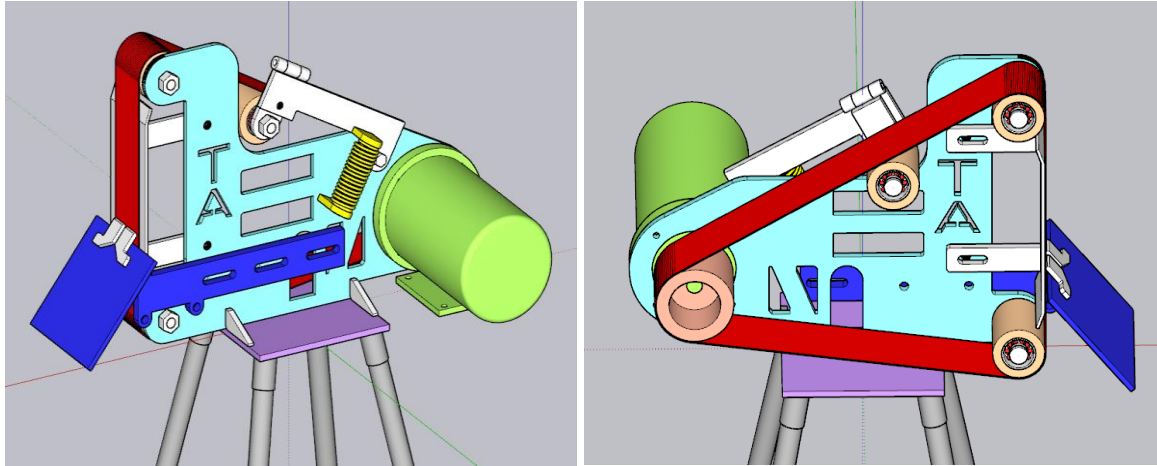


Figure 8: 3D drawing of belt grinding machine

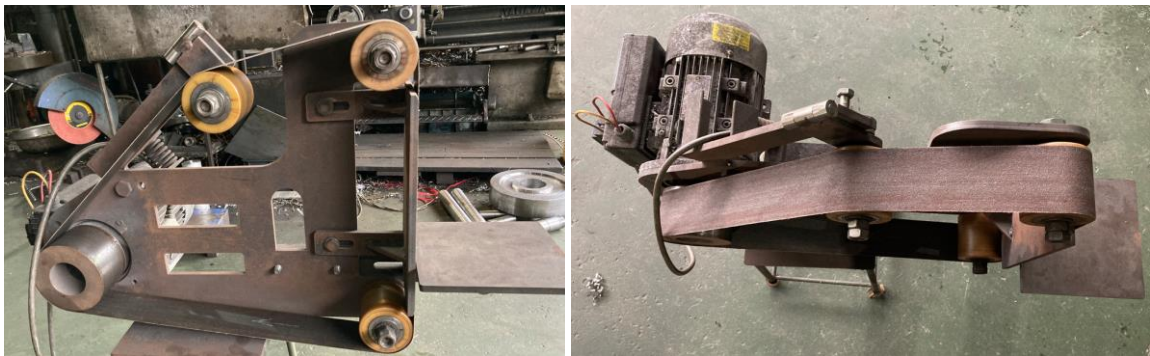


Figure 9: Photos of belt grinding machine

V. CONCLUSION

The belt grinding machine has been researched, designed and manufactured successfully. The machine is designed to manufacture workpieces at the construction site or at the workshop with outstanding productivity and quality. The belt grinding machine is used in many operations, such as polishing, burr removal, edge breaking, high stock removal, eliminating mill or tool marks, finishing surface roughness... This study calculated the complete design of the kinematic structure diagram of the machine. As a result, we successfully manufactured the belt grinding machine and the testing process achieved results consistent with what was calculated and designed. Applied in real production, the machine also meets all requirements.

ACKNOWLEDGMENT

The authors would like to express their thanks to all supports from Thai Nguyen University of Technology-Thai Nguyen University.

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