

Design and Performance Testing of Mini Capstan Lathe Machine

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Abstract: Technology has advanced and continues to improve since the dawn of time, particularly lathes. This technology is critical to the seamless manufacture of items in the industry. Without this technology, the industry's output would be sluggish, and the quality will most likely be poor. Today's advancements in lathe technology will assist in resolving this issue by making it easier for consumers to make high-quality items. A lathe is a machine that turns a workpiece to execute operations such as cutting, drilling, assembling, and rotating. The Capstan and Turret Lathe is one of the most often utilised lathes in the industry. After each tower action is turned, these machines use a hexagonal turret head instead of a tailstock to conduct numerous operations successively without changing tools manually. The project shows how the design was created and how it was implemented. A tiny lathe is driven by an electric motor in this machine. The surface smoothness of the product generated by this machine will be tested to confirm that it is of the same quality as the product produced by the existing lathe machine.

Keywords: Lathe Machine, Manufacturing, Surface Roughnes

1. Introduction

The lathe is one of the world's most versatile and commonly used machine tools. It is widely referred to as the "mother of all machine tools." [1] A lathe's primary duty is to remove metal from a work in order to give it the desired form and dimension. The job is held securely and rigidly in the chuck or between centres on the lathe machine, and then it is turned against a single point cutting tool that removes metal from the job in the form of chips. An engine lathe is the simplest and most basic type of lathe. It takes its name from the first lathes, which were powered by engines. Aside from the basic turning process mentioned above, a lathe can also be used for drilling, reaming, boring, taper turning, knurling, screw-thread cutting, grinding, and other activities. Lathes come in a wide range of sizes and kinds, from small bench lathes for precise work to massive lathes for turning enormous steel shafts. All

sorts of lathes, including speed lathes, centre lathes or engine lathes, bench lathes, tool room lathes, capstan lathes, turret lathes, and automated lathes, operate and function in the same way [2].

1.1 Mini Capstan Lathe Machine.

Capstan Mini Lathe Machine is a portable machine with dimensions of 100 cm*25 cm*60 cm and consists of using iron and aluminum, it is usually used for machining wood or iron work pieces. So here the study of the fabrication of a mini lathe machine. This machine consists of an electric motor (for high torque) which is used to drive the lathe chuck. The runner consists of a plywood bed with a movable arrangement, it also consists of ball bearings that are allowed to free rotation and work support from the other side. It also consists of a handle to hold the desired tool and this handle can slide on the bed parallel to the axis of rotation of the work. We use a chuck mounted on the shaft of the drilling machine to rotate the work. The machine is built to hold the workpiece and move the tool in a sliding mechanism, to achieve the desired operation. The outer face of the machine is designed to hold the workpiece firmly with the tool in place to achieve the desired operation easily. Therefore, we successfully studied the design and fabrication.

1.2 Lathe Machine Operation.

Bending, twisting, cutting, sanding, and bending, twisting, cutting, and sanding are all common lathe operations [3]. Understanding the feed, cutting speed, and cutting depth, as well as how to use tools, is required to operate a lathe [4]. Before using a lathe to complete work, there are a few things to consider. In order to provide high-quality product outputs, those factors must be well handled. With each desired cut, the lathe's speed, depth, and bait are adjusted for accuracy.

A lathe machine is used to execute activities such as turning. The turning operation takes material from the workpiece's perimeter with each motion. Step-turning operation. The step rotation operation is a method of removing material off a workpiece's surface in steps. Taper-turning-operations-operations-operations-operations-operations Taper turning is a form of turning that is used to produce tapered components. The act of turning or facing one's face. A face turning operation is a turning operation that removes material from the workpiece's face to minimise the length of a component. Threads are cut. Thread cutting is the technique of creating threads on the surface of components by rotating them. Drilling is now underway.

2. Materials and Methods

The main materials used are iron, and aluminum. Iron is used as the main material in making this machine. It can be said that 90.00 % of these mini machines use iron as the main material in their manufacture. Aluminum is only used as a moving track mechanism. The first step in the success of this project is to create a design with dimensions first. The method of project preparation procedure is as shown in the diagram below:

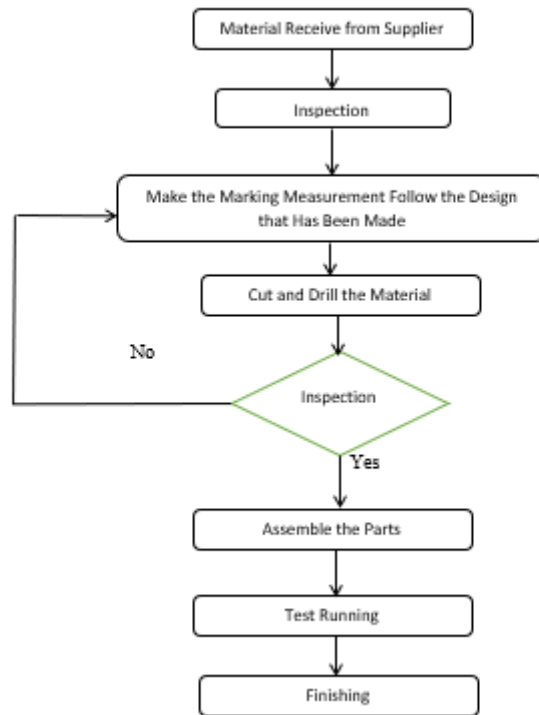


Figure 1: The Process of Fabrication the Mini Lathe Machine

The design and manufacture of the mini lathe machine aims, among other things, to provide a simple means of scraping and cutting off the product of the highest quality at the lowest cost of labour, thereby reducing people's financial burden. This machine's simple design and manufacturing make it viable, dependable, and simple to perform maintenance services at a low cost. Thus, the scopes of the project are:

1. This project focuses on some components or parts found on the capstan lathe machine such as, bed, chuck and spindle.
2. Solid works software is used to paint the design of a mini lathe machine. This is to further facilitate the process of making this project.
3. The dimensions that have been set for this mini lathe machine are 100 cm: W x 25 cm: D x 60 cm: H.
4. This machine works by using an electric motor. This electric motor will be connected to the shaft that holds the chuck jaws using a belting.

3. Results and Discussion

3.1 Solidworks Drawing

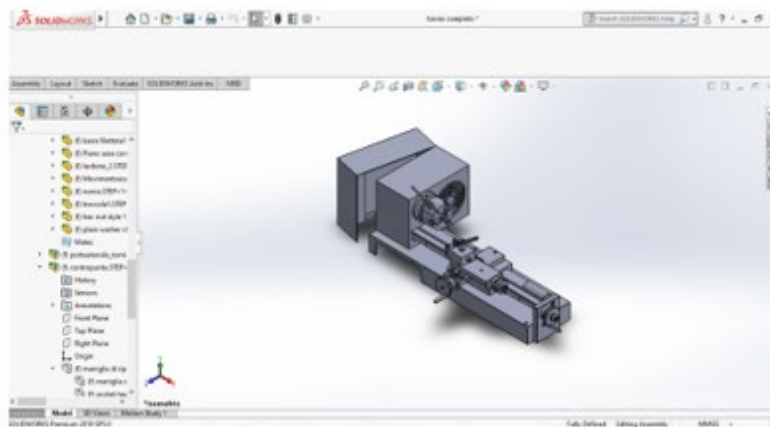


Figure 2: Isometric View of The Design

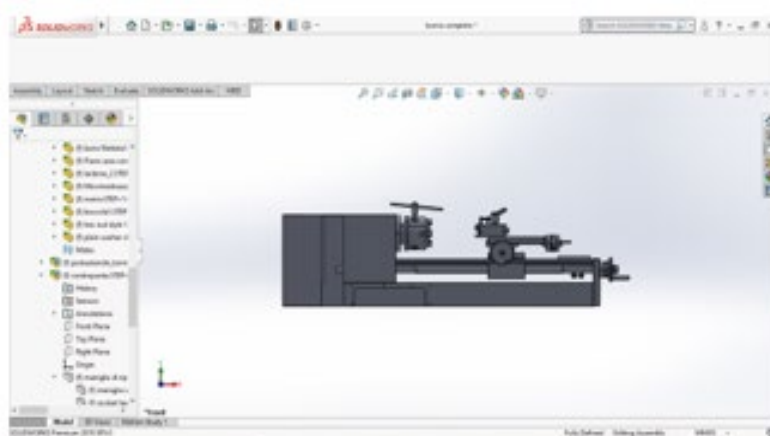


Figure 3: Front View of Design

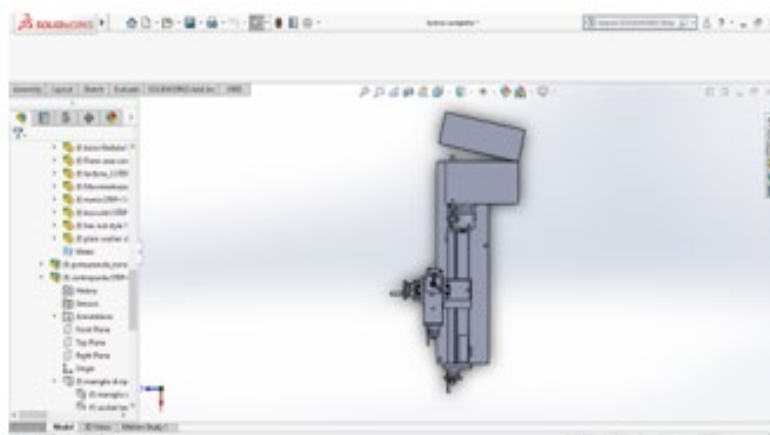


Figure 4: Top View of Design

Figure 2 shows the results of a Mini Capstan Lathe Machine drawing using Solidworks software. There are several components that need to be drawn separately to further facilitate this process. Once

each component has been drawn, the parts will be attached as in the diagram above. The major parts of mini lathe machine are:

- Bed
- Head stock
- Chuck
- Carriage

➤ Bed

The bed of the Mini Capstan Lathe Machine is made up of metal on which all component of the lathe is mounted. It is rigid single piece metal to support other active parts of the machine. On left of the bed head stock is located. Carriage is rest on the bed from left to right and vice versa. On the top of bed, a guideway is provided to slide tail stock

➤ Head Stock

The main function of headstock is to transmit power to the different parts of a lathe. It comprises of the headstock casting to accommodate all the parts within it.

➤ Carriage

Carriage is mounted on the outer guide ways of lathe bed and it can move in a direction parallel to the spindle axis. It comprises of important parts such as apron, cross-slide, saddle, compound rest, and tool post. The lower part of the carriage is termed the apron in which there are gears to constitute apron mechanism for adjusting the direction of the feed using clutch mechanism and the split half nut for automatic feed. The cross-slide is basically mounted on the carriage, which generally travels at right angles to the spindle axis.

➤ Chuck

Chuck is one of the most important devices for holding and rotating a job in a lathe. It is basically attached to the headstock spindle of the lathe. The internal threads in the chuck fit on to the external threads on the spindle nose. Short, cylindrical, hollow objects or those of irregular shapes, which cannot be conveniently mounted between centers, are easily and rigidly held in a chuck. Jobs of short length and large diameter or of irregular shape, which cannot be conveniently mounted between centers, are held quickly and rigidly in a chuck

3.2 Fabricating the Mini Lathe Machine

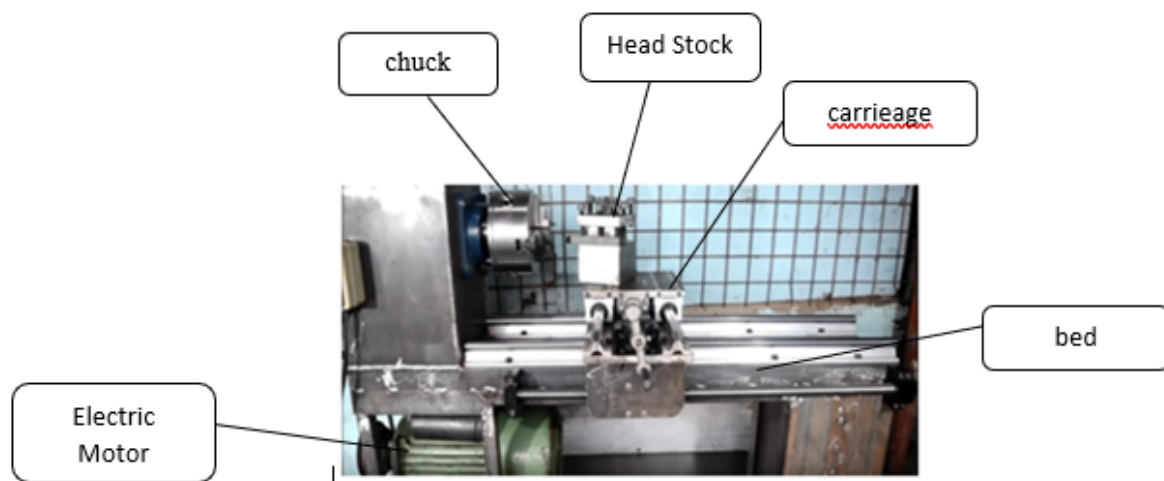


Figure 3: The Mini Capstan Lathe Machine

Figure 3 shows the results of the the Mini Capstan Lathe Machine that has been ready. As shown in the diagram this machine uses a motor as the main component to move this machine. Belt straps are used as components that transfer rotational power from the motor to the spindle.

3.3 Comparison of the Existing Lathe Machine and Mini Lathe Machine

Table 1: Surface Roughness (mm)

Testing	Mini Lathe Machine	Actual Lathe Machine	Differences
1	0.5	0.4	0.1
2	0.6	0.58	0.02
3	0.5	0.49	0.01
Average	0.53	0.49	0.04

The smoothness of the workpiece surface cut with the Mini Capstan Lathe Machine and the real Lathe Machine is compared in Table 1. The surface smoothness data generated by these two machines is obtained using six workpieces. In other words, each machine, namely the Mini Capstans Lathe Machine and the real Lathe Machine, uses three workpieces. The smoothness of the cut surface is measured using the touch inspection method after each workpiece is cut. A Surfcom Touch 35 machine was used for this testing.

4. Conclusion

The following conclusions are likely to be congruent with the respective objectives set at the beginning of this study based on laboratory findings. Solid works software can make it easier to make or draw a design to make this project a success. In addition, there are many ways to fabricate this project. For example, bolts and nuts are used to make it easier for users to make repairs or modifications. Finally, the data obtained is very satisfactory because the surface smoothness of the product produced by this machine has a value that is approximately the same as the existing lathe machine.

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