

A Review on Up-gradation Slotter Machine

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ABSTRACT: Automation is a critical step toward increasing production and decreasing human errors in any industry. With the advancement of society, businesses have become increasingly reliant on production automation, resulting in the usage of an increasing number of industrial robots in automated production lines. The tool change robot, for example, is used in the machining centre. When compared to the manual tool changing procedure, this machine is faster and more reliable, reducing tool change time and improving output performance. An organization's automated equipment reduces the demand for human labour by reducing cycle times and energy consumption. Engineers are continually looking for new ways to bring ideas and conceptions to life. As a result, advanced machines and cutting-edge procedures must be regularly created and used to ensure cost-effective product manufacturing. At the same time, we must ensure that no compromises have been made in terms of quality and accuracy. Machines have become an intrinsic component of human beings in the age of automation. The utilization of an automation machine demonstrates that it has a higher production rate than a manual machine. Everybody wants to boost their productivity and make their machine multipurpose in a competitive market. Engineers are continually confronted with the difficulties of bringing ideas and designs to life. New machinery and processes are constantly being developed in order to create various items at lower costs while maintaining excellent quality.

KEYWORDS: Slotter Machine; Automation; Cycle Time; Small Scale Industry.

1. INTRODUCTION

A slotter, also known as a slotting machine [1], is a reciprocating machine tool that works similarly to a shaper or a planer. It's possible to think of it as a vertical shaper. The primary distinction between a shaper and a slotter is the cutting action's orientation. The machine works similarly to a shaper, but the tool moves vertically rather than horizontally. The job is retained in place. The slotter has a vertical ram and a rotary table [2] that can be operated by hand or by power. In today's industry, machinery is used, and it's a highly stressful situation. Steel rule wooden dies are usually made with HSS blades. On an HSS blade [3], a slotting operation is carried out. The usual blade thickness is 0.71mm, with a width of 23.3mm and a length of 1m. Manual slotting is the traditional method for slotting the HSS Blades. It takes up more time. We will use the "Semi-Automatic Blade Slotting Machine" to solve this problem. As a result, the productivity rate increases and the machining time decreases. During slotting, additional work is necessary (Figure 1).

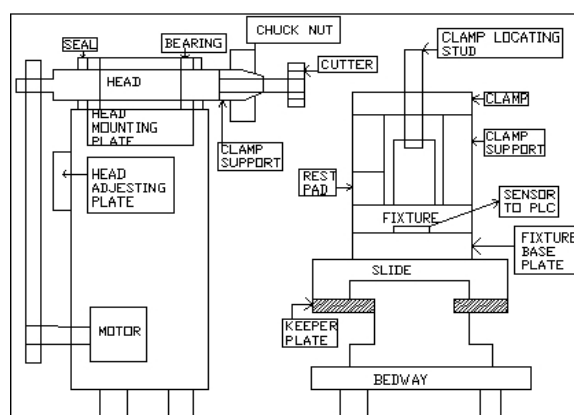


Figure 1: FBD of slotter machine

When slotting, there is less accuracy and more scrap. This m/c cannot be used in today's automated die manufacturing [4] since it lacks an automation unit for blade slotting. We

wanted automation in the slotting machine to accomplish the stiffest task at a fast speed. Execute slotting activities on a manual slotting machine because it takes longer to perform various slotted procedures, and because they are manually operated, worker fatigue is higher, and output rate is lower. We're working on a semiautomatic slotting machine to solve a variety of issues. We can lower the amount of time it takes to complete slotting operations while also reducing worker fatigue, resulting in an improvement in production rate (Figure 2).

Analysis:

Parts of Slotter Machine

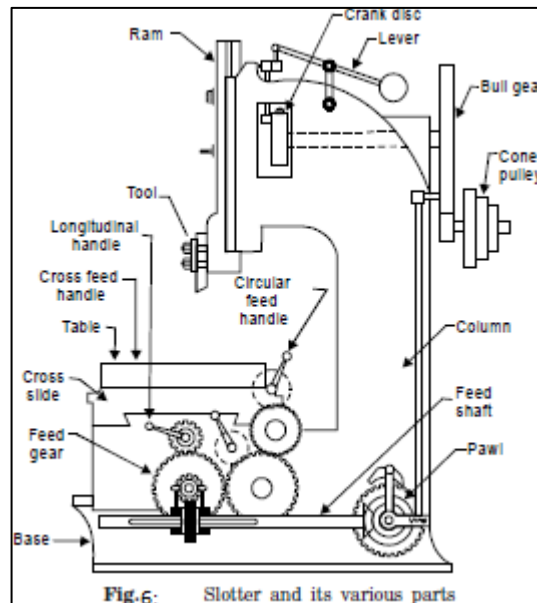


Figure 2: parts of Slotter Machine

The machine consists of following components,

A. Head:

A non-moving portion of a machine or power tool is called headstock or head that supports cutting tool. It is a principal part of the body that is positioned on either side of the bed. It serves as spindle holding tool. It is made by cast iron.

B. Bed:

It is the main part of machine body [5]. All principal components are bolted on it. Despite its high compressive strength and lubrication efficiency, it is typically made of cast iron. It is made by casting process and bolted into space on the floor. Due to downward cutting force on the tool the bed must withstand stresses.

C. Fixture:

A fixture[6] is a tool used in the manufacturing industry to hold work piece or to support it. Fixtures are used to securely locate the work in a specific location pre orientation and to support the work, ensuring that the conformity and interchangeability of all parts. The main purpose of the fixture is to create a secure mounting and allow for greater accuracy, precision, reliability and interchangeability in the finished parts.

D. Collet:

A collet is a subtype of chuck that forms a collar around an object to be held, and when

tightened, it exerts a powerful clamping force on the object, generally through a tapered outer collar. This is used for carrying a tool. This is known to be a package, consisting of a tapered receiving sleeve, the proper set that is inserted into the receiving sleeve, and a cap that screws over the collet that clamps it into a taper [7].

E. Slotting cutter:

Slotting cutter[8] is a tool used by shear deformation to extract any material from the work piece. It is mainly used to route, carve or round the shape on a piece of work. Metal cutting materials must be tougher than the material to be cut, and the metal must be able to withstand the heat produced in the process of cutting metal.

F. Belt drive:

Belt drives are a type of frictional drives used by pulleys which rotate at the same speed or at different speeds to transmit power from one shaft to another. It consists of two pulleys that pass a belt without end. Due to the frictional grip which exists between the belt and the pulley surface, the mechanical force or rotary motion is transmitted from the driving pulley to the driven pulley.

G. Sensor:

The type of sensor used in the system is proximity sensor. A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. It emits an electromagnetic field or a beam of electromagnetic radiation and looks for changes in the field or return signal. The object being sensed is often referred to as the proximity sensor's target [9].

H. Shaft

Shafts are used in every rotating machine to transmit rotary motion and torque from one location to another. A shaft is a rotating machine element usually circular in cross-section and much smaller in diameter than length. The cross-sectional area of shaft may be changed according to requirement [10].

2. DISCUSSION

Working Principle

After casting of a bearing cap, there are various operations are performed over it such as facing, face milling, drilling, milling, and boring, finishing, slotting and top milling. For performing the operation of slotting, the present working setup was used.

The present working setup consists of various components such as electric motor, belt drive, base, head, fixture, hand wheel, collet and cutter. During the working, when the electric supply is provided, the motor runs with 1440 rpm and this speed is reduced to 180 rpm with help of belt drive. Head is mounted on base at one side and fixture is placed at another side. Collet is placed in the head and the cutter is further inserted in collet. The bearing cap on which slot is to be provided is mounted on fixture and it is fixed on fixture by means of nut and bolts. For performing the operation the work piece is placed on fixture and cutter is mounted in collet. When the electric supply is given, cutter starts rotating and the work piece are stationary. Feed is given by hand wheel to obtain the required depth.

For making the operation easier and improving the worker's safety while working, a proximity sensor is placed along with signal. When the bed comes in the vicinity of sensor after completion the light starts blinking, thus the worker gets information that the work is

completed. The automation provided in the system with help of sensor, gives safety while working and also reduces the time required for loading and unloading.

Application:

In industries, slotting machines are used to make slot in bearing caps. The slotting machine and its product. The industry having two slotting machines and one of the machines is disturbed, it needs to be maintained as well as repaired to obtain actual working.

Proposed System

We are proposing a machine that can perform slotting operation on bearing cap in an industry. Figure.1 displays our experimental setup's block diagram. This is a machine which was earlier used in an industry. Due to failure in working, it categorized under breakdown maintenance. The maintenance is necessary to brought back the machine in working condition. In addition, modification such as use of sensor is necessary to reduce human errors while working (Figure 3).

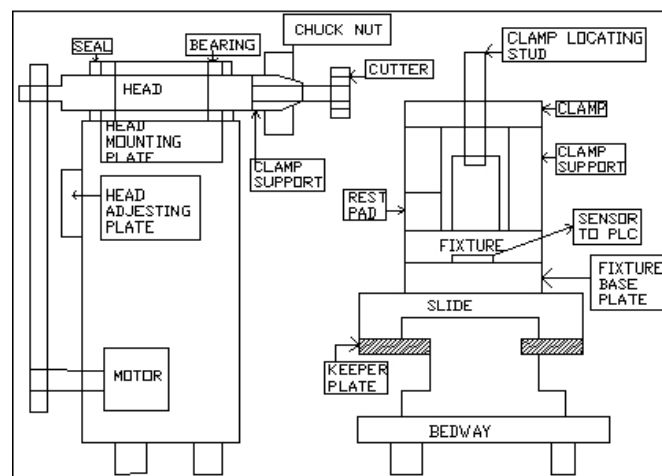


Figure 3: Experimental Setup

Operations Performed on a Slotting Machine

A slotter is a very economical tool when used for certain classes of work given.

- It is used for machining vertical surfaces.
- It is used for angular or inclined surfaces.
- It is used to cut slots, splines, keyways for both internal and external jobs such as machining internal and external gears.
- It is used for machining dies and punches.
- It is used for shaping internal and external forms or profiles.
- It is used for works as machining concave, circular, semi-circular and convex surfaces.
- It is used for internal machining of blind holes.

Since a slotter works slowly, it has less use in mass production work. It can be substituted by the broaching machine.

Tejas Patel, Saurin Sheth (2014). [11]“*Design of Semi- Automatic Slotter Machine using PLC*”.

According to author, now-a-days automation is prime requirement in industry. Hydraulic system, PLC, controller are key components of any automation. Machining attributes a major channel of finish goods. CNC turning centers, VMC and CNC grinding are available in the market but a retro fitting of Slotter machine is prime requirement as it is not readily available. So the attempt is done to made to semi automate the Slotter machine using PLC

and hydraulic system.

A. Kym Fraser (2015).[12] *“Maintenance management models: a study of the published literature to identify empirical evidence”*.

In this research paper, the researcher identified and categorized 37 different maintenance management models. From these, three models were found to be popular; Total Productive Maintenance, Condition Based Maintenance and Reliability Centered Maintenance. The purpose of this paper is to shed light on the various models and their real-world applications

B. Kiran Patel et al. (2016). *“Design and Fabrication of Semi-Automatic Slotting Machine”*

The research paper is useful for studying the constant development sophisticated machines and implementation of modern techniques in order to achieve economical manufacturing of products. The purpose of this paper is to focus on use of automation machine which gives high production rate than manual production rate.

2. CONCLUSION

The project's goal was to keep the slot machine running and upgrade it. The process began with the disassembly of the current machine, which allowed the problems to be found. 2D drawings are created by measuring the measurements of disassembled parts. According to the defects discovered, components such as bearings, belts, shafts, keys, and motors need to be replaced. The price and specifications of components are decided based on the requirements. Electric motor, belt, cutter, and collet must be purchased, and components such as bearing, belt, key, and shaft must be constructed to complete the setup. The sensor and signal are also included in the system to improve safety and productivity. After the task is completed, it can be determined that the system is maintained and upgraded by repairing and replacing various components that were not functioning effectively. As a result, this system has been fully recovered and may be beneficial in industrial activities.

Further automation of the machine can be done by using gear drives, and also the speed of the machine could be varied accordingly,

- With use of PLC operated system.
- Design and development of belt changing mechanism.
- Variable speed with dimmer stat.

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