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Design and Manufacture an Attachment to Provide Power Feeding Tailstock Spindle and Process Optimization

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Abstract - Drilling is most common operation get performed on lathe. For drilling operation on Center lathe has tailstock arrangement on lathe bed. Since lathe tailstock operated manually by hand wheel it need human interference in drill feeding which makes repetitive motion of worker along with variable feed rate. In this project, our focus is to build a prototype that provide electrical controls for movement of tailstock barrel in order to achieve drilling with constant feed rate and reduction in efforts of workers. In this process optimization included to get optimum value for maximum material removal rate of piece of aluminium using Taguchi and ANOVA analysis.

Key Words: Lathe Machine, Tailstock Mechanism, Drilling Operation

1. INTRODUCTION

Center Lathe Machine is used to perform machining operation for various ferrous and non - ferrous alloy. After survey of machine shop industrial supervisor discussion, Drilling is most repetitive operation after turning.

Drilling operation involves mounting dril l chuck in tailstock spindle and manual feeding of drill bit by rotating handle at back end of tailstock.

Since this motion is manual so feed rate of drill is not constant throughout drilling operation. Variation in feed rate cause chatters, vibration. Which mainly affect surface finish, geometry in case of soft nonferrous alloy and also tends to Variable Material removal rate during drilling.

Along with this, excess movement worker also involve such as rotate hand wheel during feeding of spindle and reverse it.

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DRILLING

Drilling is the most common machining operation and it forms the highest machining cost in many manufacturing activities. Drilling can be done by tailstock mechanism of conventional lathe machine. This research paper has main aim to make a review of that how much work have done in drilling operation using tailstock mechanism

Drilling is a widely used machining process and has considerable economical importance because it is usually among final steps in the fabrication of mechanical components. The drill geometry and plastic deformation of workpiece material are complicated in drilling operation. In drilling operation, the cutting speed is near to zero at drill center. The cutting speed and rake angle both vary with respect to the distance from the drill center and the cutting edge has the highest cutting speed called the peripheral cutting speed. Due to this cutting speed variation, the material removal occurs in the form of extrusion process. Generally drills are produced by two steps; first one is the penetration of drill point angle into the workpiece, second step is drilling of hole.

2. LITERATURE REVIEW

Chandresh P. Rana et .al (2017)- This research paper has main aim to make a review of that how much work have done in drilling operation using tailstock mechanism. In this review paper from the literature review of Drilling operation done by Tailstock Mechanism of Conventional Lathe machine, investigated the following conclusions:

While doing Operation of Drilling using tailstock mechanism, the forces acting more while performing operation and it will increase with respect to increase in diameter of drill.

The labour effort required for moving tool linearly into workpiece is higher, and due to this labour efficiency is going to decreased.

Wearing of tool is more.

Operation is Ergonomically Uncomfortable. This is directly affect the cost of the work piece.

In mass production system where the labour cost also affect the cost of the product

Puneeth H V et al (2017)- They investigate that the Cutting forces such as thrust and torque were found out using drill tool dynamometer. The results showed that the maximum thrust force of 126 kgf was developed in Titanium coated HSS compared to TiN coated and uncoated HSS of 47 kgf and of 90 kgf, whereas the torque produced in all the twist drills were at an average of 0.5 Kgm

Naseer Ahmed et al (2014)- In this research paper he concluded that the thrust force increased with increasing the cutting speed and feed. Changing the feed had an approximate linear effect on the thrust forces. But in case of torque, the effect of changing feed rate increased the torque more at higher speeds compared to that at lower speeds.

Yogendarsingh chouhan et al (2016) - They summarized that the result shows that both two parameters have their effect on the measured thrust force. The effect of feed rate is more than spindle speed. As feed rate vary, thrust force value also vary due to change in amount of material removal from work piece by tool. There is less effect of spindle speed on thrust force as the increase in spindle speed leads decrement in thrust force at 250 rpm of spindle speed which save energy and useful production time during drilling of mild steel work piece.

Mr.Prakash N. Parmar et al (2014)- It is Clear from this research paper that Innovations such as review on advance automation of conventional lathe machine.by developing automation in conventional lathe machine by retrofitting stepper based method, the machine works as CNC trainer for teaching, learning of the student subject. Also Cost of machine is minimizes approximate 4 times below the original CNC trainer.

Sanal Kumar A.P et al (2017)- In this Research, Author was discuss the Modification of Tailstock Design for the Purpose of Trepanning Operation in Heavy Duty Lathe Trepanning process is conducted in a conventional lathe with the help of modified tailstock design. The process was cheaper than any other process and the amount of wastage during making a hole is very less. The core generated during the trepanning operation can be used a raw material for any other machining process.

Majid Tolouei-Rad, et al (2012) -This paper described a methodology for processing drilling operations and explained an algorithm developed for automated machining sequence planning of drilling-related operations. The methodology concludes that properly defined operation sequences and an effective algorithm can minimize the time needed for machining, setting-up, and tool changing. It is also concluded that the choice of tooling and cutting conditions depend upon many factors that include work piece and cutting tool materials, work piece geometry, etc. The methodology developed has been used for a number of test parts and proved to be capable of handling drilling-related operations efficiently. It resulted in minimum tool changes reducing the time and cost of machining significantly

PROBLEM STATEMENT

Design and manufacture an attachment to Provide Power feeding tailstock Spindle and process optimization using Taguchi design of experiment.

OBJECTIVES

Design an attachment for lathe tailstock power feeding which fulfill manufacturing requirement

Manufacture and assemble the tailstock power feeding attachment

Develop design of experiment for process optimization

Establish relationship between input factor and response factor by ANOVA

Select optimum parameter for drilling of aluminum/PVC material using Taguchi S/N ratio analysis

3. METHODOLOGY

Concept

After doing study of tailstock structure, there is screw which in engaged condition with nut fixed in barrel end. When operator rotates screw, due to this screwing action barrel moves forward or backward depending on direction of rotation of screw. So we will develop a mechanism that rotates the screw in order to drive screw. And it is electrically controlled to provide constant feed rate while drilling

In this concept, there is use of high torque motor Ac or DC type is used. It is mounted on top surface of tailstock with help of motor support. This motor support is fixed to tailstock through nut bolt system in order to absorb shock, vibration during transmission of power. Motor shaft is coupled to chain sprocket and screw is coupled to screw of barrel. A Chain drive system in motor shaft and screw completed power transmission of power in between them. As motor activated it shaft starts to rotate, due to chain drive system screw rotates in nut of barrel. Depending on direction of rotation of screw barrel moves in or out. Through this mechanism it is possible to initiate drilling in

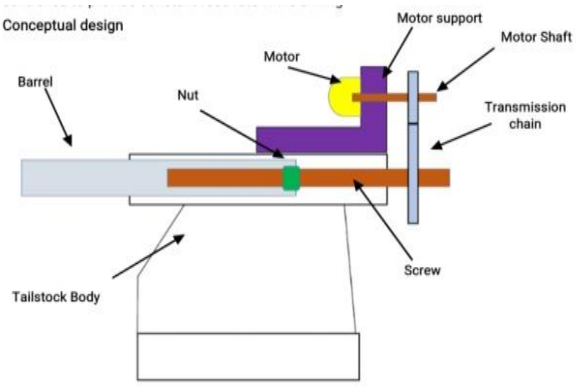

Fig 1- Schematic Diagram Of Setup

work piece in forward stroke and retraction drill in backward stroke.

4. CONCLUSIONS

From the literature review of Drilling operation done by Tailstock Mechanism of Conventional Lathe machine, investigated the following conclusions:

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