

Design and Analysis of Special Purpose Fixture for CNC Lathe Machine

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Abstract— A lathe machine is the mechanical device in which work piece is rotated against a suitable cutting tool for producing cylindrical forms. Parting is the operation performed in CNC lathe to cut a work piece from a piece of stock. During parting operation of fastener on CNC lathe machine, there was a tip remained at the center of the fastener and this tip is removed separately on the grinding wheel which was time consuming. This project is depends upon the problem faces by the PRECISION TURN COMPONENT INDUSTRY. The tip problem forced the organization to employ extra labors on work. Also they faced the poor product quality problems due to manual grinding which leads to mass rejection.

Key words: CNC Lathe, Parting

I. INTRODUCTION

A. Parting Off

Parting-off is the operation of cutting a workpiece after it has been machined to the desired size and shape. The process involves rotating the workpiece on a chuck or faceplate at half the speed to that of turning and feeding by a narrow parting off tool perpendicular to the lathe axis by rotating the cross slide screw by hand. Before the operation starts, the carriage is locked in position on the lathe bed and the cutting tool is held rigidly on the tool post with the compound slide set parallel to the lathe axis. The tool should be fed very slowly to prevent chatter. The feed varies from 0.07 to 0.15 mm per revolution and the depth of cut is equal to the width of the tool. In parting off, a work of very large diameter, cuts are made in stages. The parting off tool is first fed through a certain depth, then withdrawn and two more cuts are made at the two sides of the central groove. The tool is next fed into the central groove until the work is cut off in two parts.

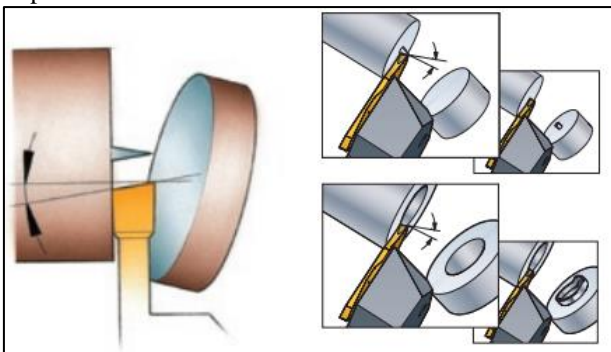


Fig. 1: Formation of tip

II. LITERATURE REVIEW

K. Adarsh Kumar ,Ch.Ratnam , BSN Murthy , B.Satish Be4 , K. Raghu Ram Mohan Reddy[1]Surface roughness has received serious attention for many years. It has formulated an important design feature in many situations such as parts subject to fatigue loads, precision fits, fastener

holes, and aesthetic requirements. In addition to tolerances, surface roughness imposes one of the most critical constraints for the selection of machines and cutting parameters in process planning . Surface finish is the method of measuring the quality of a product and is an important parameter in machining process. It is one of the prime requirements of customers for machined parts. Productivity is also necessary to fulfill the customers demand. For this purpose quality of a product and productivity should be high. In addition to the surface finish quality is also an important characteristic in turning operation and high MRR is always desirable..

Akash Tiwari¹ Niral Panchal² In today's world everyone wants to earn good money and raise their standard of living, people who have good degrees generally succeed in doing this. But there is also one class of people who want to work independently as an 'Entrepreneur'. These people mostly comes from lower or middle strata of society which face major problem of financing their project as they have limited budget and cannot afford more than one or two machine at initial level. Also, any product be it finished or semi-finished consists of one or more machining operations. And all processes cannot be done on same machine .So we came up with idea of designing and fabricating a multipurpose tool post for a lathe machine. We selected lathe machine cause it is most basic and versatile of all the machine and this is the only reason they call it 'Mother of all Machine', so we have tried to do operations which were perpendicular to Spindle axis like Grinding, Drilling, Milling in our project. The convention lathe machine only carry out the limited operation that's include, Turning(reducing diameter), Facing(reducing length), Tapering(making a conical shape), Knurling (making a diamond shaped pattern for easy grip), Grooving (making a symmetrical indentation), Parting (removing a section), Eccentric turning (turning about a point other than axis), Chamfering (creating a radially symmetrical chamfer) other than that Drilling ,reaming, can also be done only parallel to spindle axis (Operations which are perpendicular to spindle axis cannot be carried out.).Conventional lathe machine involves carrying of work piece to different machines to machine them which increases setting up time and cost. It would be very dreadful for the people who are running micro industry, because they cannot afford to have all machines at their door step.

Wen Jun Deng, Zi Chun Xie, Ping Lin, and Tong Kui Xu [3] Burrs are one of the most serious obstacles to precision manufacturing and manufacturing process automation. Burrs are formed in various machining process as a result of plastic deformation due to plasticity during mechanical manufacturing process and have been defined as undesirable projections of material beyond the edge of a workpiece. Recently, the trends of machined parts move towards more miniaturization and precision, burrs cause

many problems during inspection, assembly, and manufacturing automation of precision components. Burrs have to be removed by a deburring process for functional and aesthetic reasons after the part is machined. However, deburring processes are usually not very precise and may decrease the precision of the machined parts, damage surface finish, and produce residual stresses in the component. Moreover, adding a deburring process means extra cost, extra manufacturing time, and an extra machining station. Gillespie [1] found that on precision components, deburring operations can account for as much as 30% of the total part cost. Since burr generation in cutting cannot be avoided completely, it is very important to find a solution for minimizing the burr formation or more effective deburring method.

Richard A. Maker [4] The milling machine lathe attachment is attachable to an existing milling machine so as to eliminate the need for an operator owning both a milling machine and a lathe. It is designed to be mounted to the side of the milling machine and to be used without disturbing a setup in the associated vise. The attachment is also designed to be mounted to the front of a milling machine and allows the programming of the very point of single point tool contact so as to follow whatever contour or steps are desired. This type of cutting is not possible on a lathe with guaranteed accuracy, while on a milling machine it is quite feasible. Since the lathe is the most oldest form of machine that a man has ever known it is the most basic of all machine and almost all the operations can be done on a Lathe machine hence it is often called as "mother of machines". But there are certain operations which cannot be done on lathe machine particularly those operations which can be done only parallel to spindle axis like those of Grinding, and few those which consist of perpendicular to spindle axis like those of Drilling or milling

Jahnavi Madireddy[5] The lathe, probably one of the earliest machine tools, is one of the most versatile and widely used machine tool, so also known as mother machine tool. An engine lathe is the most basic and simplest form of the lathe. It is called so because in early lathes, power was obtained from engines. The job to be machined is held and rotated in a lathe chuck; a cutting tool is advanced which is stationary against the rotating job. Since the cutting tool material is harder than the work piece, so metal is easily removed from the job. Some of the common operations performed on a lathe are facing, turning, drilling, threading, knurling, and boring etc.

III. PROBLEM FORMULATION

Precision Turncomp Pvt. Ltd. Hingna, Nagpur manufactures about 2000 fasteners of different sizes and types. At the end of their machining cycle these fasteners are parted from the stock, during this parting operation a tip is left behind on the surface of the fasteners. This requires manual grinding of individual fasteners which consumes lots of time and requires additional manpower to complete this simple task. The company is one of the major suppliers to Mahindra and Mahindra Pvt. Ltd. Nagpur. Hence the quality of the finished product is required to be the best.

IV. RESEARCH METHODOLOGY

This project is limited to tip removing machine (CNC Lathe) attachment design and analysis using FEA. The project will involve building the CAD models of special purpose fixture (CNC Lathe) and performing FEA analysis for optimum design for Precision Turn component Pvt. Ltd. Hingna, Nagpur.

- To perform design of Special purpose fixture using CAD software which is capable of cutting the fastener during parting operation without any tip remains at its center.
- To perform FEA analysis of Special purpose fixture for validation
- To perform hand calculation for loads and structure design of Special purpose fixture.
- To help the company in optimizing its manufacturing process by eliminating the manual grinding operation required to remove the tip.

V. CONCLUSIONS

The completion of this project will be directly benefited the Precision Turn Component Industry. This tip problem forced the organization to employ extra labors on work. This solution will terminate manual grinding of individual fasteners, thus it save lots of time, additional manpower to complete this simple task and product quality will be improve.

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